COST ESTIMATION

It is the process of determining in advance the amount of cost to be incurred when a given activity is undertaken. It assumes that the total cost is made up of both fixed and variable cost.

Total cost = Fixed cost + variable cost

$Y = a + bx$

Where:
Y=Total cost
a = Fixed cost
b=Variable cost per unit
x = number of units/hours/periods.

STEPS IN ESTIMATION

1. Identify the dependent variable/item to be predicted (Y)
2. Identify the cost driver of the cost to be predicted/independent variable (x)
3. Gather data for both x and y
4. Analyze the data above and observe the trend.
5. Develop an estimation equation using appropriate method.

METHODS OF COST ESTIMATION

1. Industrial engineering method
2. Accounts analysis
3. High – low method
4. Simple regression/least square method.
5. Scatter diagram method

1. **Industrial engineering method**
   This is where a professional engineer applies his skills, knowledge and experience to determine the relationship between inputs and outputs in physical quantities. This method is preferred where:
   The item is new and unique.
   The item is of construction nature.
   The relationship can be expressed in physical quantities.
   This method is easier to understand, economical and time effective. However the method is subjective/biased, therefore it cannot be used for general estimation.
2. **Accounts analysis method**
   It involves the examining of cost drivers and classifying them as either fixed or variable costs. This costs are then used to establish an estimation equation inform of:

$Y = a + bx$

Where:
Y=Total cost
a = Fixed cost

b=Variable cost per unit
x = number of units/hours/periods.

Example: The following information has been extracted from the books of kk Ltd

		Total
Direct Materials	All variable	600,000
Labor cost	10% fixed	500,000
Maintenance cost	50% fixed	900000
Rent	All fixed	540000
Overheads	30% fixed	840,000

The number of the units manufactured during the period were 2088 units
Required:

1. Determine the cost estimation equation using the accounts analysis in the form of Y= a + bx
2. Using the equation above estimate the total cost of manufacturing 3500units
3. Using the equation in (I) above determine the number of units manufactured if the company had budgeted the total cost sh. 4.8 million

	Fixed	**Variable**
Direct material		600000
Labor	50000	450000
Maintenance	450000	450000
Rent	540000	-
Overheads	252000	588000

(i) Where:
Y=Total cost
a = Fixed cost
a = 1292000
bx = 2088000
b = 2088000/2088 = 1000units
Y=1292000+1000x

(ii) Y=1292000+1000x
= 1292000 + 1000(3500) = 4792000

(iii) Y =4.8m
4800000 = 1292000+1000x
4800000-1292000=3508000/1000 =**3508units**

CPA

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Good Health care Hospital has prepared a schedule of estimated overhead costs for its blood test unit, on the assumption that production will be 80,000 tests. Overheads costs have been classified as fixed costs and variable costs.

Overheads	Cost (sh)
Supplies	375000 (all variable)
Indirect labour	1,942,000 (1,710,000 fixed)
Rent	2,364,200 (all fixed)
Utilities	272,100 (all variable)
Depreciation	810,000 (all fixed)
Maintenance	243,300 (85000 fixed)
Data processing	253,200 (158,200 fixed)
Technical support	169,400 (all fixed)

Required:

(i) A cost estimation equation using the account analysis approach taking the number of tests as the only cost driver (6 marks)

(ii) Using the equation in (b) (i) above estimate the total cost given that the anticipated number of tests are 90,000. (2 marks)

Overheads	Cost	Fixed	Variable
Supplies	375,000	-	375000
Indirect labour	1,942,000	1,710,000	232000
Rent	2,364,200	2,364,200	-
Utilities	272,100	-	272100
Depreciation	810,000	810,000	-
Maintenance	243,300	85,000	158300
Data processing	253,200	158,200	9500
Technical support	169,400	169,400	-
		5,296,800	1,132,400

a. $y = a + bx$

- $a = 5{,}296{,}800$
- $bx = 1{,}132{,}400$
- $b = \frac{bx}{x} = \frac{1{,}132{,}400}{800{,}000}$
- $= 14.155$
- $\underline{y = 5{,}296{,}800 + 14.155x}$

b. $x = 90{,}000$

$y = 5{,}296{,}800 + 14.155(90{,}000)$ =<u>6570750</u>

Disadvantages of accounts analysis method

- Classification of cost into fixed and variable component is based on individual judgement which might be subjective.
- The result of this method cannot be defined using a statistical method since there is no procedure of distinguishing variable and fixed cost.
- Can be time consuming and expensive to perform
- May not be suitable to small business with limited resources

3 HIGH LOW METHOD

It involves taking the highest and the lowest level of activity and using this two points to develop an estimation equation in form: y = a + bx

Where;
Y – Total production Cost
a- Fixed cost
b- Variable cost
c- x- units manufactured

E.g., The following was extracted from the books of K Ltd

Period	Machine hrs. X	Maintenance cost Y
1	80	200
2	120	300
3	40	150
4	160	400

Required:

a) Determine the relationship between the machine hours and maintenance cost in the form of $y = a + bx$ using the high low method
b) Estimate the maintenance cost for 900 units

(a)	High	Low	(b) 900 units
X	160	40	Y = 80 + 2(900) = 1880
Y	400	150	

$b = \frac{400 - 150}{160 - 40} = 2$

Using the highest point to determine the value of a

Y = a + bx
400 = a + 2(160)
400 -320 = 80
Y = 80 + 2x

Example 2

Kenya Auto Assemblers Ltd cars from imported knocked –down-kits. The company has been operating at 60% capacity, assembling 3,000 cars per year.

The following information relates to the company's operations at two different levels of capacity

	Level of activity	
Costs	60%	80%
Direct materials	600,000	800,000
Direct labour	150,000	200,000
Indirect labour	200,000	240,000
Factory fuel and power	100,000	130,000
Factory repairs	130,000	155,000
Total cost	1,180,000	1,525,000

Required:

Using the high- low method, establish the cost equations of the company for Y=a+bx for each of the following costs for the company

(i) Direct Materials
(ii) Direct labour
(iii) Indirect labour
(iv) Factory fuel and power
(v) Factory repairs

(b) Using the results obtained in (a) above, estimate the total costs at 120% level of operation showing clearly the variable and fixed components of mixed costs.

60% =3000cars 80% = 3000*80% =4000cars 60%	**2.**direct labour	**4.** factory fuel and power b =130000-100000 =30 4000-3000 130000=a+30(4000) a = 130000 -120000 = 10000 y =10000+30x
1. Direct materials	High Low	5 factory repairs
High Low	X 4000 3000	b 155000-130000 =25 4000-3000 155000 = a + 25(4000) a = 155000-100000 = 55000 y = 55000+25x
X 4000 3000	Y 200000 150000	
Y 800000 600000	b = 200000-150000 =50 4000-3000	
b = 800000-600000 = 200 **4000 - 3000**	Y = a +bx 200000=a+50(4000) a=0 y=50b	
Use the highest points to obtain the value of a **Y = a + bx** **800000 = a + 200(4000)** **a = 0** **y =200b**	**3 indirect labour cost** b = 240000-200000 =40 4000-30000 240000=a+40(4000) a = 240000-160000 = 80000 y = 80000+40x	
At 120% level of operation the output level is	120% x3000 = 6000 cars 60%	

60% = 3000 **120% =?**		
KENYA AUTO ASSEMBLERS LTD COST STATEMENT FOR 6000 CARS		
VARIABLE COSTS	SH.	SH
Direct materials	200 x 6000	1200000
Direct labour	50 x6000	300000
Indirect labour	40 x6000	240000
Factory fuel power	30 x 6000	180000
Factory repairs	25 x6000	150000
		2070000
FIXED COSTS		
Indirect labour	80000	
Factory fuel and power	10000	
Factory repairs	55000	145000
		2215000

y = a + bx

	High	low
X	600	200
Y	23,600	19,500

$b = \frac{23,600 - 19,500}{600 - 200} = \frac{410}{400} = 10.25$

a = Use the highest points

y = a + bx

23,600 = a + 10.25(600)

23,600 = a + 6150

a = 23,600 – 6150

= 17450

Y = 17450 + 10.25X

Advantages of high-low method

1. Easy to use.
2. It is a faster method of cost estimation.

Disadvantage

1. It uses only two data values and ignore the rest. These values may not develop a reliable equation.
2. The equation developed cannot be appraised for efficiency and reliability

4 Regression analysis/Least square method

This is a statistical method which is used to determine the nature of the relationship existing between variables. The values of b and a are determined using the formulae below.

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

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

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The information given below relates to Brutex Ltd which manufacturers a single type of chemical. Overheads processing costs for the last 8 months have been as follows;

Month	Machine hours	Overhead costs Sh "000"
1	10600	120
2	17000	180
3	4000	70
4	21000	184
5	19000	178
6	7800	100
7	14000	172
8	12000	154

Required: Equation in the form of Y = a + bx using:

i) High – low method (2 mks)

ii) Regression analysis method (6 mks)

X	**y**	**xy ('000')**	**x2**
10,600	120	1272,000	112300,000
17,000	180	3060,000	239,000,000
4000 ————	70	280,000	16,000,000
21,000————	184	3864,000	441,000,000
19,000	178	3382,000	361,000,000
7,800	100	780,000	60,840,000
14,000	172	2408,000	196,000,000
12,000	154	1848,000	144,000,000
x=105,400	y=1158	xy=16,894,000	x2=1620, 200,000

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

$b = \frac{8 \times 16{,}894{,}000 - 105{,}400 \times 1158}{8 \times 1{,}620{,}200{,}000 - (105{,}400)^2}$

$b = 7.07$

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

$= \frac{1{,}158{,}000 - 7.07 \times 105{,}400}{8} = 51602.75$

$y = 51{,}602.75 + 7.07x$

CPA MAY 2015 Q 1b

The following details have obtained from the records of King pin Ltd, a firm dealing in computer repairs and maintenance.

week	Number of computer purchased	Total cost incurred
1	310	23200
2	200	19500
3	600	23600
4	480	20220
5	400	23600
6	440	18480
7	440	16200
8	330	20200

Required: Formulate the cost function in the form of Y = a + bx using least square method

X	**y**	**xy**	**x^2**
310	23,200		
200	19,500		
600	23,600		
480	20,220		
400	23,600		
440	18,480		
440	16,200		
330	20,200		
$\sum x=3200$	165,000	$\sum xy=66{,}322{,}800$	$\sum x^2=1382{,}600$

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

$$= \frac{8 \times 66{,}322{,}800 - 3200 \times 165{,}000}{8 \times 1382{,}600 - (3200)^2}$$

$$b = \underline{3.1462}$$

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

$$a = \frac{165{,}000 - 3 \times 3200}{8}$$

$$= 19{,}366.5$$

$$y = \underline{19{,}366.5 + 3.1462x}$$

Advantages of regression analysis

1. It uses all the data values and therefore the equation developed is more accurate.
2. The equation developed can be evaluated for reliability and efficiency.

Disadvantages/Assumptions

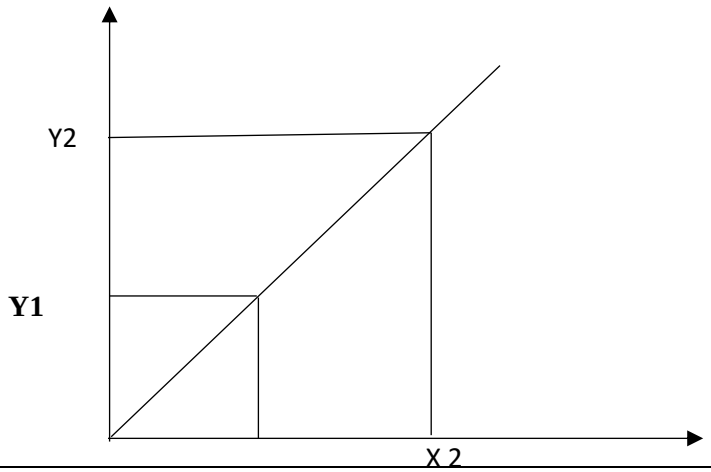
1. It assumes that all the variables are linear i.e. there is linearity before the variables.
2. There is only one factor affecting activity level i.e. the only variable which causes changes in the total cost are the units of production.
3. It uses historical data which may not predict future accurately

ASSUMPTION OF LINEAR REGRESSION MODEL

(i) The chosen sample is representative of population
(ii) There is a linear relationship between the independent variable and the dependent variable.
(iii) All the variable are normally distributed

SCATTER DIAGRAM/ VISUAL FIT METHOD

- Under this method, a scatter diagram is constructed and two points from the diagram are picked which are used to drive an estimation equation inform of Y = a + bx.



X1 =100	Y1 =1000
X2 =150	Y2 =1500

Y= a + bx
1500 = a + 150b
1000= a+ 100b
500 = 50b
b =10
1000 = a + 100(10)
a =0
Y =10x

Advantages

1. It's easy to understand and operate since the values of x & y are plotted on the diagram
2. It takes into account all the observation available.

Disadvantages

1. It can't be used if these are more than one independence variables
2. It is subjective since some of the observation are not used in making the conclusion.