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**ACCA Paper F5**

# **Performance Management**

**Class Notes**

**December 2009**

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# Introduction to the paper



## AIM OF THE PAPER

To develop knowledge and skills in the application of management accounting techniques to quantitative and qualitative information for planning, decision-making, performance evaluation and control.

## OUTLINE OF THE SYLLABUS

1. Cost accounting techniques.
2. Decision-making techniques including risk and uncertainty.
3. Budgeting techniques and methods.
4. Standard costing systems.
5. Performance appraisal including financial and non-financial measures.

## FORMAT OF THE EXAM PAPER

The syllabus is assessed by a three hour paper-based examination.

The examination consists of 5 questions of 20 marks each. All questions are compulsory.

## FAQs

### **How does the new syllabus relate to the papers in the previous syllabus?**

The paper is materially based on part of the previous paper 2.4 FMC but with additional material from papers 1.2 and 3.3. It covers the management accounting topics from the first paper but drops financial management topics. To balance against that it now incorporates new topics on performance appraisal and more business maths.

# Chapter 1

# Cost accounting and new developments



**FORMULAE SHEET****Learning curve**

$$Y = ax^b$$

Where:  $y$  = average cost per batch  
 $a$  = cost of first batch  
 $x$  = total number of batches produced  
 $b$  = learning factor (log LR/log 2)  
 LR = the learning rate as a decimal

**Regression analysis**

$$y = a + bx$$

$$b = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2}$$

$$a = \frac{\sum y}{n} - \frac{b\sum x}{n}$$

**Correlation coefficient**

$$r = \frac{n\sum xy - \sum x \sum y}{\sqrt{(n\sum x^2 - (\sum x)^2)(n\sum y^2 - (\sum y)^2)}}$$

**Demand curve**

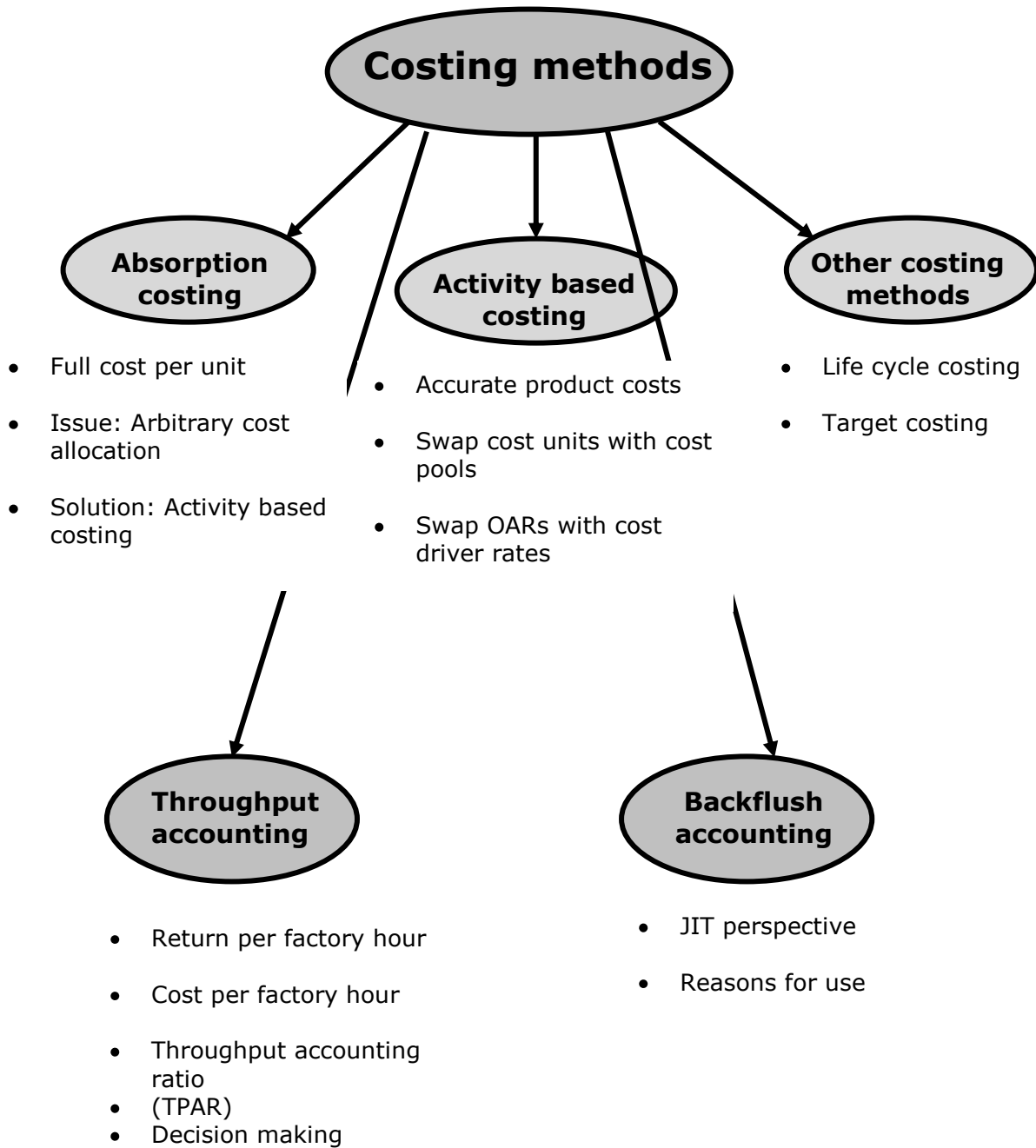
$$P = a - bQ$$

$b$  = change in price/change in quantity

$a$  = price when  $Q = 0$



**CHAPTER CONTENT DIAGRAM**



## CHAPTER CONTENTS

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## ABSORPTION COSTING – REMINDER

The linking of all costs to the cost unit to prepare a **full cost per unit**.

### Uses

1. **Stock Valuation**
2. **Pricing decisions**
3. **Budgeting**

## ABSORPTION COSTING

Overhead absorption is achieved by means of a predetermined Overhead Absorption Rate.

$$\text{Overhead Absorption Rate} = \frac{\text{Budgeted Overheads}}{\text{Budgeted Level of Activity}}$$

### Example 1

A company produces 2 products in 3 departments. Relevant product information is:

	<b>Product A</b>	<b>Product B</b>
Direct material cost (£)	20	35
Direct labour cost in Department X (£)	20	30
Direct labour cost in Department Y (£)	25	25
Direct labour cost in Department Z (£)	10	0*
Budgeted number of units	2,000	1,600

\* Product B does not pass through department Z.

The labour rate is £6 per hour in each department.

The Budgeted Departmental Overheads are:

Department X	£11,000
Department Y	£5,400
Department Z	£40,000

### Required

Calculate the cost/unit using:

- (a) Separate OARs for each department, based on labour hours.
- (b) An overall OAR, based on labour hours.
- (c) Discuss the differences.

## ACTIVITY BASED COSTING

A response to the difficulties in applying absorption costing in complex manufacturing environments. Use of absorption costing is likely to lead to inaccurate product costs per unit in such circumstances and hence reduce the usefulness of the information to the management accountant.

### Traditional overhead analysis



### Recent changes in manufacturing

The reason for the increasing inaccuracy of absorption costing is due to two basic issues:

1. Increased production complexity.
2. Increased proportion of overhead costs.

#### Production complexity

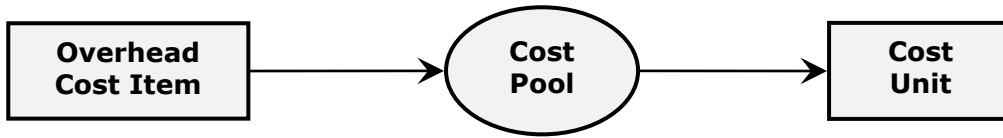
A wide variety of production processes have become more complex in recent years in a number of ways:

1. **Flexible manufacturing systems** allow for a number of widely differing products to be produced on the same machinery. Absorbing overhead on a simple volume base is unlikely to reflect the differing overhead costs incurred by each product.
2. **Fast product development** may mean that a number of differing iterations of the same product may be produced in quick order. With such products having differing production volumes again a volume base is unlikely to work.
3. **Wider product ranges** lead to a more complex cost analysis.

#### Increased proportion of overhead costs

Overheads have increased in importance as a percentage of total costs due to both the substitution of direct labour with indirect labour as companies mechanise to a greater degree. Also the increased production complexity outlined above has given rise to increased costs for such disciplines as production planning and logistics.

**A revised analysis - ABC**



**Example 2 – Hensau Ltd**

Hensau Ltd has a single production process for which the following costs have been estimated for the period ending 31 December 20X1:

	<b>£</b>
Material receipt and inspection costs	15,600
Power costs	19,500
Material handling costs	13,650

Three products - X, Y, and Z are produced by workers who perform a number of operations on material blanks using hand held electrically powered drills. The workers are paid £4 per hour.

The following budgeted information has been obtained for the period ending 31 December 20X1:

	<b>Product X</b>	<b>Product Y</b>	<b>Product Z</b>
Production quantity (units)	2,000	1,500	800
Batches of Material	10	5	16
Data per product unit:			
Direct material (square metres)	4	6	3
Direct material cost (£)	5	3	6
Direct labour (minutes)	24	40	60
No. of power drill operations	6	3	2

Overhead costs for material receipt and inspection, process power and material handling are presently each absorbed by product units using rates per direct labour hour.

An activity based costing investigation has revealed that the cost drivers for the overhead costs are as follows:

Material receipt and inspection:	Number of batches of material
Process power:	Number of power drill operations
Material handling:	Quantity of material (square metres) handled

**Required:**

**(a)** Prepare a summary which shows the budgeted product cost per unit for each product of X, Y, and Z for the period ending 31 December 20X1 detailing the unit costs for each cost element using:

- (i)** the existing method for the absorption of overhead costs and
- (ii)** an approach which recognises the cost drivers revealed in the activity based costing investigation.

(22 marks)

**(b)** Explain the relevance of cost drivers in activity based costing. Make use of figures from the summary statement prepared in (a) to illustrate your answer.

(8 marks)

**(Total 30 marks)**

### **Classification of activities**

Cooper classified activities into three major categories that drive expenses. They are:

1. unit-level
2. batch-related
3. product-sustaining.

### **Benefits and limitations**

#### **Benefits**

1. More accurate product costing.
2. Is flexible enough to analyse costs by activity providing more useful costing data.
3. Provides a reliable indication of long-run variable product cost.
4. Helps understanding of cost.
5. Provides a more logical basis for costing of overhead.

#### **Limitations**

1. Cost vs benefit.
2. ABC information is historic and internally.
3. Difficult to apply in practice.
4. Focuses on the allocation of cost rather than minimizing the cost incurred.

**Exercise 3**

The following budgeted information relates to Brunti plc for the forthcoming period.

	<b>Products</b>		
	<b>XYI (000s)</b>	<b>YZT (000s)</b>	<b>ABW (000s)</b>
Sales and production (units)	50	40	30
	£	£	£
Selling Price (per unit)	45	95	73
Prime cost (per units)	32	84	65
	<i>Hours</i>	<i>Hours</i>	<i>Hours</i>
Machine department (machine hours per unit)	2	5	4
Assembly department (direct labour hours per unit)	7	3	2

Overheads allocated and apportioned to production departments (including service cost centre costs) were to be recovered in product costs as follows.

- Machine department at £1.20 per machine hour
- Assembly department at £0.825 per direct labour hour

You ascertain that the above overheads could be re-analysed into 'cost pools' as follows:

<b>Cost pool</b>	<b>£000</b>	<b>Cost driver</b>	<b>Quantity for the period</b>
Machining services	357	Machine hours	420,000
Assembly services	318	Direct labour hours	530,000
Set-up costs	26	Set-ups	520
Order processing	156	Customer orders	32,000
Purchasing	84	Suppliers' orders	11,200
	941		

You have also been provided with the following estimates for the period:

	<b>Products</b>		
	<b>XYI</b>	<b>YZT</b>	<b>ABW</b>
Number of set-ups	120	200	200
Customer orders	8,000	8,000	16,000
Suppliers' orders	3,000	4,000	4,200

**Required**

- (a) Prepare and present profit statements using:
- (i) conventional absorption costing, and (7 marks)
  - (ii) activity based costing (12 marks)
- (b) Comment on why activity based costing is considered to present a fairer valuation of the product cost per unit. (5 marks)

**Total 25 marks**

*ACCA June 1995*



## **ACTIVITY BASED BUDGETING (ABB)**

- Activity based budgeting extends the use of ABC from individual product costing , for pricing and output decisions, to the overall planning and control systems of the business.
- The basic principle of ABB is that the work of each department for which a budget is to be prepared is analysed by its major activities, for which cost drivers may be identified. The budgeted cost of resources used by each activity is determined (from recent historical data) and, where appropriate, cost per unit of activity is calculated.
- Future cost can then be budgeted by deciding on future activity levels and working back to the required resource input.

## LIFE CYCLE COSTING

A new form of costing developed to confront two increasingly important problems associated with modern competitive pressures. They are:

1. Shorter product life-cycles.
2. Increased product development costs.

Life-cycle costing is where costs are totalled for the whole life of the project and 'spread' equitably over the products expected life volume.

### Total life costs for product

**Life Cost per Unit =** \_\_\_\_\_

### Total expected life volumes

Companies operating in an advanced manufacturing environment are finding that about 90 - 95% of a product's life-cycle cost is determined by decisions made at the inception of the product's life.

This may include costs incurred on product design, development, programming, process design and asset acquisition. This has created a need to ensure that the tightest controls are at the design stage, because most costs are committed or "locked-in" at this point in time.

Key considerations arising from life-cycle costing are:

- maximize the life of the product
- design cost reduction of the product
- accelerate the time to market.

### Management accounting systems

The key to successful application of life-cycle costing is to ensure that the systems developed to provide the costing information in the design stage are consistent with the systems that are subsequently used to 'value' the product in production. This should lead to the following:

1. Ensuring as much as possible that product costs are recouped over the life of the product.
2. A better understanding of the significance of the life of a product on overall profitability of the business.
3. Better accountability of the initial costs incurred in development.

## TARGET COSTING

### Traditional costing systems:

1. Calculate unit cost.
2. Add profit margin.
3. Equals Selling price.

This means that a product is designed, the unit costs calculated and price set without reference to the market, or what the customer is prepared to pay.

### Target costing steps:

1. Determine possible selling price – with reference to the market/customer and taking into consideration the specification of the product.
2. Establish the required profit margin – this is based upon the overall required return of the business and the level of perceived risk of the product
3. Calculate the target cost – ie the cost that the company must produce at in order to be able to achieve the required profit level (Selling price – profit margin)
4. Close the gap – reduce the cost from the original expected cost to the target cost.

### Close the gap

The target cost will usually be very much lower than the initial cost estimates for a product. In target costing the emphasis is on 'closing the gap' between the two. This can only be done at the design stage. Once the product is in production the cost base is already determined and difficult to reduce materially.

### Design stage

Significant cost savings can only be made prior to commencing production and hence the primary use of target costing is at the design stage where by iterative design the cost base can be progressively reduced.

Although there are many ways this can be achieved, two in particular can dramatically reduce product costs:

- Reduce component count – attempt to produce the same specification but using fewer individual material inputs.
- Reduce production complexity – try to produce the same product but in a simpler manner.

The very act of reducing the component count is likely to reduce the complexity associated with producing the product. Any reductions in cost must be made without damaging the quality of the product.

In addition the specification of the product could be changed, however this runs the risk of affecting the selling price of the eventual product.

## JUST IN TIME (JIT)

### The JIT concept

- This is defined as the workflow organisation technique to allow rapid, high quality, flexible production whilst minimising stock levels and manufacturing waste. (Bromwich & Bhimani)
- In practice, this means producing components only when they are needed and in the quantity that is need. This shortens lead times and virtually eliminates work in progress and finished goods inventories.

### Characteristics of JIT system

Elimination of waste (in the form of time and defects), reduced set-up time, reduced lot-size, and a smaller pool of suppliers. Use of non domestic suppliers can possibly hinder efforts at JIT implementation of materials procurement.

### Bottlenecks

- A bottleneck resource is a limiting factor that constraints production. It is therefore also known as a key resource. If a bottleneck cannot be eliminated, it should be used to 100% of its availability.
- Steps to maximise the output within a JIT process
- Identify the bottleneck ie the process that limits the level of activity that the overall operation can sustain
- Maximise output of the bottleneck resource
- Scale back production of all other process to avoid stock-building and possibly make cost savings
- Attempt to ease the bottleneck either through internal processes by investment or changing the manner in which the process is done or using an external provider
- Start again by identifying the next bottleneck

### Treatment of bottlenecks

- Bottlenecks can be identified by profiling capacity usage through the system. Usually they will be areas of most heavy usage. Thus monitoring build ups of inventory and traditional idle time and waiting time will indicate actual or impending bottlenecks.
- Traditional efficiency measures will be important bottlenecks. Changes in efficiency will indicate the presence of bottlenecks and need for response. This may take the form of creating short-term build ups of stock to alleviate the problem. Another possible solution might be to prioritise the work at bottlenecks to ensure that throughput is achieved.

## THROUGHPUT ACCOUNTING

In throughput accounting, only material costs are variable. Direct labour is treated as a fixed cost and is combined with all other operating expenses and included as a period cost. Therefore, inventory is valued at material cost only.

Throughput accounting is designed for use in JIT manufacturing environment.

Throughput can be maximised when minimising materials cost and maximising selling price per unit and sales volume.

In throughput accounting profitability is determined by the rate at which revenue is generated and also by the rate at which goods are produced to meet customer demand.

**Key Terminology** (Please note the similarity to marginal costing terminology that we already know)

### Marginal costing

### Throughput accounting

Variable Cost = Direct Material Cost

Fixed Cost = Total Factory Cost  
(Including labour cost)

Contribution = Throughput  
(Sales – Variable Cost) (Sales – Direct Material Cost)

### Measures

Return per Factory Hour =  $\frac{\text{Throughput per unit}}{\text{Factory hours per unit}}$

Cost per Factory Hour =  $\frac{\text{Total factory cost}}{\text{Total factory hours}}$

Throughput Accounting Ratio (TPAR) =  $\frac{\text{Return per factory hour}}{\text{Cost per factory hour}}$

**Limitations of throughput accounting**

- Selling price could be uncompetitive
- Material suppliers may not be reliable
- Product quality is low
- Need to deliver on time
- Very little attention is paid to overhead costs
- Ignores market developments, product developments and the stage the product has reached in the product life cycle.

## **BACKFLUSH ACCOUNTING**

Backflush accounting is a product costing approach, used in a Just-In-Time (JIT) operating environment, in which costing is delayed until goods are finished.

Backflush accounting focuses on the output of an organisation and then works backwards when allocating costs between cost of goods sold and inventories. Therefore, backflush accounting simplifies costing since it ignores both labour variances and work-in-progress. In practice there will be a small amount of work-in-progress in the system at any point in time.

In backflush accounting, costs are applied to products at a very late stage of the production cycle. Standard costs are then flushed backward through the system to assign costs to products. Therefore backflush accounting eliminates the need for tracking of costs. Standard costs are used to assign costs to units and to flush costs back to the points at which inventories remain.

In situations where inventory levels remain low, most of the manufacturing costs will form part of cost of sales rather than being deferred into inventory. As a consequence, there is little benefit in tracking the costs of stock movements through work-in-progress, cost of sales, and finished goods inventory. Therefore backflush accounting reduces the volume of accounting transactions which would be recorded in a conventional costing system. In keeping with a just-in-time philosophy the recording of such transactions can be regarded as a non-value added activity.

Backflush accounting is employed where the overall cycle time is relatively short and inventory levels are low.

Backflush accounting is suitable for companies operating a JIT system and companies who have low inventory levels and in which the majority of the manufacturing costs are part of cost of sales rather than being deferred to inventory.

For backflush accounting to be successful, companies should have predictable levels of efficiency and the price and quality of the materials should be fixed.



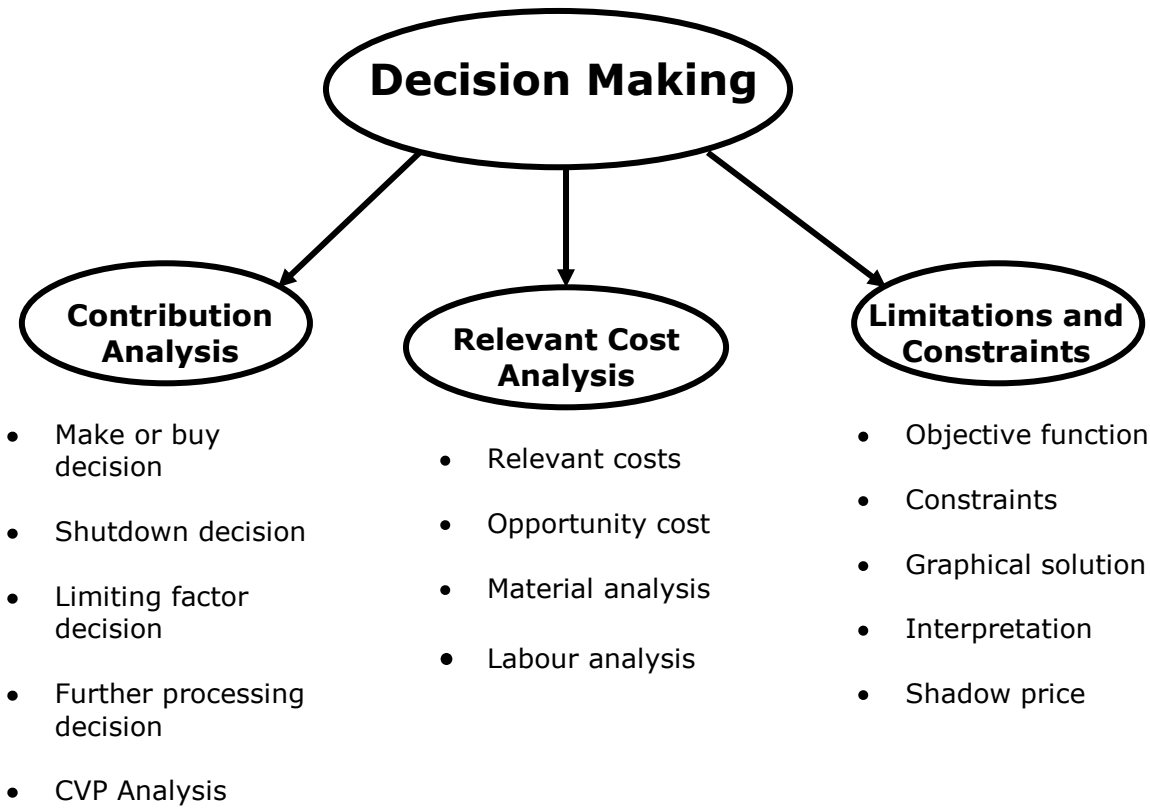


## Chapter 2

# Decision making and linear programming



## CHAPTER CONTENT DIAGRAM



## CHAPTER CONTENTS

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## DECISION MAKING

The choice between two or more alternatives, decision making normally considers only the short term consideration of maximising profitability. We base our decisions on relevant costs.

### Contribution analysis

One aspect of decision making is closely linked to the impact of a change in the level of activity. In these situations the decision is based upon the variable costs or contributions generated. Fixed costs are not affected by activity and hence can be ignored.

#### Make or buy decision

The decision to make a component or product 'in-house' or to buy from an outside supplier. The underlying assumption of this decision is that all fixed costs of manufacture are general to the organisation as a whole and hence only the marginal cost of making the component is relevant.

**Decision criteria : Compare marginal cost of making to the purchase price (the marginal cost of buying).**

#### Example 1

Clemence Ltd produces a number of components, two of which he is considering buying in, components X and Y.

Cost of making (£)	<b>X</b>	<b>Y</b>
Variable	14	28
Fixed	4	4
Total	18	32
Purchase price (from outside supplier)	17	25

#### Required

Should we make or buy in?

#### Shutdown (discontinuance) decisions

The decision whether to shut down a part or segment of a business. The focus of the question is the impact of the shutdown on the cost base. Revenue will be foregone but which costs will be affected.

The avoidable costs include variable costs and specific fixed costs. Specific fixed costs are those costs specific to the part or segment of the business to be shutdown. General fixed costs will not be relevant.

The simplest way to consider such a problem is to re-draft any information in the form of a marginal costing profit statement.

### Example 2

Jones Ltd operates three divisions within a larger company. The CEO has been shown the latest profit statements and is concerned that division C is losing money. You are required to advise her whether or not to close down division C.

Division	A	B	C
(000s)			
Sales	<u>100</u>	<u>80</u>	<u>40</u>
Variable costs	60	50	30
Fixed costs	<u>20</u>	<u>20</u>	<u>20</u>
Profit/(loss)	<u>20</u>	<u>10</u>	<u>(10)</u>

You are also informed that 40% of the fixed cost is product specific, the remainder being allocated arbitrarily to the divisions from head office.

**Required:**

Should division C be shut down?

### Limiting factor decision

Where there is a factor of production that is limited in some way

1. Scarce raw materials.
2. Shortage of skilled labour.
3. Limited machine capacity.
4. Finance (see capital rationing in FM).

**Aim : Maximise the contribution per unit of limiting factor**

- Steps:
1. Contribution per unit of sale.
  2. Contribution per unit of scarce resource.
  3. Rank in order of 2 - highest first.
  4. Use up the resource in order of the ranking.

### Example 3

Neal Ltd produces two products using the same machinery. The hours available on this machine are limited to 5000. Information regarding the two products is detailed below:

Products (per unit data)	M	N
Selling price (£)	<u>40</u>	<u>30</u>
Variable cost (£)	16	15
Fixed cost (£)	<u>10</u>	<u>8</u>
Profit (£)	<u>14</u>	<u>7</u>
Machine hours	8	3
Bud. sales (units)	600	500

**Required:**

Calculate the maximum profit that may be earned.

**Example 3 (b)**

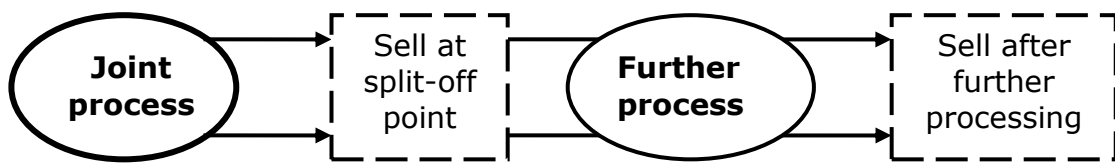
Using the previous example the company is now able to buy in the products at the following costs

Products (per unit data)	<b>M</b>	<b>N</b>
Purchase price (£)	24	21

**Required:**

What is the revised production schedule and the maximum profit earned.

**Further processing decisions**



**Aim: Compare incremental costs and revenues**

**Example 4**

Heighway Ltd operates a joint process from which four products arise. The products may be sold at the separation point of the process or can be refined further and be sold at a premium. Information regarding the products and the refining process can be found below:

Product	<b>E</b>	<b>F</b>	<b>G</b>	<b>H</b>
Selling price –				
at the split-off point	12	16	15	18
After further processing	20	23	25	22
Costs				
Joint process cost per unit	8	8	8	8
Refining cost per unit	5	5	5	5
Specific fixed cost (total)	1,000	2,000	3,000	4,000
General fixed cost (total)				20,000
Budgeted units	2,000	500	5,000	6,000

**Required**

Which products should be further processed?

**CVP analysis (breakeven analysis)**

An understanding of the relationship between the level of activity and costs and revenues.

**Terminology**

**Marginal Cost**

The sum of the variable costs

**Contribution**

Either **1.** the net of sales and variable costs.

Or **2.** the contribution towards covering fixed costs and making a profit.

**Breakeven**

The level of activity at which neither a profit nor a loss is made.

**Key idea.**

**SALES - VARIABLE COSTS = CONTRIBUTION = FIXED COSTS + PROFIT**

**Group Task**

Given the following information calculate the breakeven point and the level of activity at which profits are £20,000.

	<b>Hughes</b>	<b>Smith</b>
Variable cost per unit	£20	£300
Selling price	£40	£350
Fixed cost	£10,000	£5,000
Budgeted units	8,000	250

## Relevant cost

There are 3 components to a relevant cost:

1. **Future**
2. **Cash flow**
3. **Arising as a direct result of the decision**

### Relevant costs

Opportunity cost

Incremental cost

Variable cost

Avoidable cost

### Non-relevant costs

Sunk cost

Committed cost

Fixed O/H absorbed

Depreciation (non cash flows)

## Opportunity cost

The benefit foregone by choosing one alternative in preference to the next best alternative.

### Example 5

A lecturer is being timetabled for the coming year, she has expressed a desire to teach in London. The courses she alone can do, in a specific week, generate the following contributions:

	£
London	1200
Croatia	1500
Moscow	2100

### Required

What is the opportunity cost of working in:

- (a) London?
- (b) Croatia?
- (c) Moscow?

## Avoidable costs

Costs attached to a part or segment of a business which could be avoided if that part or segment ceased to exist. Variable costs are normally considered avoidable, fixed costs normally not. Fixed costs may be considered avoidable if arise within the single part or segment of the business that is relevant. They are particularly applicable in shutdown decisions.



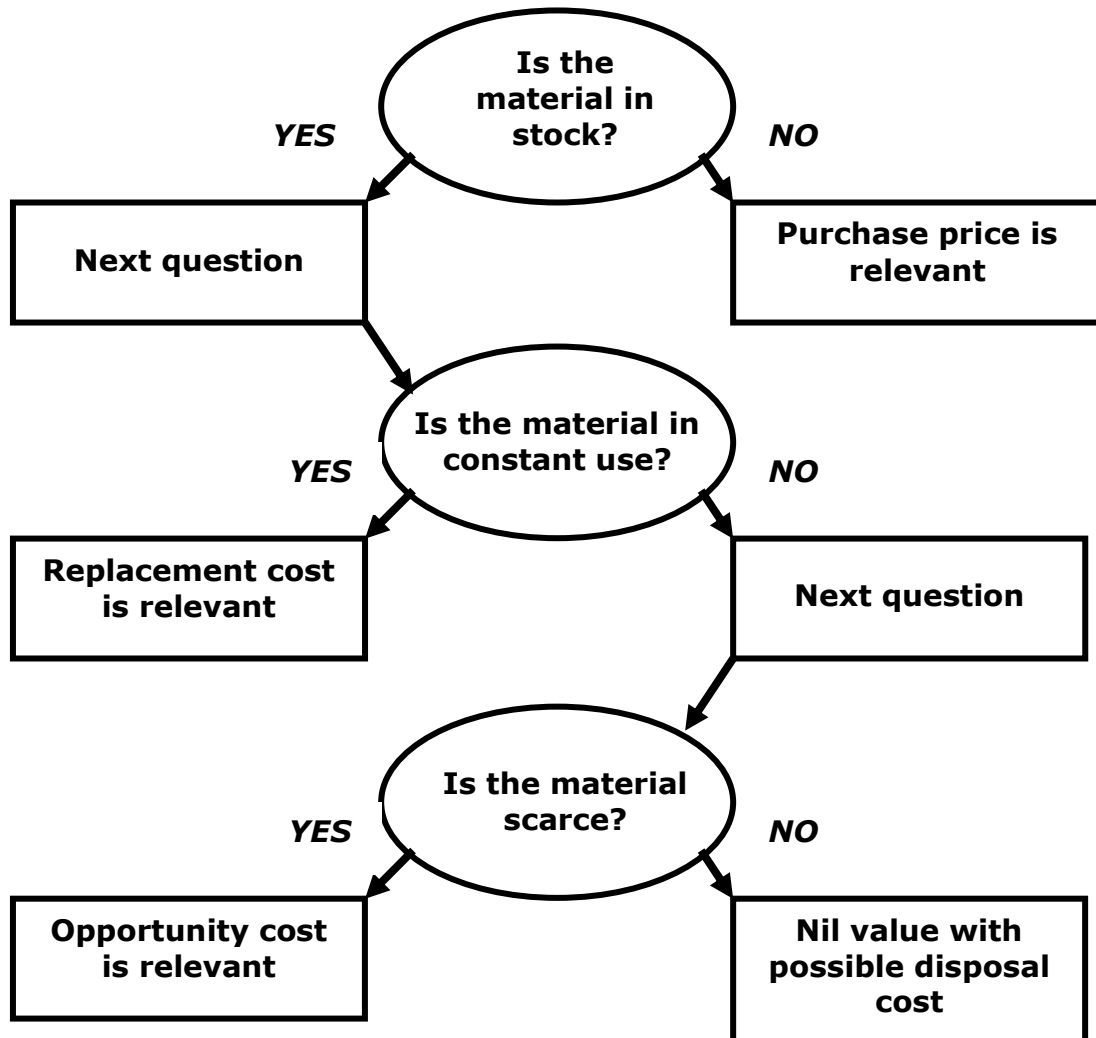
**Variable costs**

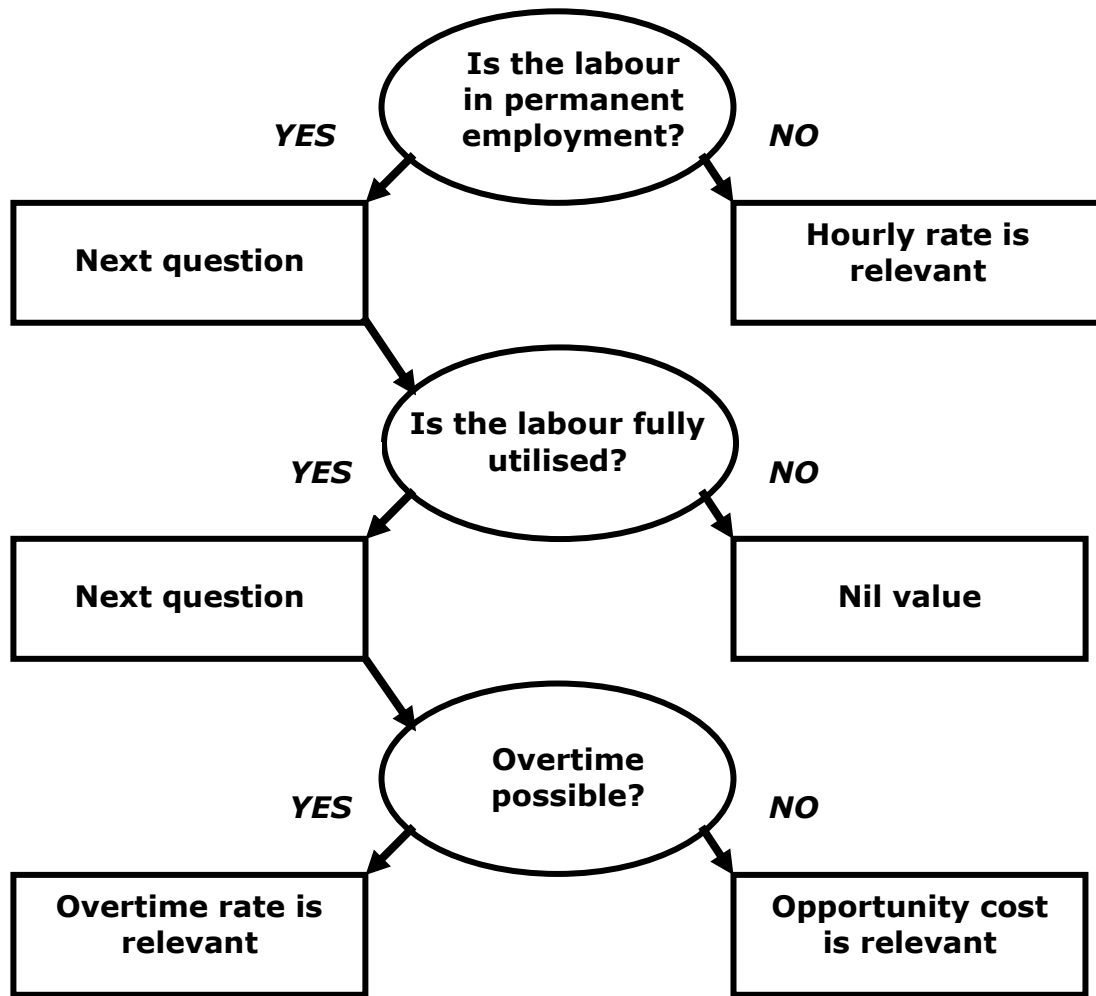
Those costs which vary proportionately with the level of activity. As seen above the variable nature of the cost often makes it more likely to be relevant. We should already know that the variable cost is useful for break-even analysis or any other form of contribution analysis.

**Incremental costs**

Those additional costs (or revenues) which arise as a result of the decision. This classification is particularly useful for further processing decisions, but may be used as a basis for tackling any relevant cost analysis.

**Material costs flow chart**





**Example 6 Tricks**

You are the management accountant of Tricks an organisation which has been asked to quote for the production of a pamphlet for an event. The work could be carried out in addition to the normal work of the company. Due to existing commitments, some overtime working would be required to complete the printing of the pamphlet. A trainee has produced the following cost estimate based upon the resources required as specified by the operations manager:

	£
Direct materials:	
- paper (book value)	4,000
- inks (purchase price)	2,400
Direct labour:	
- highly skilled 250 hours @ £4.00	1,000
- semi-skilled 100 hours @ £3.50	350
Variable overhead	350 hours @ £4.00 1,400
Printing press depreciation	200 hours @ £2.50 500
Fixed production costs	350 hours @ £6.00 2,100
Estimating department costs	400
	12,150

You are aware that considerable publicity could be obtained for the company if you are able to win this order and the price quoted must be very competitive.

The following notes are relevant to the cost estimate above:

- (1) The paper to be used is currently in stock at a value of £5,000. It is of an unusual specification (texture and weight) and has not been used for some time. The replacement price of the paper is £9,000, whilst the scrap value of that in stock is £2,500. The stores manager does not foresee any alternative use for the paper if it is not used on the pamphlet.
- (2) The inks required are presently not held in stock. They would have to be purchased in bulk at a cost of £3,000. 80% of the ink purchased would be used in producing the pamphlet. There is no foreseeable alternative use for the remaining unused ink.
- (3) Highly skilled direct labour is in short supply, and to accommodate the production of the pamphlet, 50% of the time required would be worked at weekends for which a premium of 25% above the normal hourly rate is paid. The normal hourly rate is £4.00 per hour.
- (4) Semi-skilled labour is presently under-utilised, and 200 hours per week are currently recorded as idle time. If the printing work is carried out, 25 unskilled hours would have to occur during the weekend, but the employees concerned would be given two hours time off during the week in lieu of each hour worked at the weekend.
- (5) Variable overhead represents the cost of operating the printing press and binding machines.
- (6) When not being used by the company, the printing press is hired to outside companies for £6.00 per hour. This earns a contribution of £3.00 per hour. There is unlimited demand for this facility.
- (7) Fixed production costs are those incurred by and absorbed into production, using an hourly rate based on budgeted activity.
- (8) The cost of the estimating department represents time spent in discussions with the organisation concerning the printing of its pamphlet.

**Required:**

Prepare a revised cost estimate using the opportunity cost approach, showing clearly the minimum price that the company should accept for the order. Give reasons for each resource valuation in your cost estimate. (16 marks)

## LINEAR PROGRAMMING

The aim of decision making is to maximise profit, assuming that the fixed cost does not change, this would mean that we must maximise contribution. Alternatively the aim may be to minimise cost to subsequently maximise profit.

### Steps

1. **Define the problem**
2. **Objective function**
3. **Constraints**
4. **Graph**
5. **Optimal solution**
6. **Shadow prices**

### Illustration

A company makes two products (R and S), within three departments (X, Y and Z). Production times per unit, contribution per unit and the hours available in each department are shown below:

	Product R	Product S	Capacity (hours)
Contribution/unit	£4	£8	
	Hours/unit	Hours/unit	
Department X	8	10	11000
Department Y	4	10	9000
Department Z	12	6	12000

### Required

What is the optimum production plan in order to maximise contribution?

**Define the problem**

Let  $x$  = number of units of R produced

Let  $y$  = number of units of S produced

**Objective Function – maximise contribution = Z**

$$Z = 4x + 8y$$

**Subject to – constraints**

(Dept A hrs)  $8x + 10y \leq 11000$

(Dept B hrs)  $4x + 10y \leq 9000$

(Dept C hrs)  $12x + 6y \leq 12000$

(non-negativity)  $x, y \geq 0$

**Plotting the graph**

If we know the constraints we are able to plot the limitations on a graph identifying feasible and non-feasible regions. The linearity of the problem means that we need only identify two points on each constraint boundary or line. The easiest to identify will be the intersections with the  $x$  and  $y$ -axes.

For example

Dept A hrs – equating the formula  $8x + 10y = 11000$

If  $x = 0$  then  $y = 1100$  Co-ordinates (0, 1100)

If  $y = 0$  then  $x = 1375$  (1375, 0)

And hence

Dept B hrs –  $4x + 10y = 9000$  (0, 900) (2250, 0)

Dept C hrs –  $12x + 6y = 12000$  (0, 2000) (1000, 0)

By plotting the individual constraints we build up an area of what is possible within all the constraints ie the FEASIBLE REGION.

**Identifying the optimal solution**

1. The Iso-contribution (IC line) line is plotted identifying points of equal contribution. The linear nature of the problem means that this line will be a straight line identifying an inverse relationship between the two products.

The IC line is of importance because the relationship of the contribution earned by each product is constant (ie £4 for R against £8 for S). This means that the gradient of the line will remain constant as the total contribution figure gets larger or smaller.

If we 'push out' the IC line to the point where it leaves the feasible region, that point will be the point of maximum contribution.

Steps

- (i) Choose an arbitrary contribution figure (preferably one that can be easily plotted on the graph just drawn).

Example contribution =  $Z = £3200$

- (ii) What are the objective function values?

$4x + 8y = 3200$

- (iii) Translate those values into co-ordinates for plotting on the graph

Co-ordinates (0, 400) and (800, 0)

2. The optimal solution can now be found by interrogating the point at which the IC line leaves the feasible region to identify the co-ordinates and hence the product mix and maximum contribution.

The intersection or VERTEX identified is where two constraints meet, those constraints can be solved simultaneously to identify the product mix.

$$\begin{array}{rcl} \text{a} & 8x + 10y & = 11000 \\ \text{b} & 4x + 10y & = 9000 \\ (\text{a} - \text{b}) & 4x & = 2000 \\ & x & = 500 \\ & y & = 700 \end{array}$$

Therefore the optimal product mix is to make and sell 500 units of X and 700 units of Y. The maximum contribution is  $(500 \times 4 + 700 \times 8) = £7600$ .

We can check this point by seeing how much of the constraints are used up:

Dept	hours used	hours available
A	$500 \times 8 + 700 \times 10 = 11,000$ hours	11,000 hours
B	$500 \times 4 + 700 \times 10 = 9,000$ hours	9,000 hours
B	$500 \times 12 + 700 \times 6 = 10,200$ hours	12,000 hours

We can see that both departments, A and B, are fully utilised or what are termed binding constraints (ie they bind the decision or output). Department C has 1800 hours un-utilised and is not binding on the decision, it is called a slack constraint.

## SENSITIVITY ANALYSIS

An investigation to identify how the optimum solution will change with changes to individual variables.

The SHADOW PRICE or dual price is the amount by which the total optimal contribution would rise if an additional unit of input (hour) was made available.

### Department X – shadow price of one hour

If one more hour was available (ie 11,001 hours now), the constraint of department A will relax outward slightly which should improve the overall optimum solution.

Solve the new constraint equations

$$\text{Dept X} \quad 8x + 10y = 11001$$

$$\text{Dept Y} \quad 4x + 10y = 9000$$

Revised solution

Revised contribution

Shadow price

Effects – As A increases by 1:

1. x
2. y
3. Contribution
4. Dept Z

### Department Y – shadow price of one hour

If one more hour was available (ie 9,001 hours now), the constraint of department B will relax outward slightly which should improve the overall optimum solution.

Solve the new constraint equations

$$\text{Dept X} \quad 8x + 10y = 11000$$

$$\text{Dept Y} \quad 4x + 10y = 9001$$

$$4x + 0 = 1999$$

Revised solution  $x = 499.75, \quad y = 700.2$

Revised contribution  $499.75 \times 4 + 700.2 \times 8 = \text{£}7600.6$

Shadow price  $\text{£}7600.6 - \text{£}7600.0 = \text{£}0.6/\text{hour of dept Y}$

Effects – As Y increases by 1:

- 1 x decreases by 0.25
- 2 y increases by 0.2
- 3 Contribution increases by £0.6

Dept Z slack actually increases by 1.8 hours

**Department Z – shadow price of one hour**

Department Z already has spare capacity, extra hours would not increase the contribution generated by the optimum solution (they would not change the solution). They have no shadow price.



# Chapter 3

# Pricing



## CHAPTER CONTENTS

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## PRICING

The pricing of products or services is one of the more difficult and more important for the organisation. The prices adopted by a company are going to have an immediate effect on the profitability of an organisation and longer term implications on the marketing of the product. There are three ways in which we may calculate the price of the cost unit:

1. **Cost-plus pricing** - marginal cost or full cost as a base.
2. **Marketing based pricing** - the aim to generate profit maximisation in the longer term.
3. **Demand based pricing** - the application of economic theory to maximise profit in the short-term.

## **COST-PLUS PRICING**

The simplest form of pricing, it is still widely used particularly in the retail industry and in specific order costing situations. The price is based on the cost plus a margin.

Cost-plus pricing may be based on:

1. full cost (calculated using absorption costing) or
2. marginal cost.

The rationale behind this method is that if the price is greater than the cost then a profit must be made (providing that the expected volumes are achieved).

### **Advantages of full cost plus pricing strategy:**

- It is believed easy to calculate once the company has made a policy as to whether to use marginal or absorption costing.
- Ensures that all costs are covered and that the company makes a profit provided that the budgeted figures used in the calculation are reasonably accurate.
- Ensures that selling price is greater than cost of producing the product, so that a firm can generate profits and survive in the future.
- Avoids costs of collecting market information on demand and competitor activity.

### **Disadvantages of full cost plus pricing strategy:**

- Based on the assumption that demand for the company's product is inelastic and that a change in price will not lead to a significant change in demand. If demand is inelastic firms should increase their price and earn higher revenue and profits because increasing prices will not lead to a fall in demand.
- The absorption basis used to calculate the full cost is often determined arbitrarily. Depending on the absorption basis used in calculating the total cost, the strategy will produce different selling prices.
- Takes no account of market conditions since its focus is entirely internal. This means that the selling price of companies adopting this strategy have no resemblance to the prices of competitors.
- By using a fixed mark up it does not permit the company to respond to the pricing decisions of its competitors.

## MARGINAL COST PLUS PRICING

Pricing strategy in which a profit margin is added to the budgeted marginal or variable cost of the product.

### Advantages

- This strategy ensures that fixed costs are covered.
- The size of the mark up can be adjusted to reflect demand.

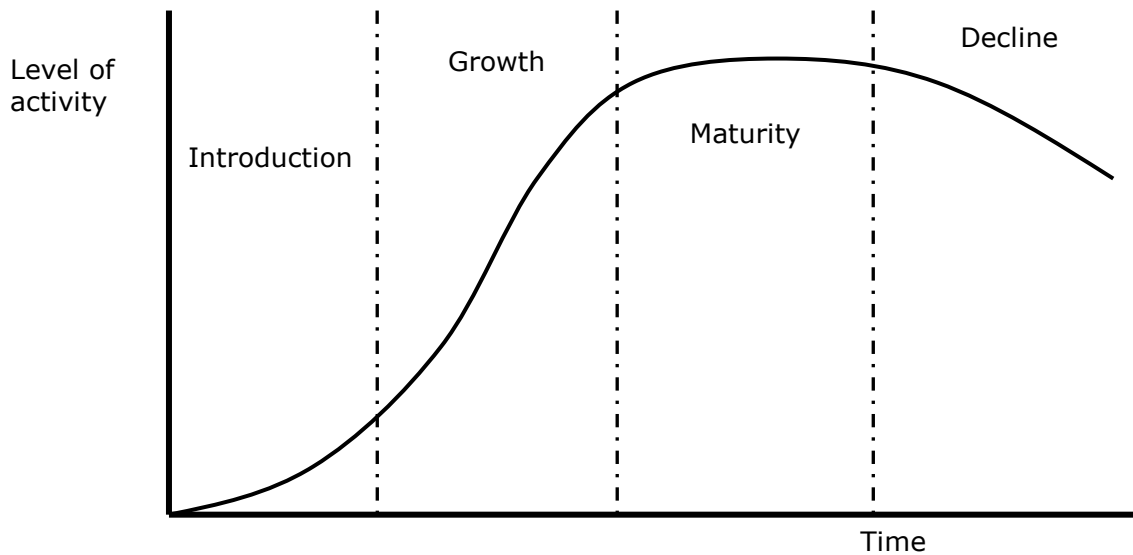
### Disadvantages

- Ignore profit maximisation.
- Ignores fixed overheads. The price may not be high enough to ensure that a profit is made after fixed overheads are covered.

## MARKETING APPROACHES

The aim is to maximise the profit over the length of the products life.

### Product life cycle



#### Team task

What are the implications on profitability, cash flow and strategy of each stage in the product life cycle?

Phase	Introduction	Growth	Maturity	Decline
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Profitability

Cash flow

Strategy

## Pricing techniques

### For new markets – monopoly position

#### Market skimming

The price is set at a high level to generate maximum return per unit in the early units. The aim is to sell to only that small part of the market which is not price sensitive. For market skimming to be effective the company must have a barrier to entry in the form of a patent, brand, technological innovation or other.

#### Features

- 1 Low volume, high price
- 2 Low initial investment in production capacity
- 3 Low risk, if strategy fails price can be dropped.

#### Limitations of market skimming strategy

- It is only effective when the firm is facing an inelastic demand curve. If the long run demand schedule is elastic, market equilibrium will be achieved by quantity changes rather than price changes. Penetration pricing is a more suitable strategy in this case.
- Price changes by any one firm will be matched by other firms resulting in a rapid growth in industry volume. Dominant market share will typically be obtained by a low cost producer that pursues a penetration strategy.
- Skimming encourages the entry of competitors. When other firms see the high margins available in the industry, they will quickly enter.
- Skimming results in a slow rate of diffusion and adaptation. This results in a high level of untapped demand. This gives competitors time to either imitate the product or leap frog it with a new innovation.

#### Penetration pricing

The price is set at a level which should generate demand from the whole market and by so doing encourage an acceleration of the life cycle quickly into growth and maturity phases. Necessary if the market skimming approach is not possible because of a lack of barriers to entry or high initial development costs.

#### Features

- 1 Low price, mass market
- 2 Substantial investment required
- 3 High risk, the low price is used to deter other competitors

Penetration pricing strategy is appropriate when:

- Product demand is highly price elastic so that demand responds to price changes.
- Substantial economies of scale are available.

- The product is suitable for a mass market and there is sufficient demand.
- The product will face competition soon after introduction.
- There is inadequate demand in the low elasticity market segment for price skimming.

## Existing market – no monopoly position

### Penetration pricing - see above

May also be used in an existing market.

### Going rate pricing or average pricing

Where the product is a leading brand (in market share terms) and any change in price made that company will lead to a change by other competitors. Competition will continue in other forms.

#### Team task

Identify three industries/companies who use going rate pricing.

### Premium pricing

The product is able to command a premium due to specific and identifiable features of the product. The premium may be payable for a number of differing reasons such as:

1. Prestige
2. Reliability
3. Longevity
4. Technology
5. Style

#### Team task

Identify the car manufacturers which use each feature to command a premium for their product.

### Discount pricing

The product is sold at a discount to encourage higher sales. This often has the effect of reducing the image of the product because customers equate price with quality.

#### Team task

Identify three industries/companies that use discount pricing.



**Complementary product pricing**

Complementary products are products that are goods that tend to be bought and used together. For example computers and software. If sales of one increase, demand for the other will also increase. Also referred to as joint demand.

**Captive product pricing**

Where products have complements, companies will charge a premium price where the consumer is captured.

**Product line pricing**

A product line is a group of products that are related to each other.

Product line pricing strategies include setting prices that are proportional to full or marginal cost with the same profit margin for all products in the product line. Alternatively, prices can be set to reflect demand relationships between products in the line so that an overall return is achieved.

**Volume discounting**

A volume discount is a reduction in price given for purchases of large volume. The objective is to increase sales from large customers. The discount differentiates between wholesale and retail customers. The reduced cost of a large order will compensate for the loss of revenues from offering the discount.

**Price discrimination**

This is the practice of selling the same product at different prices to different customers. Example, off peak travel bargains, theatre tickets sold at different prices based on location so that customers pay different prices for the same performance.

## DEMAND BASED PRICING

The preparation of a price in relation to the demand for a product. This technique considers the demand for a product at a given price by developing a demand curve. Note that this is as far as the F5 paper goes, there is no need to further calculate profit maximising solutions.

## Deriving the demand curve

### Formula sheet extract

#### Demand curve

$$P = a - bQ$$

$b$  = change in price/change in quantity

$a$  = price when  $Q = 0$

#### Example 1 Biscan

A product sells 500 units at a price of £25 and 700 units at a price of £20.

#### Required

Assuming a unitary demand curve what is the formula for the demand curve.

#### Example 2 Mellor

A company presently sells 20,000 units at £12.50 each, the managing director believes that they will be more profitable if they sell 20% more unit at a price of £11 each.

#### Required

- (a) Derive the demand curve.
- (b) Calculate the total revenue in each circumstance.

Is the managing director necessarily correct in her assumption?

The demand for a particular company's goods will be influenced by 3 main factors: -

1. The Product Life Cycle (PLC). If life cycle is short, a high price strategy is adopted.
2. Quality of the product. High quality of product can support a high price.
3. Marketing (Price is one of the 4 P's). Can capture a higher market share by adopting a particular pricing strategy.

## Price elasticity of demand

Price elasticity of demand is the measure of the extent of change in market demand for a good in response to a change in its price. When a small change in price results in more than a proportionate change in demand, the product is said to be elastic, where a change in price results in less than proportionate change in demand, we have price inelastic (e.g. salt). However, where a change in price results in an equal change in demand, we have unitary elastic demand.

Elasticity of demand (Ped) = % change in demand of good X / % change in price of good X.

If the PED is greater than one, the good is **price elastic**. Demand is responsive to a change in price. If for example a 15% fall in price leads to a 30% increase in quantity demanded, the price elasticity = 2.0.

If the PED *is less than one*, the good is **inelastic**. Demand is not very responsive to changes in price. If for example a 20% increase in price leads to a 5% fall in quantity demanded, the price elasticity = 0.25.

If the PED is equal to one, the good has **unit elasticity**. The percentage change in quantity demanded is equal to the percentage change in price. Demand changes proportionately to a price change.

If the PED is equal to zero, the good is **perfectly inelastic**. A change in price will have no influence on quantity demanded. The demand curve for such a product will be vertical.

If the PED is infinity, the good is **perfectly elastic**. Any change in price will see quantity demanded fall to zero. This demand curve is associated with firms operating in perfectly competitive markets.

### Other factors affecting elasticity

- Availability of substitutes.
- Complementary products.
- Disposable income.
- Necessities.
- Tastes and fashions.



## Chapter 4

# Decision making under uncertainty



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## WHAT IS RISK AND UNCERTAINTY?

Uncertainty simply reflects that there is more than one possible outcome for a given event.

Risk is where that uncertainty can be quantified in some way. It is normal to quantify the risk in terms of a probability distribution.

## Probability

The measurement of the outcomes in terms of their estimated likelihood of occurring.

Overall probability of an event must sum to 1.0 (or if you wish 100%). For example if you toss a coin there is a 0.5 (50%) probability of a head or a tail. Adding both outcomes to total 1.0 (100%)

## Expected values

A weighted average value of all the possible outcomes. It does not reflect the degree of risk, but simply what the average outcome would be if the event were repeated a number of times.

### Expected value formula

$$EV = \sum px$$

P = probability of an outcome

X = value of an outcome

### Example 1

A company expects the following monthly profits:

Monthly profit	Probability
£50,000	0.6
£35,000	0.4

**Calculate the expected value of monthly profit.**

### Limitations of expected values

- The EV shows a long term average, so that the EV will not be reached in the short term and is therefore not very suitable for one-off decisions.
- The accuracy of the results depends on the accuracy of the probability distribution used.
- EV takes no account of the risk associated with a decision.

## Decision-making criteria

### Maximax

The best of the best, a risk taker's decision criteria that focuses on maximising the value of the best possible outcome.

### Maximin

The best of the worst, a risk averse decision criteria that focuses on maximising the value of the worst possible outcome.

### Minimax regret

A decision criteria that focuses on the opportunity cost. It can be described as the 'sore loser' criteria because the comparison of the outcome is against the best possible outcome that could have occurred.

### Expected value

The expected value ignores the degree of risk and focuses solely on the average return of the event given repetition of the event.

### Example 2

Mr Byornbye is a greengrocer (food seller). He buys a product for £20 per case. He can sell the product for £40 per case on his stall. The product is perishable and it is not possible to store any food, instead any cases unsold at the end of the day can be sold off as scrap for £2 per case.

Purchase orders must be made before the number of sales is known. He has kept records of demand over the last 150 days.

Demand / day	Number of days
10	45
20	75
30	30

### Required

- (a) Prepare a summary of possible net daily margins using a payoff table.
- (b) Advise him:
  - (i) How many cases to purchase if he uses expected values.
  - (ii) How many cases to purchase if he uses maximin / maximax.
  - (iii) How many cases to purchase if he uses minimax regret.



## **Risk attitudes**

### **Risk seeker**

This is where the strategy with the best possible outcome is selected irrespective of the likelihood of it occurring. The maximax criterion will apply in such a situation.

### **Risk averse**

This is where the decision maker will consider the worst outcome each time. The maximin criterion will apply in such a situation.

### **Risk neutral**

This is where the decision maker will consider all possible outcomes and will select the strategy that maximises the expected value of benefit. The minimax criterion also applies in this situation.



# Chapter 5

# Budgeting types



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## BUDGETING

### Budget

A quantitative plan prepared for specific time period. It is normally expressed in financial terms and prepared for one year.

### Functions of budgeting (PCCCEMA)

We can identify the aims of a budget in six ways:

1. Planning
2. Control
3. Communication
4. Co-ordination
5. Evaluation
6. Motivation
7. Authorisation

### Budget preparation

#### Steps

#### Budget aims

Strategic aims.

Key assumptions.

#### Identify the principal budget factor.

1. Sales demand for production environment.
2. Cash resource for non profit making organisation.

#### Prepare the sales budget

Start with the principal budget factor:

1. Marketing department function.
2. Price/volume relationship.

### **Prepare all other functional budgets**

Prepare each functional budget separately.

Participatory process

1. Local knowledge.
2. Promotes ownership.

### **Negotiation**

Meeting between junior management and senior managers to ensure that the budget is a realistic target. In particular the aim is to eliminate budgetary slack.

### **Review**

Bring all individual functional budgets together to form a master budget, an overall budget for the whole organization.

Budget assessed for:

1. Feasibility
2. Acceptability

Once completed budgeted financial statements and cash flow statements can be prepared.

### **Acceptance**

Acceptance means that the budget becomes a formal authorisation for all levels of management to take action for and on behalf of the company.

## TYPES OF BUDGET

When looking at differing types of budgeting we are concerned with the benefits or otherwise to the more traditional budget techniques. We would normally expect a budget to be:

1. **Incremental**
2. **Periodic**
3. **Participatory**

In comparison to this we will look at four alternative budgeting types:

1. **Zero based budgeting (ZBB)**
2. **Continuous (or rolling) budgets**
3. **Non-participatory budgets**
4. **Activity based budgeting**

### Zero based budgeting

A simple idea of preparing a budget from a 'zero base' each time ie as though there is no expectation of current activities to continue from one period to the next. ZBB is normally found in **service** industries where costs are more likely to be **discretionary**. A form of ZBB is used in local government. There are four basic steps to follow:

#### 1. Prepare decision packages

Identify all possible services (and levels of service) that may be provided and then cost each service or level of service, these are known individually as **decision packages**.

#### 2. Rank

Rank the decision packages in order of importance, starting with the mandatory requirements of a department. This forces the management to consider carefully what their aims are for the coming year.

#### 3. Funding

Identify the level of funding that will be allocated to the department.

#### 4. Utilise

Use up the funds in order of the ranking until exhausted.

### **Advantages (as opposed to incremental budgeting)**

1. Emphasis on future need not past actions.
2. Eliminates past errors that may be perpetuated in an incremental analysis.
3. A positive disincentive for management to introduce slack into their budget.
4. A considered allocation of resources.
5. Encourages cost reduction.

### **Disadvantages**

1. Can be costly and time consuming.
2. May lead to increased stress for management.
3. Only really applicable to a service environment.
4. May 're-invent' the wheel each year.
5. May lead to lost continuity of action and short term planning.

## **Continuous budgeting**

In a periodic budgeting system the budget is normally prepared for one year, a totally separate budget will then be prepared for the following year. In continuous budgeting the budget from one period is 'rolled on' from one year to the next.

Typically the budget is prepared for one year, only the first quarter in detail, the remainder in outline. After the first quarter is revised for the following three quarters based on the actual results and **a further quarter is budgeted for.**

This means that the budget will again be prepared for 12 months in advance. This process is repeated each quarter (or month or half year).

### **Advantages (as opposed to periodic budgeting)**

1. The budgeting process should be more accurate.
2. Much better information upon which to appraise the performance of management.
3. The budget will be much more 'relevant' by the end of the traditional budgeting period.
4. It forces management to take the budgeting process more seriously.

### **Disadvantages**

1. More costly and time consuming.
2. An increase in budgeting work may lead to less control of the actual results.



## Non-participatory budgeting

Some organisations may not require junior management to participate in the budgetary process. This may be because of security or more likely due to centralised nature of the company.

### Disadvantages

1. Saves time and money.
2. Individual wishes of senior management will not be diluted by others' plans.
3. Reduces the likelihood of information 'leaking' from the company.

## Activity based budgeting

Use of activity based costing principles to provide better **overhead cost** data for budgeting purposes. The advantages of using such a technique accrue from better cost allocation.

Exam questions will be closely related to the ABC questions we looked at earlier on in the course.

### Applicability of ABB

Used in an environment with the following criteria:

1. Complex manufacturing environment.
2. Wide range of products.
3. High proportion of overhead costs.
4. Competitive market.

### Benefits of ABB

1. Better understanding of overhead costs.
2. Identifies the accurate relationship between product and activity.
3. Each activity more accurately describes where costs are incurred.

Each and every benefit allows for better control of costs together with the opportunity to reduce the costs using other management accounting techniques.

### Key point

Whenever discussing ABB in an exam context a balance must be drawn between the better information that is provided against the high cost of implementation and maintaining an ABB system.



# Chapter 6

# Budgetary control

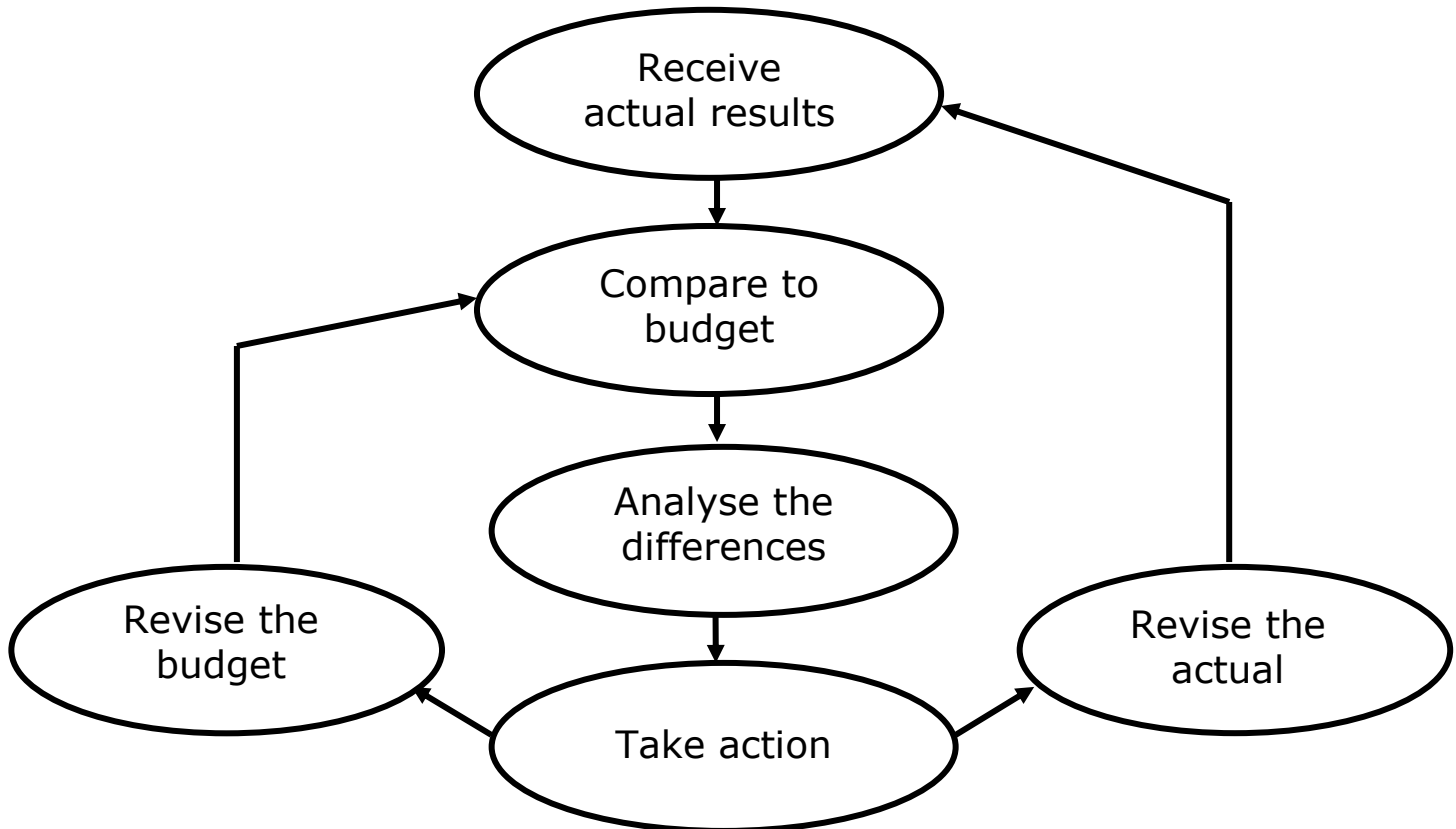


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## BUDGETARY CONTROL

The use of budgeted data for control purposes. The budget is used as the comparator against which the actual results may be compared. Any differences can then be investigated and appropriate action taken. Budgetary control may also be called **responsibility accounting** because it gives individual managers the responsibility to achieve results.



### Example 1 Ogrisovic

A company has the following budgeted and actual information

	Units	Cost
Budget	1,000	£20,000
Actual	1,200	£22,500

#### Required

Has the company done better or worse than expected?

If we are now told that £10,000 of budgeted costs are variable, the remainder being fixed: are we able to tell whether the company has done better or worse than expected?

## Fixed budget

A budget prepared at a single (budgeted) level of activity.

## Flexible budget

A budget prepared with the costs classified as either fixed or variable. The budget may be prepared at any activity level and can be '**flexed**' or changed to the actual level of activity for budgetary control purposes.

### Exercise 2

Complete a budgetary control statement using a flexible budgeting approach

	<b>Original Budget</b>	<b>Actual Results</b>
<b>Sales Units</b>	1000	1200
	£	£
<b>Variable Costs:</b>		
Direct Material	10,000	12,500
Direct Labour	15,000	17,000
Variable Overheads	25,000	27,000
Sub-Total	50,000	56,500
Fixed overheads	25,000	33,500
<b>Total Cost</b>	75,000	90,000

### Example 3

You have been provided with the following operating statement, which represents an attempt to compare the actual performance for the quarter that has just ended with the budget.

	<b>Budget</b>	<b>Actual</b>	<b>Variance</b>
Number of units sold (000)	640	720	80
	£000	£000	£000
<i>Cost of sales (all variable)</i>			
Materials	168	144	24
Labour	240	288	(48)
Overheads	32	36	(4)
	440	468	(28)

<i>Fixed Labour cost</i>	100	94	6
<i>Selling and distribution costs</i>			
Fixed	72	83	(11)
Variable	144	153	(9)
<i>Administration costs</i>			
Fixed	184	176	8
Variable	48	54	(6)
	548	560	(12)
Total Costs	988	1,028	(40)
Sales	1,024	1,071	47
Net Profit	36	43	7

**Required:**

- (a)** Using a flexible budgeting approach, redraft the operating statement so as to provide a more realistic indication of the variances, and comment briefly on the possible reasons (other than inflation) why they have occurred.

(12 marks)

- (b)** Explain why the original operating statement was of little use to management.

(2 marks)

- (c) (i)** Discuss the problems associated with the forecasting of figures which are to be used in flexible budgeting.

(7 marks)

- (ii)** Further analysis has indicated that the 'variable' overheads for cost of sales are, in fact, only semi-variable. Whilst the budgeted overheads for 640,000 units is indicated to be £32,000, it is felt that the budget for 760,000 units would be £37,000. Included in this later cost is £1,000 incurred when the activity reached 750,000 units due to extra hiring capacity.

Produce a revised flexed budget for the overheads contained in cost of sales for an activity level of 720,000 units.

(4 marks)

**(Total 25 marks)**

(ACCA)





## Chapter 7

# Behavioural aspects of budgeting



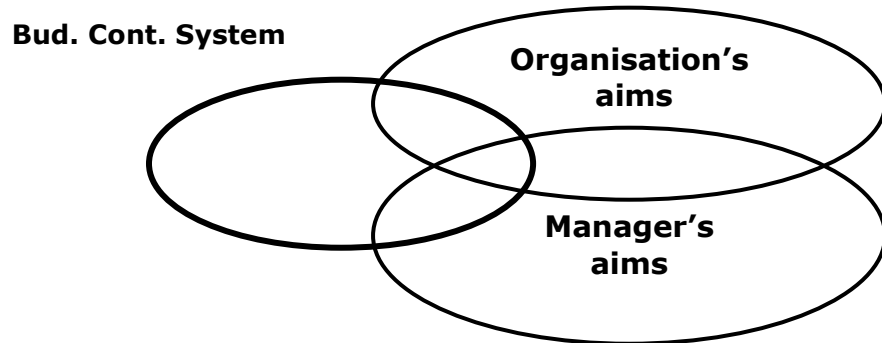
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## BEHAVIOURAL ASPECTS OF BUDGETING

It is very easy for the budgetary process to cause dysfunctional activity. For example, if junior management believe that a budget imposed upon them is unattainable, their aim may well be to ensure that the budget is *not* achieved, thereby proving themselves to be correct.

Otley Illustration



### Team task

Identify as many examples of dysfunctional behaviour as you can in the time provided.

## Participation

Behaviour studies have shown relationships between budget levels and performance

### Top-down budgeting

A budget that is set without allowing the ultimate budget holder to have the opportunity to participate in the budgeting process. Also called "imposed" budget, or non-participative.

### Bottom-up budgeting

A system of budgeting in which budget holders have the opportunity to participate in setting their own budgets. Also called participative budgeting.

Advantages of participation		Disadvantages of participation	
1	Increased motivation to the budget holder(ownership of budget)	1	Senior managers may not be able to give up control
2	Should contain better information, due to local knowledge	2	Poor decision making due to inexperience
3	Increases managers' understanding	3	Lack of goal congruence

4	Better communication forced upon the company	4	Budget preparation is slower and may lead to conflict
5	Senior managers can concentrate on strategic matters	5	Junior managers may introduce budgetary slack
		6	Participation may not really occur as senior managers revise data receive to their own ends

# Chapter 8

# Quantitative aids to budgeting



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## ESTIMATING THE LINE OF BEST FIT

### Regression

Identifying the relationship between one variable and another.

The dependent variable is  $y$  and must always be on the vertical axis

The independent variable is  $x$  and always goes on the horizontal axis.

#### Key formulae (given in the exam)

$$b = \frac{n \sum xy - \sum x \sum y}{n \sum x^2 - \frac{(\sum x)^2}{n}}$$

$$a = \frac{\sum y}{n} - b \frac{\sum x}{n}$$

#### Example 1

A company has recorded expenditure on advertising and resulting sales for 6 months as follows:

Month	Marketing spend (£000)	Sales (£000)
	$x$	$y$
July	40	680
August	80	960
September	100	1,040
October	120	1,200
November	60	880
December	80	1,000

#### Required:

- (a) Plot the data on a scatter diagram and comment.
- (b) Calculate the line of best fit through the data, and interpret your values of  $a$  and  $b$ .
- (c) Forecast Sales when advertising expenditure is:
  - (i) £100,000
  - (ii) £250,000
 and comment on your answers.

## Correlation coefficient

The correlation coefficient ( $r$ ) measures the strength of a linear relationship between 2 variables. Its range of values is  $-1$  through  $0$  to  $+1$ . It shows how well the data supports the line of best fit.

### Negative correlation

Indicates an inverse relationship. This means that the line will be downwards sloping. For example the relationship between price and volume. The coefficient will be negative.

### Positive correlation

A direct relationship. This means that the line will be upward sloping. For example the relationship between a team winning and sales of its merchandise. The coefficient will be positive.

### Calculating the correlation coefficient

$$r = \frac{n\sum xy - \sum x\sum y}{\sqrt{(\sum x^2 - (\sum x)^2)(\sum y^2 - (\sum y)^2)}}$$

### Example 2

Calculate the correlation coefficient in example 1 above, and interpret your answer.

## Coefficient of determination

The coefficient of correlation squared ( $r^2$ ). The coefficient of determination shows the amount of the change in the dependent variable that is due to the independent variable.

For example, if ice cream sales show a coefficient of determination of  $0.6$  or  $60\%$  in relation to daily maximum temperature this would mean that sales of ice cream was  $60\%$  determined by temperature and  $40\%$  due to other factors.

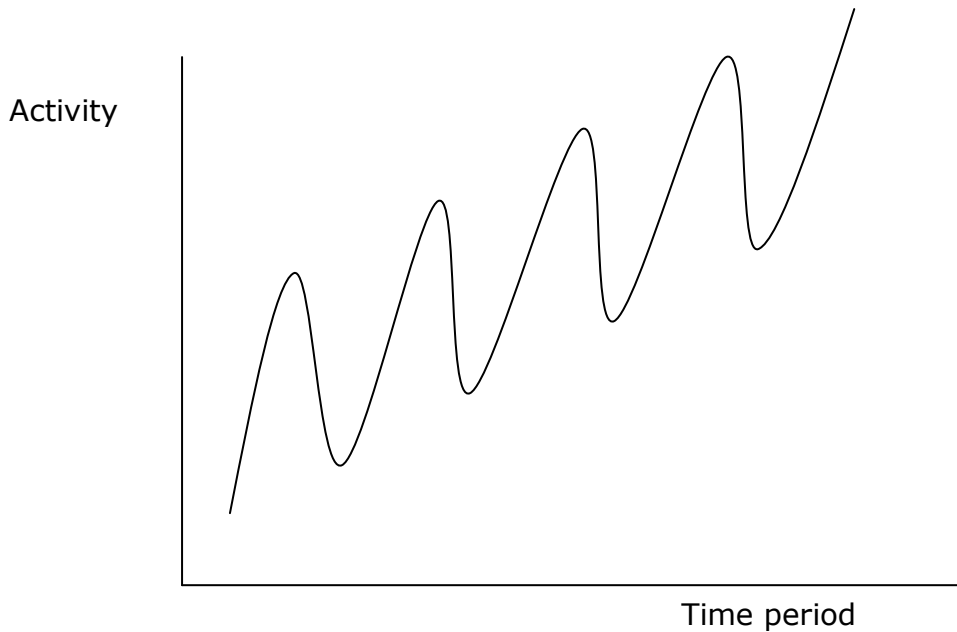
### Example 3

Calculate the coefficient of determination from example 2 above, and interpret your answer.



## TIME SERIES ANALYSIS

A time series is a complex series changing value of a variable over time. The data often has an underlying pattern over time. This pattern can be used to forecast into the future.



There are four components

- 1. The Trend**
- 2. Seasonal Variation**
- 3. Cyclical Variation**
- 4. Residual Variation**

### The analysis

This is performed by carrying out two distinct steps:

1. To find the trend.
2. To find the seasonal variation.

### Identifying the trend line

There are two methods of evaluating the trend.

- (i) Fit the line by eye on the graph.
- (ii) Moving averages.

## Moving averages

### Illustration

<i>Year</i>	<i>Quarter</i>	<i>Sales</i>	<i>Moving Total</i>	<i>Moving average</i>	<i>Centred moving average</i>
1	Q1	18			
	Q2	20			
	Q3	34	116	29	29.5
	Q4	44	120	30	30.0
2	Q1	22	120	30	30.5
	Q2	20	124	31	31.5
	Q3	38	128	32	31.5
	Q4	48	124	31	31.0
3	Q1	18	124	31	31.5
	Q2	20	128	32	33.0
	Q3	42	136	34	
	Q4	56			

## Evaluating the seasonal variation

There are two models:

### 1. The additive model:

This is based upon the idea that each actual result is made up of two influences. The magnitude of the seasonal variation is not affected by the change in the trend line

$$\text{Actual} = \text{Trend} + \text{Seasonal Variation}$$

The seasonal variation (SV) will be expressed in absolute terms.

**2. The multiplicative model:**

The magnitude of the seasonal variation is in direct proportion to the change in the trend.

$$\text{Actual} = \text{Trend} \times \text{Seasonal Variation factor}$$

The seasonal variation (SV) will be expressed in proportional terms.

For example, if, in one particular period the underlying trend was known to be £10,000 and the seasonal variation in this period was given as +12%, then the actual result could be forecast as:

$$£10,000 \times \frac{112}{100} = £11,200.$$

**The additive model - an example**

Year	Quarter	Sales	Centred moving average	Seasonal variation
1	Q1	18		
	Q2	20		
	Q3	34	29.5	4.5
	Q4	44	30.0	14.0
2	Q1	22	30.5	-8.5
	Q2	20	31.5	-11.5
	Q3	38	31.5	6.5
	Q4	48	31.0	17.0
3	Q1	18	31.5	-13.5
	Q2	20	33.0	-13.0
	Q3	42		
	Q4	56		

Now calculate the average 'Actual – Trend' for each quarter. This is a task that should be carried out by drawing up a second working table (see below).

Year	Quarter			
	Q1	Q2	Q3	Q4
1			4.50	14.00
2	- 8.50	- 11.50	6.50	17.00
3	- 13.50	- 13.00		
Average Seasonal Variations (rounded)	- 11	- 12	6	16

**The multiplicative model – an example**

The multiplicative seasonal variations are calculated in a similar manner, but the variations are proportions. Instead of finding  $A - T$ , we find  $A/T$ , then average the results as above. For example, for quarter 1,  $A/T$  is  $22/30.5 = 0.71$  in year 2, and  $18/31.5 = 0.55$  in year 3. The average of these is 0.6; the variations below have been rounded to one decimal place for simplicity, so that the seasonal variations are approximately:

**Quarter 1: 0.6**

**Quarter 2: 0.6**

**Quarter 3: 1.2**

**Quarter 4: 1.6**

**Forecasting**

The model used in the analysis of the historical numbers should be used to perform the forecast.

**Additive Model = Forecast of Trend + SV**

**Multiplicative Model = Forecast of Trend x SV proportion**

The trend may be forecast by extrapolating the trend line on the time series graph.

Forecasting the quarterly sales in Year 4, using both the additive and then the multiplicative model

**Exercise 4****Required**

Forecast the trend value and the actual predicted result in year 5 quarter 2 using:

- (a) The additive model.
- (b) The multiplicative model.

## LEARNING CURVE

A statistical relationship identified during WW2 that labour time per unit falls as a complex task is repeated. As workers become more familiar with the production of a new product or task, average time (and average cost) will decline and exhibit a statistical relationship. It can be stated as follows:

**“As cumulative production doubles from the first unit, the cumulative average time per unit falls by a constant percentage”**

## Mathematical illustration

### Example 1

If the first unit requires 100 hours and the learning curve rate is 80%, calculate the following cumulative and incremental data.

Cumulative units	Average time per unit	Cum total time	Incremental units	Incremental total time	Average time per unit
1 unit					
2 units					
4 units					
8 units					

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

## Using the formula

The geometric formula can be used to establish the average time (or average cost) per unit.

$$y = ax^b$$

where **y = average time (or average cost) per unit**

**a = time (or cost) for first unit**

**b = slope =  $\frac{\log r}{\log 2}$  (r = rate of learning)**

**x = cumulative output**

### Required

Using the above example calculate the incremental time taken by the 2nd, 3rd and 4th units.

**Applying the learning curve theory**

The application of the learning curve is important and can be found in questions involving

1. pricing
2. budgeting
3. standard costing, and
4. decision making.

The following illustration shows its use in the preparation of budgets.

**Example 2 Limitation plc**

Limitation plc commenced the manufacture and sale of a new product in the fourth quarter of 1991. In order to facilitate the budgeting process for quarters 1 and 2 of 1992, the following information has been collected.

(a) Forecast production/sales (batches of product) is as follows:

Quarter 4, 1991	30 batches
Quarter 1, 1992	45 batches
Quarter 2, 1992	45 batches

(b) It is estimated that direct labour is subject to a learning curve effect of 90%. The labour cost of batch 1 of quarter 4, 1991 was £600 (at £5 per hour). The labour output rates from the commencement of production of the product, after adjusting for learning effects, are as follows:

<i>Total batches produced</i>	<i>Overall average time per batch</i>
Batches	Hours
15	79.51
30	71.56
45	67.28
60	64.40
75	62.25
90	60.55
105	59.15
120	57.96

Labour hours worked and paid for will be adjusted to eliminate spare capacity during each quarter. All time will be paid for at £5 per hour.

- (c) Direct material is used at the rate of 200 units per batch of product for the first 20 batches of quarter 4, 1991. Units of material used per batch will fall by 2% of the original level for each 20 batches thereafter as the learning curve effect improves the efficiency with which the material is used. All material will be bought at £1.80 per unit during 1992. Delivery of the total material requirements for a quarter will be made on day one of the quarter. Stock will be held in storage capacity hired at a cost of 30p per quarter per unit held in stock. Material will be used at an even rate throughout each quarter.
- (d) Variable overhead is estimated at 150% of direct labour cost during 1992.
- (e) All units produced will be sold in the quarter of production at £1,200 per batch.

**Required**

- (a)** Calculate the labour hours requirement for the second batch and the sum of the labour hours for the third and fourth batches produced in quarter 4, 1991.

(3 marks)

- (b)** Prepare a budget for each of quarters 1 and 2, 1992 showing the contribution earned from the product. Show all relevant workings.

(14 marks)

- (c)** The supplier of the raw material has offered to deliver on a 'just-in-time' basis in return for a price increase to £1.90 per unit in quarter 1, 1992 and £2 per unit thereafter.

**(i)** Use information for quarters 1 and 2, 1992 to determine whether the offer should be accepted on financial grounds.

**(ii)** Comment on other factors which should be considered before a final decision is reached.

(8 marks)

- (d)** Limitation plc wish to prepare a quotation for 12 batches of the product to be produced at the start of quarter 3, 1992.

Explain how the learning curve formula  $y = ax^b$  may be used in the calculation of the labour cost of the quotation. Your answer should identify each of the variables,  $y$ ,  $a$ ,  $x$  and  $b$ . No calculations are required.

(5 marks)

**(Total 30 marks)**





# Chapter 9

# Standard costing



## CHAPTER CONTENTS

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## STANDARD COSTING

- A standard is 'a benchmark measurement of resource usage, set in defined conditions'.
- Variance analysis is performed by comparing the actual cost and the standard cost to ascertain the difference.
- Standard costing is a system of accounting based on pre-determined costs and revenue per unit, which are used as a benchmark to compare actual performance, and therefore provide useful feedback information to management.
- Standard costs can be prepared using either absorption costing or marginal costing.

## Types of standards

### Ideal standard

- A standard that assumes perfect working conditions and does not make allowance for any losses, waste and machine breakdown.
- It can be used as a long-term organisational goal and is particularly applicable in total quality management environments.
- The variances can only be adverse and it may have an adverse motivational impact.

### Attainable standard

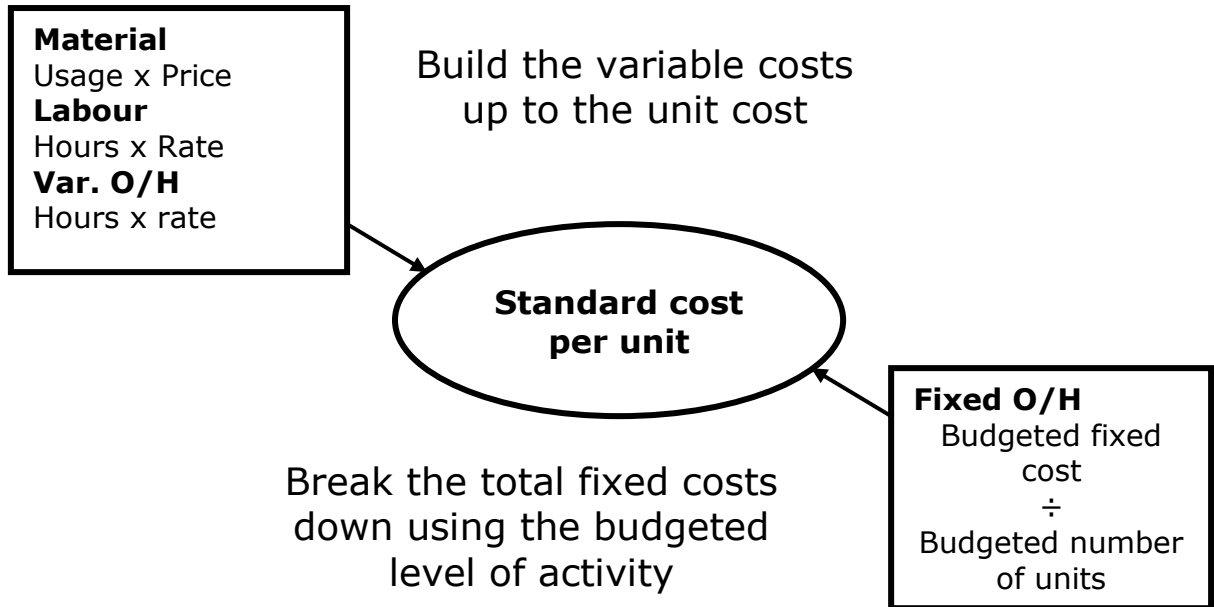
- It is based upon efficient (but not perfect) levels of operation but will include allowances for normal material losses, realistic allowances for fatigue, machine breakdowns, etc.
- Attainable standards must be based on a tough but realistic performance level so that its achievement is possible, but has to be worked for.
- They are used for budgeting and budgetary control.

### Basic standard

- These are long-term standards which remain unchanged over a period of years. Their sole use is to show trends over time for such items as material prices, labour rates and efficiency and the effect of changing methods.
- They cannot be used to highlight current efficiency because they are out-of-date.

## Preparation of standard costs

Standard costing is directly linked to the budgeting process. Individual standards are prepared for each component of cost. From these a standard cost may be prepared for each product produced (or service provided).



## Uses of standard costs

- Preparation of budgets.
- Stock valuation.
- Budgetary control and variance analysis.

# Chapter 10

# Basic variances



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## VARIANCE ANALYSIS

The application of standard costs for budgetary control purposes. The standard is compared to the actual result the difference being the variance. The analysis provides the following information:

1. Cost control.
2. Reconciliation between Budgeted and Actual Profit (or Contribution or cost).
3. Variances may quantify the value of a known difference.
4. Performance Appraisal.

### Example 1

Owen Ltd uses a standard costing system. The standard cost card for one product is shown below:

Direct Material	4 kg at £5 per kg	£ 20
Direct Labour	2 hours at £8 per hour	16
Variable Overhead	2 hours at £3.5 per hour	<u>7</u>
Total Variable Cost		43
Fixed Overhead	2 hours at £7 per hour	<u>14</u>
Total Product Cost		57
Standard Selling Price		<u>70</u>
Standard Profit Margin		<u>13</u>

The budgeted output and sales was 1,000 units. Actual output for the period was 1,300 units and actual sales for the period was 1,250 units.

Actual cost and revenue were as follows:

Direct Material	5,000 kg, costing	£ 22,700
Direct Labour	2,850 hours, costing	21,500
Variable Overhead		7,800
Fixed Overhead		14,600
Sales Revenue	1,200 units at £68 per unit	78,000

### Required

Calculate all possible variances.

## Material variances

### Standard Cost

Direct Material 4 kg at £5 per kg

### Actual Results

Actual output		1,300 units
Materials Purchased and used	5,000 Kg, costing	£22,700

### Key pro forma

### SQSP

### Usage

### AQSP

### Price

### AQAP

### Possible reasons

#### Price Variance

1. Wrong budgeting
2. Lower/higher quality material
3. Good/poor purchasing
4. External factors (inflation, exchange rates etc)

#### Usage Variance

1. Wrong budgeting
2. Lower/higher quality of material
3. Lower/higher quality of labour
4. Theft



## Labour variances

### Standard Cost

Direct Labour 2 hours at £8 per hour

### Actual Results

Actual output	1,300 units
Hours paid and worked	2,850
Labour Cost	£21,500

### Key pro forma

### SHSR

### Efficiency

### AHSR

### Rate

### AHAR

### Possible reasons

#### Rate Variance

1. Wrong budgeting
2. Wage inflation
3. Lower/higher skilled employees
4. Unplanned overtime or bonuses

#### Efficiency Variance

1. Wrong budgeting
2. Lower/higher morale
3. Lower/higher skilled employees
4. Lower/higher quality of material

## Variable overhead variances

### Standard Cost

Variable overhead 2 hours at £3.5 per hour

### Actual Results

Actual output	1,300 units
Hours worked (from above)	2,850
Variable overhead Cost	£7,800

### Key pro forma

### SHSR

### Efficiency

### AHSR

### Expenditure

### AHAR

### Possible reasons

#### Efficiency Variance

As per labour efficiency.

#### Expenditure (rate) Variance

Variable overheads are made up of many different overhead cost elements; to identify reasons for the variance we would need to analyse all elements separately.

## FIXED OVERHEAD VARIANCES

Fixed costs are a constant in total terms, hence total cost is our starting point. The analysis of variances will be dependent on the costing methodology. Do we use absorption costing or marginal costing? Either is potentially applicable.

### Absorption costing principles

Using absorption costing the fixed cost is charged or absorbed to the cost unit or product. The total fixed overhead variance will be similar to the under/ over absorption of overhead.

The total variance may be sub-analysed into two:

1. **Volume variance** – if the company produces more or less units and hence absorb more or less overhead than budgeted.
2. **Expenditure variance** – if the company spends more or less fixed overhead than budgeted.

### Question extract

#### Standard and Budgeted Cost

The fixed cost per unit is	£14 per unit
The budgeted number of units is	1,000
Budgeted fixed overheads is therefore	£14,000

#### Actual Results

Actual output	1,300 units
Hours worked (from above)	2,850
Fixed overhead Cost	£14,600

#### Key pro forma

#### Std fixed o/h cost (of actual output)

#### Volume variance

#### Budgeted fixed o/h cost

#### Expenditure variance

#### Actual fixed o/h cost

### Further analysis of fixed overheads

It is also possible to further analyse fixed overheads by considering actual hours in relation to the actual and budgeted units produced. To be comparable the output measures must be measures in terms of standard hours.

#### Key pro forma

##### SHSR

##### Efficiency

##### AHSR

##### Capacity

##### BHSR

##### Expenditure

##### AHAR

### Possible reasons

#### Efficiency

As per labour efficiency.

#### Capacity

If adverse

1. Machine breakdown.
2. Poor sales demand.
3. Strike.

#### Expenditure

Must be analysed further, fixed overheads are made up of many individual costs all of which would have to be analysed individually.

**Standard Cost Card**

		<b>£</b>
Direct Material	4 kg at £5 per kg	20
Direct Labour	2 hours at £8 per hour	16
Variable Overhead	2 hours at £3.5 per hour	<u>7</u>
Total Variable Cost		43
Fixed Overhead		<u>14</u>
Total Product Cost		57
Standard Selling Price		<u>70</u>
Standard Profit Margin		<u>13</u>
Budgeted production & sales	units	1,000

**Actual Results**

Sales (units)		1,250
Selling Price		£68
Production units		1,300

## SALES VARIANCES

The sales variances identify any change between the selling price and the standard cost.

### Key formulae

#### Volume variance

$$(AS - BS) \times SPM$$

#### Price variance

$$(AP - SP) \times AS$$

## Reconciliation of profit statements

### Absorption costing

#### Example 1 (cont.)

#### Required

Prepare an absorption costing operating statement for Owen.

**Key pro forma**

<b>Budgeted Profit</b>	<b>X</b>
<b>Sales volume variance</b>	<b><u>X</u></b>
<b>Standard profit</b>	<b>X</b>
<b>Sales price variance</b>	<b><u>X</u></b>
<b>Sub-total</b>	<b>X</b>
<b>Cost variances</b>	<b><u>X</u></b>
<b>Actual profit</b>	<b>X</b>

**Marginal costing**

**Variances that remains the same**

All variable cost variances

Sales price variance

Fixed overhead expenditure

**Variances that change**

Sales volume variance now valued at standard contribution margin

Fixed overhead volume (and hence capacity and efficiency) disappear

**Revised sales volume variance**

**$(AS - BS) \times SCM$**

**Example 1 (cont.)**

**Required**

Prepare a marginal costing operating statement for Owen.

**Key pro forma**

<b>Budgeted contribution</b>		<b>X</b>
<b>Sales variances</b>		<b><u>X</u></b>
<b>Sub-total</b>		<b>X</b>
<b>Variable cost variances</b>	<b><u>X</u></b>	
<b>Actual contribution</b>		<b>X</b>
<b>Budgeted fixed cost</b>	<b>X</b>	
<b>Fixed o/h variances</b>	<b><u>X</u></b>	<b><u>X</u></b>
<b>Actual profit</b>		<b>X</b>

**Exercise 2 Barnes**

The standard cost and price for one unit being as follows:

	<b>£</b>
Direct material A - 8 Kilograms at £13 per Kg	104
Direct material B - 5 Kilograms at £6 per Kg	30
Direct wages - 6 hours at £6 per hour	36
Fixed production overhead – 6 hours at £10 per hour	60
	<hr/>
<i>Total Standard Cost</i>	230
Standard gross profit	50
	<hr/>
Standard Selling price	<u>280</u>

The fixed production overhead included in the standard cost is based on an expected monthly output of 800 units. Overheads are absorbed using direct labour hours.

During Sept 2008 the actual results were as follows:

Sales	780 units @ £300	£	£
			234,000
Direct Materials:	A: 7,500 Kg	91,500	
	B: 3,500 Kg	20,300	
Direct Wages	3,400 hours	27,880	
Fixed production overhead		<u>37,320</u>	
			<u>177,000</u>
Gross Profit			47,000

**Required**

Reconcile budgeted profit with actual profit for September, calculating the following variances:

Selling price, sales volume, material price, material usage, labour rate, labour efficiency, fixed overhead expenditure, fixed overhead capacity and fixed overhead efficiency.



## BACKWARDS STANDARD COSTING

### Exercise 3

CRV Limited makes and sells a single product and operates a standard costing system. During a period, production was 40,000 units and actual labour costs were £480,000. The standard labour time per unit is 2 hours. Materials actually used were 2.9 kgs per unit and the standard price per kg is £12.50.

At the end of the period, the following variances were reported to management:

Labour variances:		
Rate	16,800	Favourable
Efficiency	3,200	Adverse
Material variances:		
Price	71,050	Adverse
Usage	43,750	Favourable

There was no movement in opening and closing stocks in the period.

### Required

Calculate

- (i) the standard labour rate per hour,
- (ii) the actual hours worked,
- (iii) the actual expenditure on materials,
- (iv) the standard material allowance in kgs per unit.



# Chapter 11

# Advanced variance analysis



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## ADVANCED VARIANCE ANALYSIS

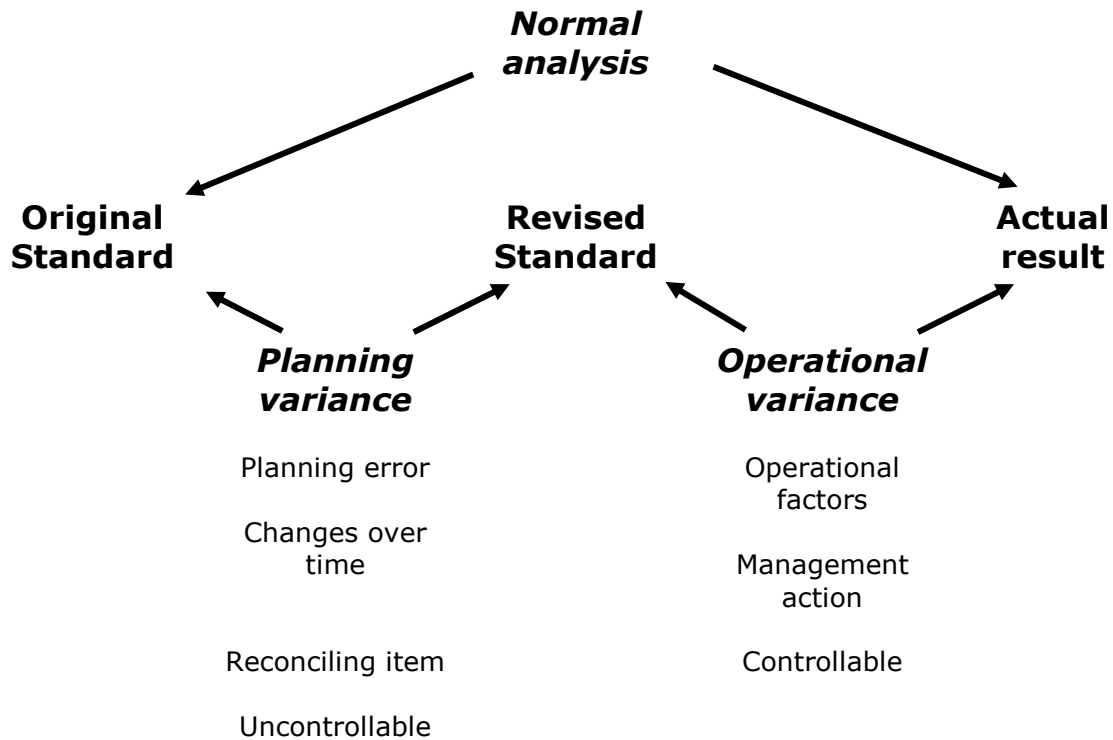
Variance analysis is used to separate costs and revenues into controllable elements (eg material, labour etc) in order that we can compare expected (standard) performance with actual results. Advanced areas simply increase the degree to which the variances may be sub-analysed into

1. Planning and operational variances.
2. Excess idle time variances.
3. Investigation and interpretation of variances.

## PLANNING AND OPERATIONAL VARIANCES

Traditionally, when comparing standards to actual results the comparison has suffered from the time delay between setting the standard and the incurrence of actual results.

The standard is set as part of the budgeting process which occurs before the period to which it relates, this means that the difference between standard and actual may arise solely due to an unrealistic budget and not due to operational factors.



### Example 1 Liddell

A company expects to use 4kg per unit at a standard price of £5/kg. During the period it used 4,000 kilos at a total cost of £25,000.

After closer consideration of the market for the raw material it has been found that the general market price of the material has risen by 50% due to exchange rate movements.

#### Required

- Based on normal variance analysis, has the purchasing manager done a good or bad job?
- Is your conclusion changed as a result of sub-analysing the variance into planning and operational elements?

**Pro Forma (using materials variances)**

<b>Basic pro forma</b>	<b>Planning</b> <i>(substitute actual with revised standard)</i>	<b>Operational</b> <i>(substitute standard with revised standard)</i>
<b>SQSP</b>	<b>SQSP</b>	<b>RSQRSP</b>
<b>Usage</b>		
<b>AQSP</b>	<b>RSQSP</b>	<b>AQRSP</b>
<b>Price</b>		
<b>AQAP</b>	<b>RSQRSP</b>	<b>AQAP</b>

**Example 2**

**Standards**

3kg/unit for £5/kg

**Actual**

Output	12,500 units
Usage	38,000 kg
Cost	£195,500

**Required:**

Prepare the variances using basic variance analysis and assess whether the purchasing manager and production manager individually have done a good or bad job.

After further consideration the standards have been revised to reflect changes that have occurred over time. The standard usage is now expected to be 3.1kg due to a poor harvest leading poorer quality material inputs. In addition due to adverse movements in the exchange rate the material costs have changed. It is now expected that each kg will cost £5.15.

**Required:**

Prepare an analysis of variances into both planning and operational elements and assess the performance of the purchasing manager and the production manager individually.

## MIX AND YIELD VARIANCES

**A sub-analysis of the material usage variance into a mix and a yield component.**

Applicable in a manufacturing environment where:

1. 2 or material inputs go into to making the product (a mix)
2. The material inputs are inter-changeable to some degree (process costing environment).

### Key pro forma

**SQSP**

**Yield**

**AQ(SM)SP**

**Mix**

**AQSP**

**Price**

**AQAP**

### Example 3 Dalglish

Dalglish manufactures a fertiliser by mixing three chemicals, A, B and C, and the following standards apply:

	<i>Standard proportions</i>	<i>Standard cost per tonne</i>
	<i>%</i>	<i>£</i>
A	70	20
B	20	30
C	10	50

During the process of mixing, a process loss of 10% is regarded as the standard.

In week 17, 855 tonnes of the fertiliser were produced and inputs were as follows:

	<i>Actual inputs</i>	<i>Actual prices</i>	<i>Actual cost</i>
	<i>tonnes</i>	<i>£ per tonne</i>	<i>£</i>
A	660	21	13,860
B	210	32	6,720
C	130	47	6,110
	<hr/> 1,000 <hr/>		<hr/> £26,690 <hr/>

#### Required:

Calculate the material price, mix and yield variances.



## Excess idle time

The use of variance analysis where idle time is expected to occur and hence budgeted. This has the effect of differentiating between the hours paid (gross hours) and hours worked (net or productive hours).

### Example 4 Hansen

A company budgets to pay 10,000 hours of labour during the year. Due to seasonal and other factors the labour force is expected to stand idle 20% of the time.

#### Required

What are the budgeted hours worked?

#### Idea

If the hours worked differ from the hours paid then we must ensure that the total labour cost is 'absorbed' or recovered over those hours worked.

$$\text{Standard Rate Paid} \\ \text{Standard Rate/ Hour Worked} = \frac{\text{Standard Rate Paid}}{\text{(1 - Idle Time \%age)}}$$

### Example 5

Continuing from example 4 the company pays £5 per hour.

#### Required

Standard rate per hour worked.

### Example 6 Carragher

#### Labour standards

£6/hour x 3 hours/unit = £18/unit

#### Actual results

Output	1300 units
Hours worked	4200 hrs
Hours paid	5500 hrs
Labour cost	£32000

#### Required

All normal labour variances.

### Example 7

As per example 6 but we reflect the expected idle time by introducing a budgeted idle time equal to 20% of total hours paid.

#### Required

Calculate all variances including excess idle time.

**SH(W)SR(W)**

**Efficiency**

**AH(W)SR(W)**

**Excess Idle Time**

**AH(P)SR(P)**

**Rate**

**AH(P)AR(P)**

## INVESTIGATION AND INTERPRETATION

The preparation of variances is only to provide an indicator of what is actually happening in relation to some control standard. The analysis does not stop with the calculation of the variance; this is simply a figure upon which to base further analysis or investigation. We work on the assumption that the standard is the optimum, or at least acceptable, level of performance. If we achieve the standard then no control action need be taken and a variance prompts some control action. This is simplistic in reality we would be concerned with the following factors when considering whether to investigate or not:

1. Trend.
2. Materiality.
3. Controllability.

### Trend

A budget or standard is normally set for one year, and hence is an average value for that period. If we have one anomalous variance arising in an individual month, whereas the other values are all within acceptable limits, this would suggest a problem that is non-controllable or arising in the reporting system for that month, rather than a structural problem that needs addressing with control actions.

The underlying movement of variances in relation to the control standard is of vital importance to the control of the system. We would normally consider calculating individual monthly variances together with an annual running total. We are then able to see the movement in trend and the total impact over the year.

### Materiality

When assessing whether to investigate a variance we can consider how significant the variance is in three ways:

1. Total value.
2. As a percentage to the budgeted (or standard) value.
3. Statistical significance.

#### Total value

It is normal to investigate the largest variances first to eliminate the greater amount of value initially. It is important to note however that such an approach leads to assessing the same few areas of the organisation every period as the size of variance is normally strongly correlated to the amount of a resource being used.

#### As a percentage

Used in addition to the above technique where key anomalies arise. The percentage reflects better than overall value the degree to which the variance is out of control (distance from the standard value).

### **Statistical significance**

Theoretically the best basis upon which to select a variance for investigation. If we have reliable historic data regarding the likelihood that a process was under control we can establish effective rules as to when we should and should not investigate variances. In practice, it is difficult to identify the appropriate standard deviations required.

It is expected that almost all elements will give variances of some value each month due to the difficulties of easily segmenting results into individual periods and the average nature of the standard. We need to only investigate those variances that most warrant the cost of the investigation.

### **Controllability**

Once the variance has been investigated then if a poor result was achieved we would look to improve the results in the future (negative feedback). This is only possible if all aspects of the following situation are present:

- 1. The variance is investigated.**
- 2. The reason for poor performance is identified.**
- 3. The poor performance is expected to continue in the future.**
- 4. Control action is possible to change the present situation.**
- 5. Control action is successful.**

If just one of the above is not present, we are unable to control the future costs or revenues.

# Chapter 12

# Performance evaluation



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## PERFORMANCE EVALUATION

### Responsibility accounting

#### Cost centre

- a unit of a business where the manager is made accountable for all the cost.

#### Revenue centre

- a unit of an organisation where the manager is accountable for the sales earned in the unit.

#### Profit centre

- where the manager is responsible for the profitability of the unit.

#### Investment centre

- where the manager is responsible for both the profitability and the capital investment of the unit.

Note that variance analysis alone will not work particularly well in the last two situations.

### Divisionalisation (decentralisation)

Delegating responsibilities to divisional managers or unit heads.

#### Advantages

- It increases motivation of the divisional managers as they feel involved in the decision making of the organisation.
- It is a form of training for the divisional managers and it easy for them to rise through the ranks to strategic positions.
- It should promote goal congruence (see later), as all decisions been taken are all geared towards achieving the objectives of the whole organisation.
- It drastically reduces the time taken to make decisions.

#### Disadvantages

- Divisional managers may make dysfunctional decisions (decisions that are not in the best interests of the organisation).
- There is a need for a performance appraisal system to assess the performance of individual managers.

## Performance evaluation measures

The basic measure of performance is profit. The measure of profit that is used is normally related to operating profit or PBIT this being the measure that is within the control of operational management.

When assessing performance of a manager it is important to only assess the manager on a profit measure that is within the control of the manager. This means that any costs or revenues that are outside the control of the manager should be excluded.

In practice the obvious uncontrollable cost for a division would be apportioned head office costs on the basis that the incurrence of cost is controllable by head office and is charged in an arbitrary manner to the division.

When looking at an investment centre the manager is able to control the amount of investment in the division. It is normal to assess the performance of profit in relation to investment made by head office in the division using either return on investment (ROI) or residual income (RI)

### Return on capital employed (ROCE)

$$= \frac{\text{Profit before interest and tax}}{\text{Capital Employed}} \times 100$$

#### Capital Employed

- Expressed in percentages, making it widely understood by managers.
- It can be used to compare the performance of divisions of different sizes.

Since it is a relative measure it can lead to managers turning down profitable projects (since not profitable enough to maintain the current ROCE).

### Residual income (RI)

$$= \text{Profit} - (\text{Capital employed} \times \text{the cost of capital})$$

- It ensures that decisions made are in the best interest on the organisation as a whole (if a project has a positive NPV then it also has a positive RI).
- But it encourages the use of aged assets.
- It cannot be used to compare the performance of the divisions on different sizes.

### Key Issues

1. Goal congruent decision making
2. Short-termism
3. Management fraud
4. Transfer pricing



### Goal congruent decision making

The performance measures such as ROI and RI should not be used for decision making, however because these measures will be used to appraise performance of managers, the managers will assess new projects in relation to the performance measures upon which they are assessed.

#### Example 1

There are two divisions with the following performance for the current year

Division	X	Y
Investment (\$m)	10	30
Controllable Profit	2	3
Required rate of return	15%	

#### Required:

Calculate the performance of each division based using:

- (a) ROI
- (b) RI

Which division has superior performance?

#### Example 2

Continuing from the previous example each division has the opportunity to invest in a new project.

Division	X	Y
Investment (\$000s)	500	1,000
Controllable Profit	80	120
Required rate of return	15%	

#### Required:

Using the measures of performance above assess the decisions that would be made by:-

- (a) The divisional managers
- (b) Head office
- (c) Whether the decisions are congruent with each other.

### Short-termism and depreciation of assets

However the performance is appraised, it is normal to appraise divisional managers over one year. When using ROI and RI the investment will fall in value over time as a result of depreciation. This has the impact of increasing the reported performance for each year that investment is not made within the division.

A cynical manager could improve their perceived performance simply as a result of deferring investment and using increasingly outdated assets. This could well have adverse consequences to the business including:

1. Poorer quality output due to worn out machines

2. Higher risk of machine breakdown
3. using outdated technology.

### **Management fraud**

Having a single profit measure or relatively few related measures of performance appraisal allows managers to manipulate the figures underpinning these measures. In simple terms the manager only needs to overstate profits in a period or understate the investment.

#### **Simple ways to overstate of profits**

1. Phasing of apportioned costs to charge fewer costs during the period
2. Revenue recognition of sales in previous periods or future periods
3. Ignoring part of the cost base
4. Incorporate sales from other divisions
5. Double count sales

To reduce the opportunity for fraud a range of performance measures should be used that are inter-linked. They will make it more difficult for managers to manipulate the figures for personal gain.

### **Transfer Pricing**

The sale of goods between one division and another within the same organisation. The setting of the transfer price will have no direct impact on the overall performance of the company but a very real impact on individual divisional performance.

The setting of transfer prices will therefore be highly political. The manager can improve his own reported performance more easily by arguing for a better transfer price than in any other way.

## Ratio analysis

Any financial ratios could be required by the examiner. Please note that it is unlikely that a wide range of ratios will be required in a single question, instead the focus will be on 3 or 4 ratios at most normally focussing in profit measures.

### Profitability ratios

Return on Capital Employed	=	$\frac{\text{Gross Profit}}{\text{Capital Employed}}$
Profit margin	=	$\frac{\text{Gross Profit}}{\text{Sales}}$
Asset Turnover	=	$\frac{\text{Sales}}{\text{Capital Employed}}$

### Liquidity ratios

Current ratio	=	$\frac{\text{Current Assets}}{\text{Current Liabilities}}$
Quick (acid test) ratio	=	$\frac{(\text{Current Assets} - \text{Inventory})}{\text{Current Liabilities}}$

### Efficiency ratios

Inventory days	=	$\frac{\text{Inventory}}{\text{Cost of sales}} \times 365$
Receivable days	=	$\frac{\text{Receivables}}{\text{Revenue}} \times 365$
Payable days	=	$\frac{\text{Payables}}{\text{Cost of sales}} \times 365$

### Gearing ratios

Gearing	=	$\frac{\text{Debt}}{\text{Debt} + \text{Equity}}$
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# Chapter 13

# Non-financial performance indicators



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## NON-FINANCIAL PERFORMANCE INDICATORS

### The balanced scorecard

The balanced scorecard forces managers to look at the business from four important perspectives.

It links performance measures by requiring firms to address four basic questions:

1. How do customers see us? - Customer perspective.
2. What must we excel at? - Internal perspective.
3. Can we continue to improve and create value? - Innovation & learning perspective.
4. How do we look to shareholders? - Financial perspective.

#### Customer perspective

- How do customers perceive the firm?
- This focuses on the analysis of different types of customers, their degree of satisfaction and the processes used to deliver products and services to customers.
- Particular areas of focus would include:
  - Customer service.
  - New products.
  - New markets.
  - Customer retention.
  - Customer satisfaction.

#### Internal business perspective

- How well the business is performing.
- Whether the products and services offered meet customer expectations.
- Activities in which the firm excels?
- And in what must it excel in the future?
- Quality performance.
- Quality.
- Motivated workforce.

### **Innovation and learning perspective**

- Can we continue to improve and create value?
- In which areas must the organisation improve?
- Product diversification.
- % sales from new products.
- Amount of training.
- Number of employee suggestions.
- Extent of employee empowerment.

### **Financial perspective**

- This is concerned with the shareholders view of performance.
- Shareholders are concerned with many aspects of financial performance.
- Amongst the measures of success are:
  - Market share.
  - Profit ratio.
  - Return on investment.
  - Economic value added.
  - Return on capital employed.
  - Cash flow.
  - Share price.

#### **Example 1**

Why are financial performance indicators not considered sufficient for measuring the performance of part of an organisation?

#### **Example 2**

Explain what is meant by the “internal business perspective” of the balanced score card and give some examples of measures that could be used for a private hospital.

### **Service industries**

In general services differ from manufacturing since they are:

- Intangible.
- Simultaneous.
- Perishable.
- Heterogeneous.



## The building block model

This model is particularly suited to service industries.

Fitzgerald and Moon divide performance measurement into three areas:

1. Standards.
2. Rewards.
3. Dimensions.

### 1. Standards

This refers to the targets that are set within the organisation. These should be:

- High enough to motivate.
- Be owned by the employees (through participation in target-setting).
- Be seen to be equitable.

### 2. Rewards

This refers to what the organisation (and the employee) is trying to achieve.

- The organisation's objectives should be clearly understood.
- Employees should be motivated to work towards these objectives.
- Employees should be able to control areas over which they will be held responsible.

### 3. Dimensions

This refers to how performance will be measured. The areas are:

- Financial
- Competitive performance
- Quality of service
- Flexibility
- Resource Utilisation
- Innovation.

**Example 3 - Scotia Health Consultants Ltd**

Scotia Health Consultants Ltd provides advice to clients in medical, dietary and fitness matters by offering consultation with specialist staff.

The budget information for the year ended 31 May 19X7 is as follows.

- (i) Quantitative data as per Appendix 1.
- (ii) Clients are charged a fee per consultation at the rate of: medical £75; dietary £50 and fitness £50.
- (iii) Health foods are recommended and provided only to dietary clients at an average cost to the company of £10 per consultation. Clients are charged for such health foods at cost plus 100% mark-up.
- (iv) Each customer enquiry incurs a variable cost of £3, whether or not it is converted into a consultation.
- (v) Consultants are *each* paid a fixed annual salary as follows: medical £40,000; dietary £28,000; fitness £25,000.
- (vi) Sundry other fixed cost: £300,000.

Actual results for the year to 31 May 1997 incorporate the following additional information.

- (i) Medical salary costs were altered through dispensing with the services of two full-time consultants and sub-contracting outside specialists as required. A total of 1,900 consultations were sub-contracted to outside specialists who were paid £50 per consultation.
- (ii) Fitness costs were increased by £80,000 through the hire of equipment to allow sophisticated cardio-vascular testing of clients.
- (iii) New computer software has been installed to provide detailed records and scheduling of all client enquiries and consultations. This software has an annual operating cost (including depreciation) of £50,000.

**Required**

- (a)** Prepare a statement showing the financial results for the year to 31 May 19X7 in tabular format.

This should show the budget gross margin for each type of consultation and for the company. (*Expenditure for each expense heading should be shown as relevant.*)

- (b)** Suggest ways in which each of the undernoted performance measures (1 to 5) could be used to supplement the financial results calculated in (a). You should include relevant quantitative analysis from Appendix 1 for each performance measure.

1. Competitiveness.
2. Flexibility.
3. Resource utilisation.
4. Quality.
5. Innovation.

**Appendix 1**

**Statistics relating to the year ended 31 May 19X7**

	Budget	Actual
Total client enquiries		
– new business	50,000	80,000
– repeat business	30,000	20,000
Number of client consultations		
– new business	15,000	20,000
– repeat business	12,000	10,000
Mix of client consultations		
– medical	6,000	5,500
(note)		
– dietary	12,000	10,000
– fitness	9,000	14,500
Number of consultants employed		
– medical	6	4 (note)
– dietary	12	12
– fitness	9	12
Number of client complaints	270	600

**Note** Client consultations *includes* those carried out by outside specialists. There are now 4 full-time consultants carrying out the remainder of client consultations.

## **PERFORMANCE MEASUREMENT IN A NOT FOR PROFIT ORGANISATION AND THE PUBLIC SECTOR**

In simple terms the basic objective of a not for profit is to provide a service without making a loss, a profit or surplus simply being either a timing issue or a means to an end.

The wider issue is that the organisation is providing a service of social or moral worth. We can attempt to measure this service.

### **Objectives of a not for profit entity**

The objective for such an organisation will differ widely from one organisation to another. They may include one or more of the following:

1. Client satisfaction
2. Employee satisfaction (particularly when volunteers are a substantial part of the workforce)
3. Maximisation of surplus (perhaps to assist in growth or protect against loss of future funding)
4. Growth
5. Usage of facilities (for example library services)
6. maintenance of capability (for example a fire service or army)

The key to remember in the exam is that for every not for profit organisation there will be multiple objectives that have to be addressed as opposed to a profit making organisation where profit is the key aim in relation to satisfying the owners or shareholders.

### **Problems of performance measurement of a not for profit entity**

1. Multiple objectives - As seen above most organisations will have competing objectives. The difficulty arises when attempting to identify the relative importance of the objectives.
2. Measurement of services provided – the nature of many services is that they are more qualitative than quantitative. When measuring such outputs it is often very difficult to get meaningful aggregate measures of performance.
3. No profit motive – measures such as ROI and RI cannot be used to gain an overall measure of performance.
4. Identification of cost unit – the cost unit is likely to be relatively complex and there is likely to be more than one cost unit. For example what is a cost unit for a hospital/ there are likely to be multiple such cost units being used by a single patient.
5. Key constraint – For most organisations the key constraint is the level of finance available. A charity is limited to its donations and a government department is limited to its allocation from the finance department. This constraint is separate in most organisations to their end objective.

6. Political intervention – unlike commercial entities not for profit entities are far more likely to be affected by political influence, either directly in the form of elected official or indirectly by public sentiment.
7. Legal considerations – it is likely that adherence to restrictive legal rules are going to impact on a not for profit entity because of the nature of the organisation or the links to government at a local or national level.

## Performance measurement

In order to establish meaningful measures within such an environment we can employ the following solutions

1. Input measurement – in the absence of easily measured output then more consideration can be put into the costs and resourcing of an organisation.
2. Independent scrutiny and target setting – There is need for fine judgement when setting qualitative targets. By use of independent experts then measures can be set that reflect performance levels appropriate without introducing bias.
3. External comparison – A powerful assessment of the performance of an organisation is to benchmark that performance in relation to similar organisations. This allows for both historical results to be used but also best practice measures to be developed.

## Value for money (VFM)

Value for money is a framework by which not for profit organisations can be measured. It separates the performance of the business into three areas, the three E's

1. Effectiveness
2. Efficiency
3. Economy

### Effectiveness (An output measure)

This may be described as how well the organisation meets its objectives. Perhaps an easier way of understanding it would be to see how well the output of services match the client need.

### Efficiency (the relationship between input and output)

This describes how well resources are utilised; it measures the output of services for a given level of resource or input.

### Economy (An input measure)

This considers the cost of sourcing the input resources. The aim being to minimise the costs of the input for a given standard and level of resource.

The key to VFM is to understand that performing in a single area is not sufficient, instead the organisation must achieve in relation to all three aspects in order to provide value for money.

### **Example 4**

#### **Required**

Suggest measures that may be used to assess the performance of the following organisations using a VFM framework:

- (a)** Hospital
- (b)** School

# Chapter 14

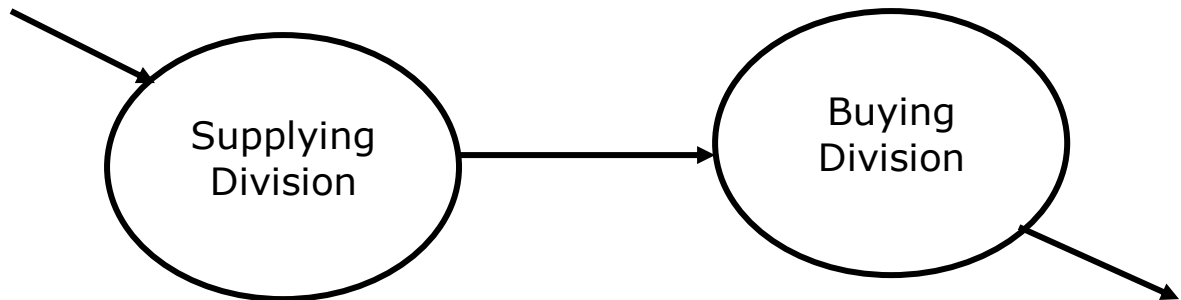
# Transfer pricing



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**TRANSFER PRICING****Objectives****Goal congruent decision making**

Any decision by the management to improve the performance of either of the divisions must also improve the performance of the company as a whole.

**"Fair" performance measurement**

The transfer price used will normally have a substantial effect on the distribution of profit between divisions, it is important that this distribution is seen to be equitable to all parties.

**Maintaining divisional autonomy**

A key purpose of decentralisation is to provide greater autonomy at divisional level, there is little point in granting autonomy and then imposing transfer prices that will materially affect the profitability of those supposedly autonomous divisions.

## Subsidiary objectives

### Minimising global tax liability

If transactions occur within one tax regime little can be gained by manipulating transfer prices. A multinational organisation can and will use transfer pricing to move profits “round the world” either to a low tax regime or alternatively to the country of the holding company.

### Recording the movement of goods and services

An important function of transfer pricing is simply to record movement of goods and services in financial terms.

## Decision-making

In order to promote goal congruence we must ensure that the transfer price encourages the divisions to trade with each other only when it is appropriate for the larger organisation. In order for this to take place we follow a simple rule:

**GENERAL RULE - All goods and services should be transferred at opportunity cost.**

## Performance Measurement

The aim is to set a transfer price that will give a “fair” measure of performance in each division, ie profit. There is no formula for ensuring this and the result will always be an arbitrary allocation between the divisions involved. We will see however that in some circumstances this will give a “better” result than others. How do the transfer prices we have already calculated measure up?

## Divisional autonomy

Should the transfer prices be imposed on the divisions by Head Office, or should the divisions negotiate the transfer price between themselves? The negotiation route seems more consistent with divisional autonomy. There are however significant disadvantages:

1. Negotiation is time-consuming.
2. It leads to conflict between divisions.
3. Negotiated transfer prices are unlikely to reflect rational factors.
4. They will reflect Personality/Skill/Status/Training.
5. Senior management will need to spend substantial time overseeing the process.