Contabilidade de Gestão Avançada

Mestrado CFFE

Aula 1

100 ANOS A PENSAR NO FUTURO

1. Cost Terms and Concepts

1.1 Cost Objects and Cost Drivers

- A cost object is any activity for which a separate measurement of cost is required (e.g. cost of making a product or providing a service).
- A cost collection system normally accounts for costs in two broad stages:
  - Accumulates costs by classifying them into certain categories (e.g. labour, materials and overheads).
  - Assign costs to cost objects.

1.1 Cost Objects and Cost Drivers

- A cost driver is a factor, such as the level of activity or volume, that causally affects costs (over a given time span).
- The cost driver of variable costs is the level of activity or volume whose change causes the (variable) costs to change proportionately.
- The number of bicycles assembled is a cost driver of the cost of handlebars.

1.2 Direct and Indirect Costs

- Direct costs can be specifically and exclusively identified with a given cost object.
- Indirect costs cannot be specifically and exclusively identified with a given cost object.
- Indirect costs (i.e. overheads (gastos gerais de fabrico)) are assigned to cost objects on the basis of cost allocations.

1.2 Direct and Indirect Costs

- Cost allocations
  - Process of assigning costs to cost objects that involve the use of surrogate, rather than direct measures.
- The distinction between direct and indirect costs depends on what is identified as the cost object.

1.2 Direct and Indirect Costs

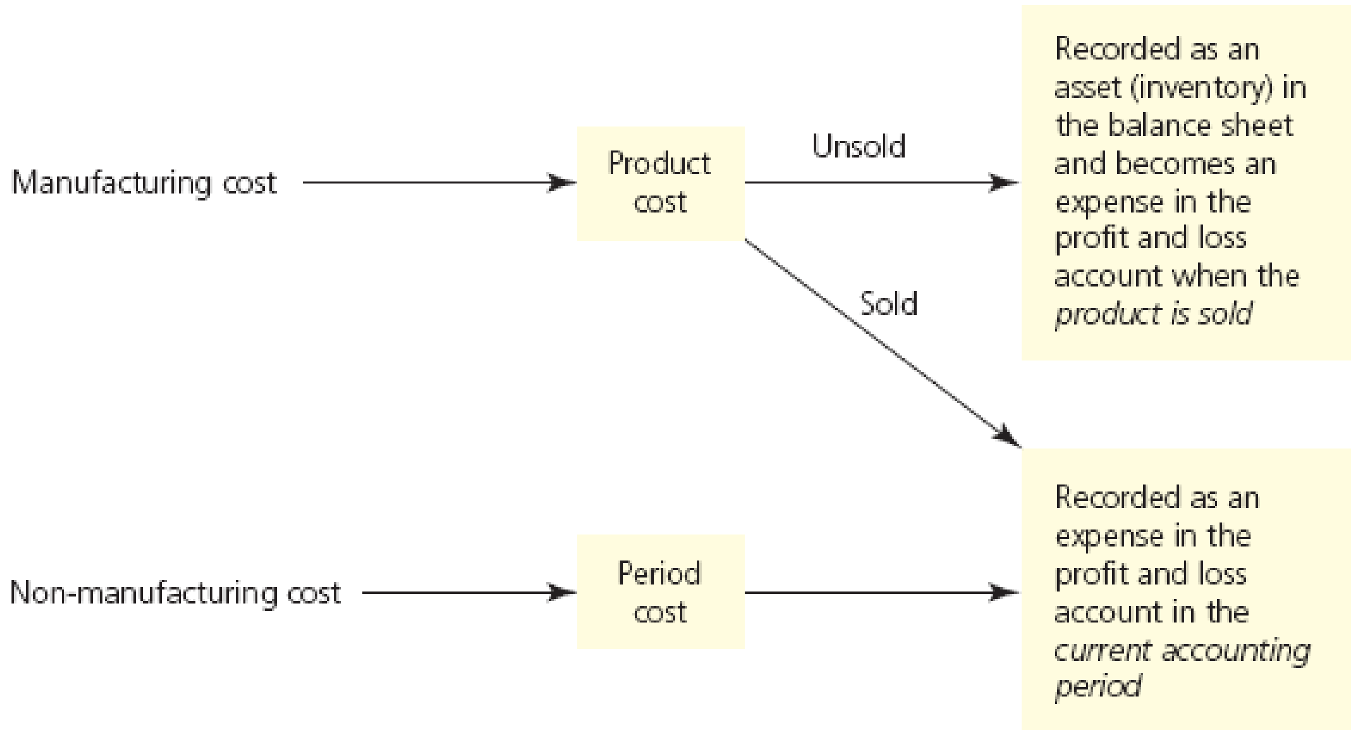
- Categories of Manufacturing Costs
  - Traditional cost systems accumulate product costs as follows:

Direct Materials (Matéria-Prima)	XXX
Direct Labour (MOD)	XXX
Prime Cost (Custo Directo)	XXX
Manufacturing cost (Gastos Gerais de Fabrico)	XXX
Total Manufacturing Cost	XXX
Non-manufacturing Costs	XXX
Total Cost	**XXX**

1.3 Product Costs

- Product costs are those that are attached to the products and included in the stock (inventory valuation).
- Period costs are *not* attached to the product and included in the inventory valuation.

1.3 Product Costs



1.3 Product Costs

- Example
  - Product costs: €100.000
  - Period costs: €80.000
  - 50% of the output for the period is sold and there are no opening inventories

Production cost (product costs)	100.000
Less closing stock (50%)	50.000
Cost of goods sold (50%)	50.000
Period costs (100%)	80.000
Total Cost recorded as an expense for the period	**130.000**

1. Cost Terms and Concepts

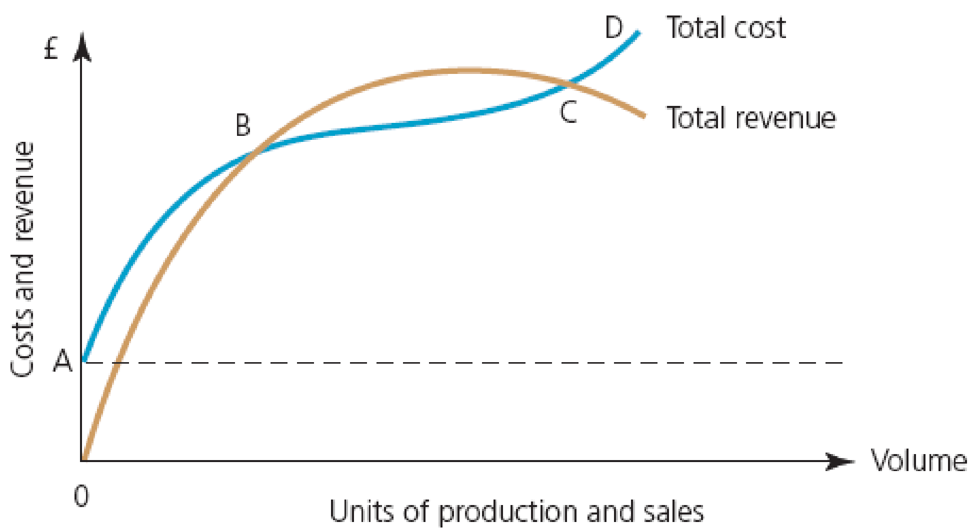
1.4 Cost Behaviour

- Classification by cost behaviour
  - Important to predict costs and revenues at different activity levels for many decisions.
  - Variable costs vary in direct proportion with activity.
  - Fixed costs remain constant over wide ranges of activity.

1.4 Cost Behaviour

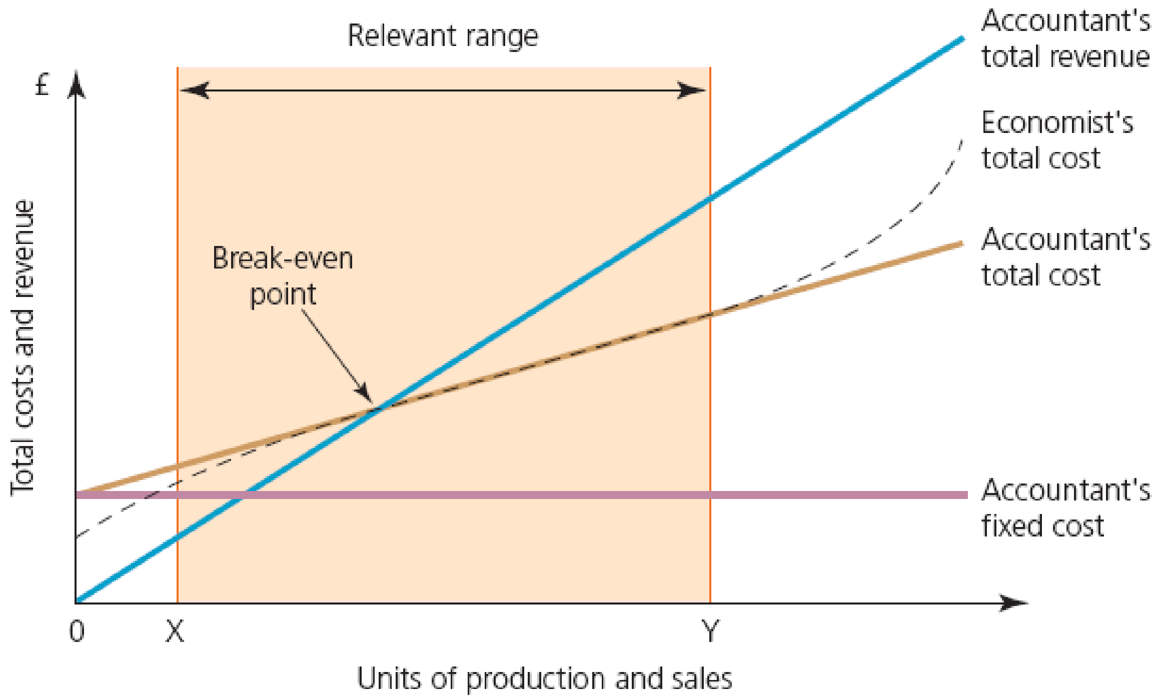
- Classification by cost behaviour
  - Semi-fixed costs are fixed within specified activity levels, but they eventually increase or decrease by some constant amount at critical activity levels.
  - Semi-variable costs include both a fixed and a variable component (e.g. telephone charges).
- Note that the classification of costs depends on the time period involved. In the short term some costs are fixed, but in the long term all costs are variable.

1.4 Cost Behaviour

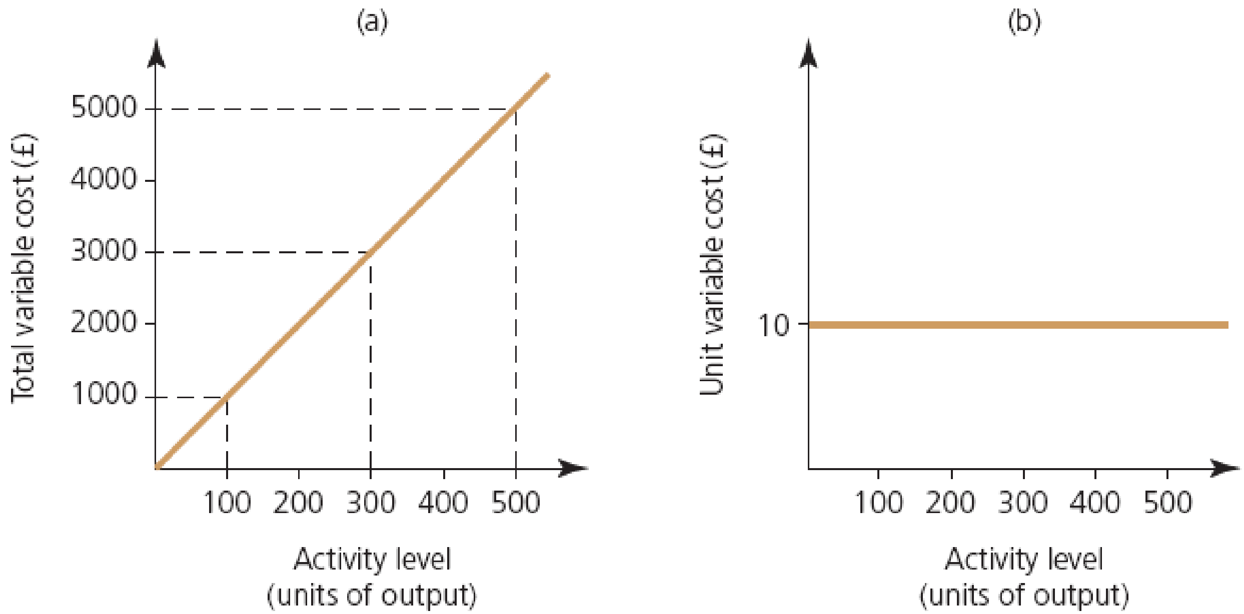


1. Curvilinear graph results in two break-even points.
2. Note the shape of the total cost function:
   - initial steep rise, levels off, followed by a further steep rise.
3. The total revenue line initially rises steeply, then levels off and declines.

1.4 Cost Behaviour

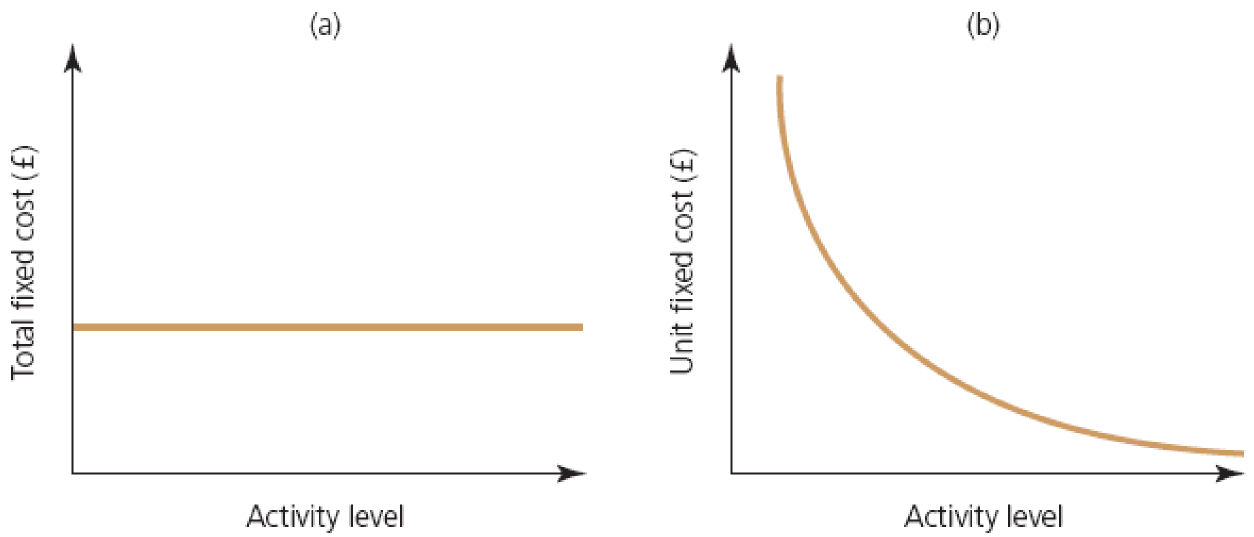


1.4 Cost Behaviour

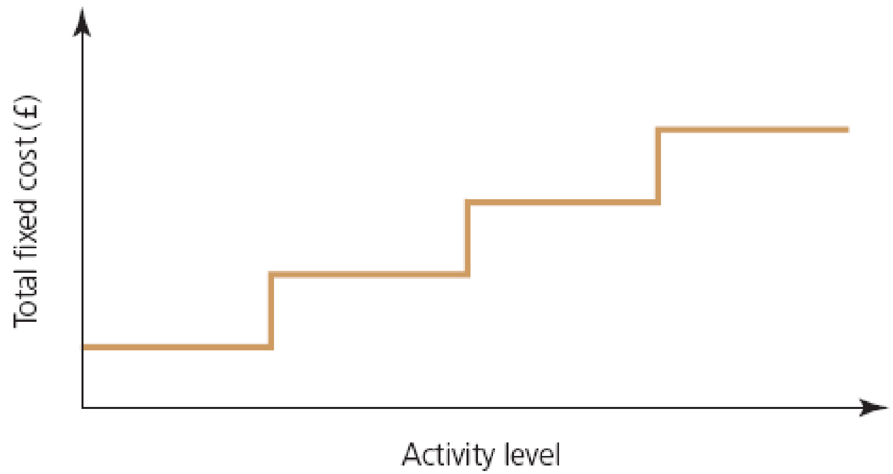


1. Cost Terms and Concepts

1.4 Cost Behaviour

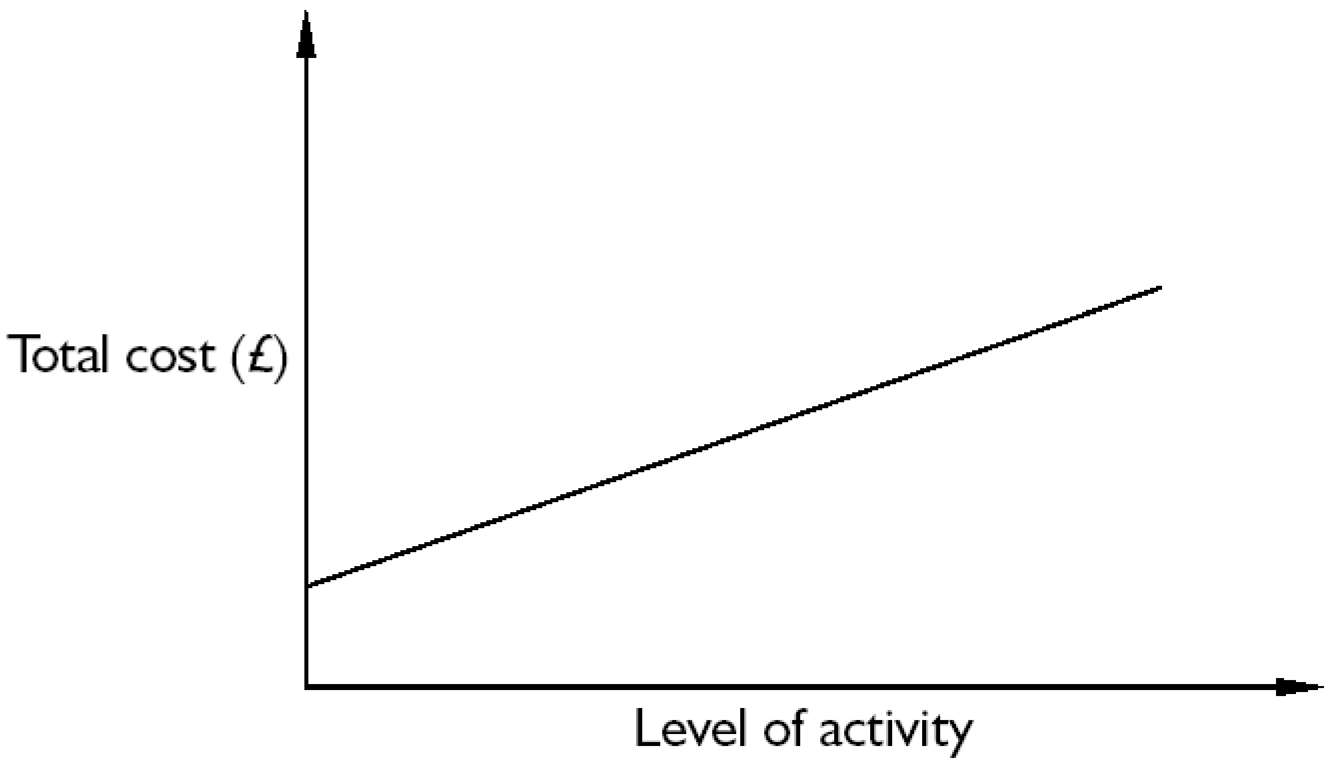


1.4 Cost Behaviour



1.4 Cost Behaviour

Semi-variable costs



1.5 Other Types of Costs

- Avoidable and unavoidable costs
  - Avoidable costs are those costs that can be saved by not adopting a given alternative, whereas unavoidable costs cannot be saved.
  - Avoidable/unavoidable costs are alternative terms sometimes used to describe relevant/irrelevant costs.

1.5 Other Types of Costs

- Relevant and irrelevant costs and revenues
  - Relevant costs and revenues are those future costs and revenues that will be changed by a decision
  - Irrelevant costs and revenues will not be changed by a decision

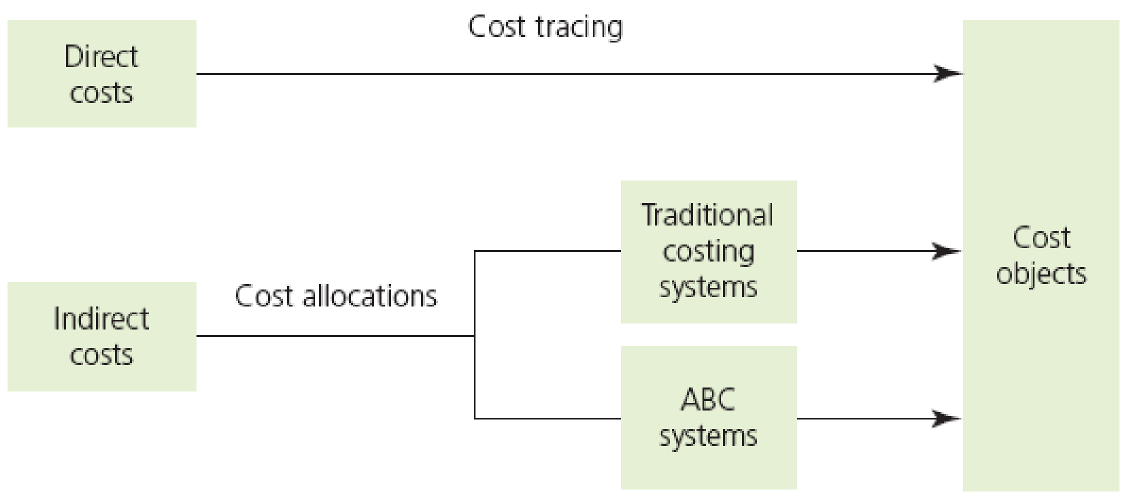
1.5 Other Types of Costs

- Example
  - Materials previously purchased for €100 have no alternative other than being converted for sale at a cost of €200. The sale proceeds after conversion would be €250

	Do not Convert	Convert	
Materials	€100	€100	Irrelevant
Conversion costs		€200	Relevant
Revenue		€(250)	Relevant
Net cost	**€100**	**€50**	

Note that in the short term not all cost may be relevant for decision-making

1.6 Costing Systems



1.6 Costing Systems

- Assigning indirect costs using blanket overhead rates
  - Some firms use a single overhead rate (i.e.blanket or plant-wide) for the organization as a whole
  - Example

Total overheads	€900.000
Direct labour (or machine hours)	€60.000
Overhead rate	€15 per hour

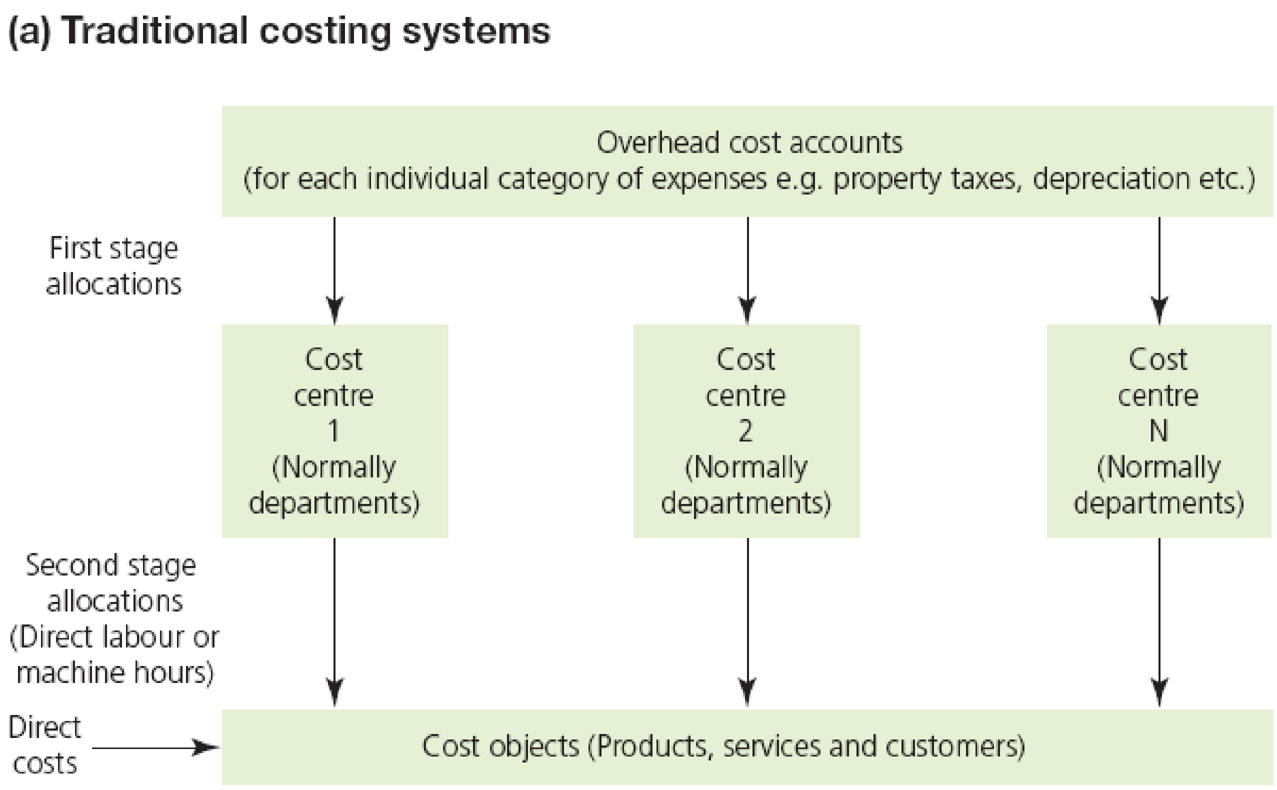
1.6 Costing Systems

- The two-stage allocation process
  - To establish departmental or cost centre overhead rates a two-stage allocation procedure is required:
    - Stage 1 – Assign overheads initially to cost centres.
    - Stage 2 – Allocate cost centre overheads to cost objects (e.g. products) using second stage allocation bases/cost drivers.

Traditional Costing System

ABC Costing System

1.6.1 Traditional Costing Systems



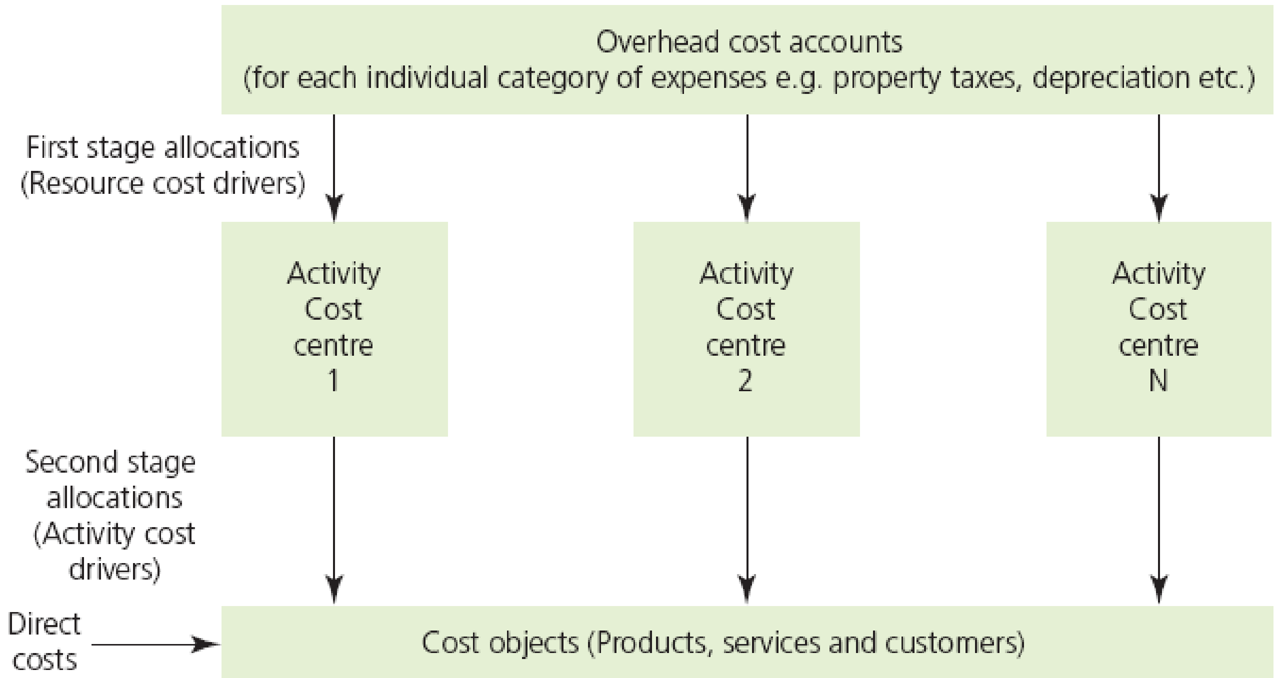
1.6.2 Traditional Costing Systems

- An illustration of the two-stage process for a traditional costing system
  - Applying the two-stage allocation process requires the following 4 steps:
    1. Assigning all manufacturing overheads to production and service cost centres.
    2. Reallocating the costs assigned to service cost centres to production cost centres.
    3. Computing separate overhead rates for each production cost centre.
    4. Assigning cost centre overheads to products or other chosen cost objects.

1.6.2 Traditional Costing Systems

- Steps 1 and 2 comprise stage one and steps 3 and 4 relate to the second stage of the two-stage allocation process
- Note that in the third stage above traditional costing systems mostly use either direct labour hours or machine hours as the allocation bases

1.6.2 ABC Costing Systems



2.1 General principles

- A regression equation (or cost function) measures past relationships between a dependent variable (total cost) and potential independent variables (i.e. cost drivers/activity measures).
- Simple regression

$$y = a + bx$$

  - Where
    - y = Total cost
    - a = Total fixed cost for the period
    - b = Average unit variable cost
    - x = Volume of activity or cost driver for the period
- Multiple regression

$$y = a + b_1 X_1 + \cdots + b_n X_n$$

- Resulting cost functions must make sense and be economically plausible.

2.2 Cost Estimation Methods

- Engineering methods
- Inspection of accounts method
- Graphical or scattergraph method
- High-low method
- Least squares method.

2.2 Cost Estimation Methods

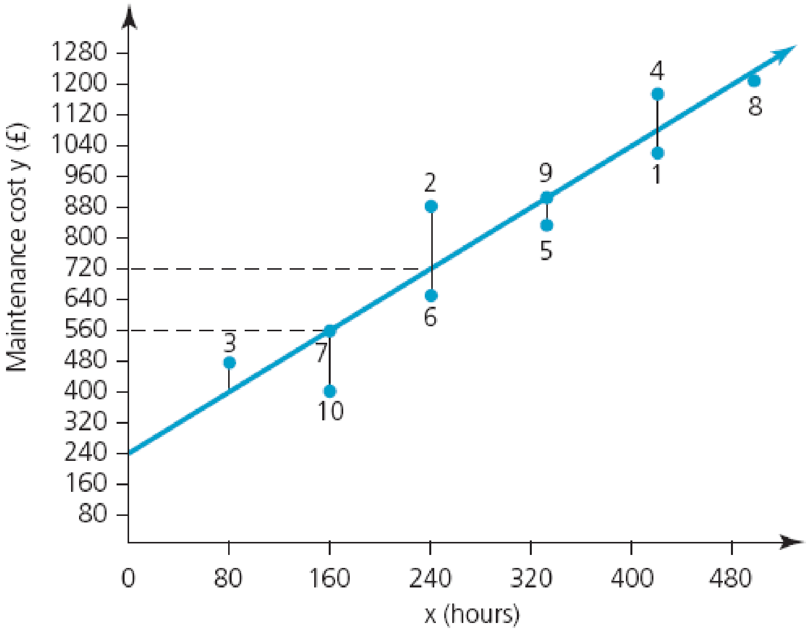
- Engineering methods
  - Analysis based on direct observations of physical quantities required for an activity and then converted into cost estimates.
  - Useful for estimating the costs of repetitive processes where input-output relationships are clearly defined.
  - Appropriate for estimating the costs associated with direct labour, materials and machine time.

2.2 Cost Estimation Methods

- Inspection of accounts
  - Departmental manager and accountant inspect each item of expenditure within the accounts for a particular period and classify each item as fixed, variable or semi-variable.

2.2 Cost Estimation Methods

- Graphical or scattergraph method
  - Past observations are plotted on a graph and a line of best fit is drawn.



$$Slope = \frac{\text{Difference in Cost}}{\text{Difference in Activity}}$$

$$= \frac{€720 - €560}{240 \text{ hours} - 160 \text{ hours}}$$

$$= €2 \text{ per hour}$$

Y=€240+€2X

2.2 Cost Estimation Methods

- High – low method
  - Involves selecting the periods of highest and lowest activity levels and comparing changes in costs that result from the two levels.

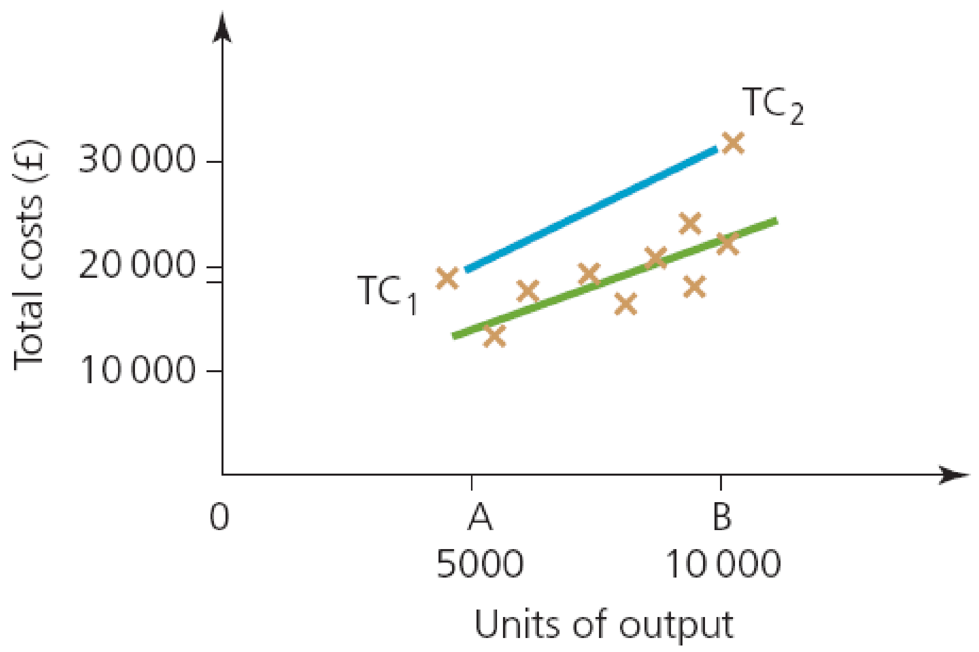
Example	***Volume of Production***	***Maintenance Costs***
Lowest activity	5,000 units	€22,000
Highest activity	10,000 units	€32,000

Cost per unit = €10,000/5,000 units = €2 per unit

Fixed costs = €22,000 – (5,000 × €2) = £12,000

2.2 Cost Estimation Methods

- High – low method
  - Relies on only two observations
  - Cannot be recommended



2.2 Cost Estimation Methods

- The Least squares method

Hours x	*Maintenance cost y (£)*	x^2	xy	y^2
90	1 500	8 100	135 000	2 250 000
150	1 950	22 500	292 500	3 802 500
60	900	3 600	54 000	810 000
30	900	900	27 000	810 000
180	2 700	32 400	486 000	7 290 000
150	2 250	22 500	337 500	5 062 500
120	1 950	14 400	234 000	3 802 500
180	2 100	32 400	378 000	4 410 000
90	1 350	8 100	121 500	1 822 500
30	1 050	900	31 500	1 102 500
120	1 800	14 400	216 000	3 240 000
60	1 350	3 600	81 000	1 822 500
$\sum x = 1260$	$\sum y = 19\ 800$	$\sum x^2 = 163\ 800$	$\sum xy = 2\ 394\ 000$	$\sum y^2 = 36\ 225\ 000$

2.2 Cost Estimation Methods

- The Least squares method
  - The simple regression equation $y = a + bx$ can be found from the following two equations and solving for a and b

$$\begin{cases} a = \dfrac{\sum y}{n} - \dfrac{b\sum x}{n} \\ b = \dfrac{n\sum xy - \sum x \sum y}{n\sum x^2 - \left(\sum x\right)^2} \end{cases}$$

2.2 Cost Estimation Methods

- The Least squares method
  - The previous equation can be used to predict costs at different output levels

$$b = \frac{12 \times 2{,}394{,}000 - 1{,}260 \times 19{,}800}{12 \times 163{,}800 - 1{,}260^2} = \frac{3{,}780{,}000}{378{,}000} = €10$$

$$a = \frac{19{,}800}{12} - \frac{10 \times 1{,}260}{12} = €600$$

$$Y = a + bX = €600 + €10X$$

2.2 Cost Estimation Methods

- The Least squares method
  - Multiple regression analysis
    - With simple regression analysis it is assumed that total cost is determined by only one activity-based variable
    - With multiple regression several factors (rather than one are assumed to determine total cost.
    - For example, $Y=a+b_1X_1+b_2X_2$
      where X_1 and X_2 are different activity variables

2.2 Cost Estimation Methods

- The Least squares method
  - Multiple regression analysis
    - Example
      - Assume

        X_1 = Number of machine hours

        X_2 = Number of days in period in which temperature < 15 degrees

        $Y=20+4X_1+12X_2$
      - Estimate the total cost for 1,000 machine hours and a period of 30 days with a temperature of less than 15 degrees

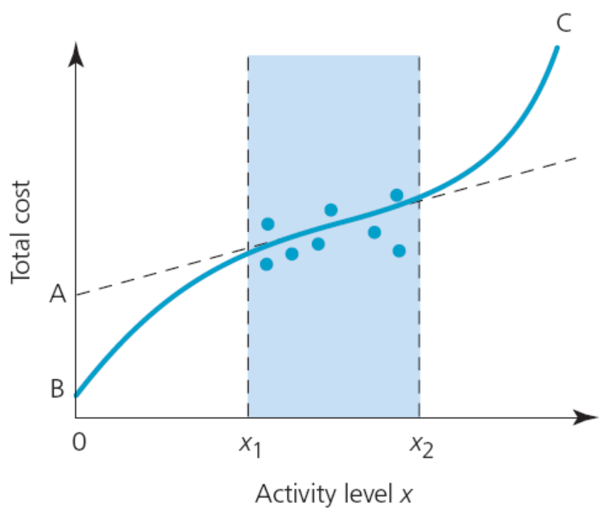
$$\text{Total Cost } (Y) = 20 + 4 \times 1{,}000 + 12 \times 30 = €4{,}380$$

2.2 Cost Estimation Methods

- The Least squares method
  - Multiple regression analysis
    - Multicollinearity exists when the independent variables are highly correlated with each other, resulting in it being impossible to separate the effect of each of these variables o on the dependent variable
    - The existence of multicollinearity does not affect the validity of the prediction of total cost but is does affect the validity of the individual coefficient estimates

2.2 Cost Estimation Methods

- The Least squares method
  - Multiple regression analysis
    - Summary
      - Select the dependent variable (y) to be predicted.
      - Select the potential cost drivers.
      - Plot the observations on a graph.*
      - Estimate the cost function.
      - Test the reliability of the cost function.



*Be aware of the dangers of predicting costs outside the relevant range.

2.2 Cost Estimation Methods

- The Least squares method
  - Multiple regression analysis
    - Tests of reliability
      - Tests of reliability indicate how reliable potential cost drivers are in predicting the dependent variable.
      - The most simplistic approach is to plot the data for each potential cost driver and examine the distances from the straight line derived from the visual fit.
      - A more simplistic approach is to compute the coefficient of variation (known as r^2)

2.2 Cost Estimation Methods

- The Least squares method
  - Multiple regression analysis
    - Tests of reliability - Example

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

$$=\frac{12\times 2{,}394{,}000-1{,}260\times 19{,}800}{\sqrt{\left(12\times 163.800-1{,}260^2\right)\left(12\times 36{,}225{,}000\times 19{,}800^2\right)}}$$

$$=\frac{3{,}780{,}000}{4{,}015{,}654}=0.941$$

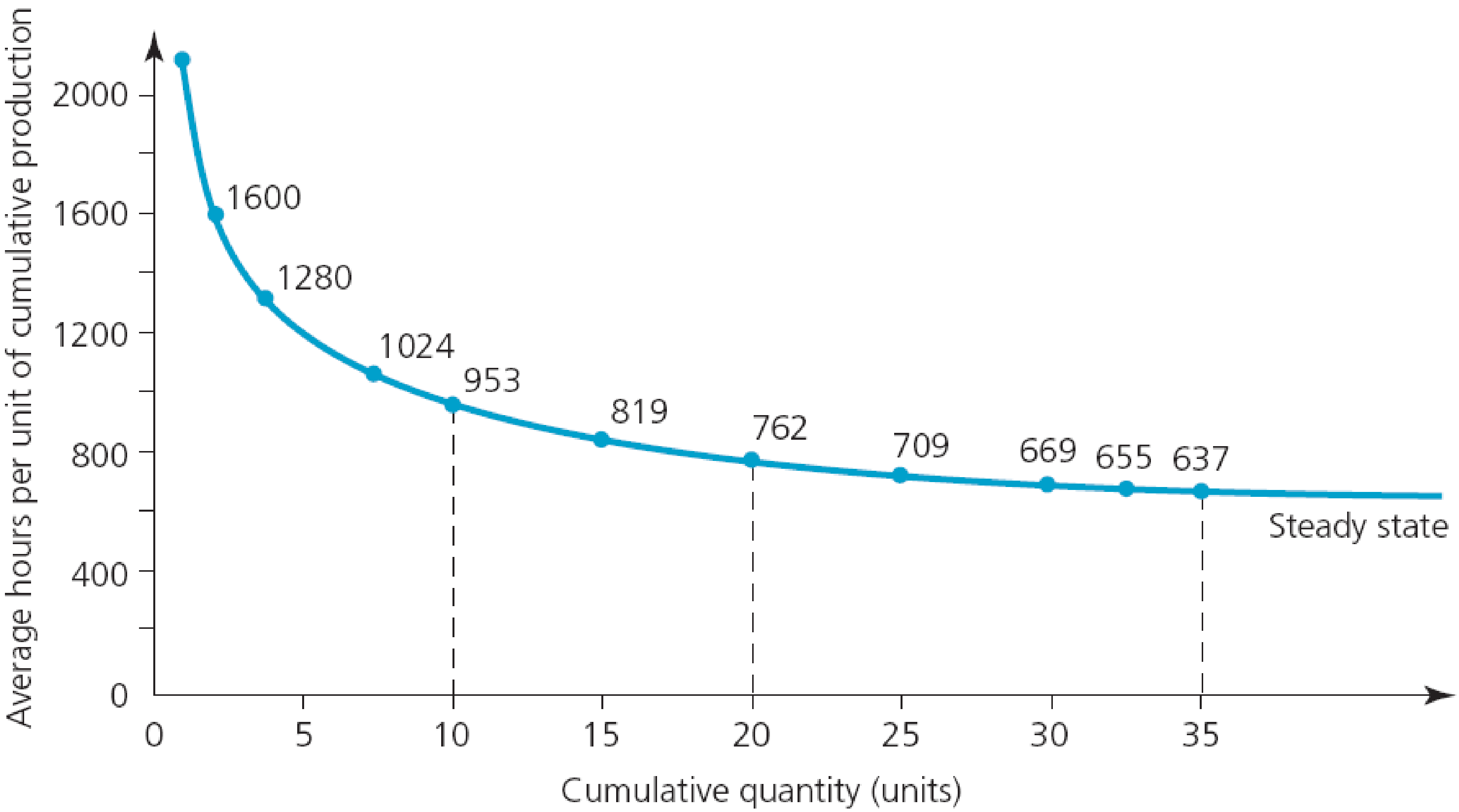
$$r^2=0.941^2=0.8861$$

2.3 Learning Curve

- An illustration of an 80% learning curve

(1) Order no.	Number of units (2) Per order	(3) Cumulative Production	Cumulative Hours (4) Per unit	(5) Total (3) × (4)	Hours for each order (6) Total	(7) Per unit (6) ÷ (2)
1	1	1	2.000	2.000	2.000	2000
2	1	2	1.600	3.200	1.200	1.200
3	2	4	1.280	5.120	1.920	960
4	4	8	1.024	8.192	3.072	768
5	8	16	819	13.104	4.912	614
6	16	32	655	20.960	7.856	491

2.3 Learning Curve



2.3 Learning Curve

- Mathematically

1. $Y_X = ax^b$

   Y_x = Cumulative average time to produce x units

   a = Time required to produce the first unit of output

   b = Ratio of the log of the learning curve improvement rate divided by log of 2

2. For an 80% learning curve

$$b = \frac{\log 0.8}{\log 2} = \frac{-0.2231}{0.6931} = -0.322$$

3. $Y_{10} = 2000 \times 10^{-0,322} = 2000 \times 0,476431 = 953$

4. $Y_{20} = 2000 \times 20^{-0,322} = 2000 \times 0.381126 = 762$

2.3 Learning Curve

- Mathematically

5. Assume the company has completed four units cumulative production.

To calculate incremental hours for six more units

Total hours for 10 units (10 × 953 hours)	9.530
Total hours for 4 units (4 × 1280 hours)	5.120
Total Cost	**4.410**

6. Note learning effect only applies to direct labour-related variable costs.
7. Learning curve applications
   - Pricing decisions; Work scheduling; Standard setting