Chapter 2 Solutions

Solution 2.1

a) Explain what you understand by the term 'cost'

The term ‘cost’ can be defined as 'the resources consumed or used up to achieve a certain objective'. This objective may be the running of a business or a department within a business. Thus cost represents the expenditure occurred in running a business on a day to day basis.

b) Explain what you understand by the 'elements of costs'.

The ‘elements of costs’ refer to a cost classification system. Cost analysis involves classifying costs according to their common characteristics. There are a number of different classification systems, each differing according to the purpose to which the cost data is to be used. Cost classification by element is a system that classifies costs according to what they are. It normally classifies cost into three categories namely, materials, labour and expenses that are incurred in making a product or offering a service. Thus in the case of a restaurant, materials represent food and beverages, subsequently labour (chefs and waiters) and production facilities (kitchen equipment) are used to convert the materials into a finished product to be sold. Expenses include the light and heat, insurance, advertising, depreciation, repairs, maintenance and rent used to ensure the product is sold. This classification system is generally used for profit and loss presentations in financial reporting.

c) Distinguish between the following, giving examples of each

- **Direct and indirect costs.**
- **Fixed and variable costs.**

CIMA Official Terminology describes direct cost as ‘expenditure that can be attributed to a specific cost unit’. A direct cost is a cost that can be traceable and thus attributable to a particular product or service. Direct costs can be further broken into direct materials, direct labour and direct expenses. An example of a direct cost is the ingredients in a meal. Indirect costs are costs that cannot be traced to an individual product or service. This would include all costs that are not direct costs. Indirect costs can be further broken down into indirect material, indirect labour and indirect expenses. The total of all indirect costs is known as overhead. CIMA Official Terminology describes overhead as ‘expenditure on labour, materials or services that cannot be economically identified with a specific saleable cost unit’. Examples of overheads include costs such as supervision and management (unless only one product or service is involved), electricity, depreciation, insurance and advertising.

The classification of costs into fixed and variable categories relates to how costs behave in relation to changes in sales volume. This costs classification systems is important in terms of planning and decision-making. Fixed costs are costs that are a function of time rather than sales activity and thus are not sensitive to changes in sales volume. As sales volume increases, these costs would be expected to remain the same or maybe increase due to other reasons such as inflation. Examples of fixed costs would include rent, rates, insurance and management salaries. Any of these costs would not be expected to increase as sales volume increases. It does not matter if there are 100 people or one person in a restaurant, the same rent must still be paid. Variable costs are costs that increase as sales or production volume increases. For example if sales volume fluctuates by 10 per cent then variable costs will fluctuate also by 10 per cent or close to it. Thus a variable cost is a cost that is sensitive to changes in sales activity. Examples would include direct materials as identified above. The cost of food or beverages for a restaurant would be considered a variable cost. The cost of toys in a toyshop would be a variable cost.

Solution 2.2

You are required to classify each of the following costs according to whether they are direct or indirect, based on tracing the cost to a) department and b) product line

Cost	Department	Product line
Salary of restaurant supervisor	Direct	Indirect
Rent of shop unit	Indirect	Indirect
Depreciation of computer reservation system	Direct	Indirect
Sales commission	Direct	Direct
Purchase of goods for resale in a shop	Direct	Direct
Paint for each product	Direct	Direct
Oil for central heating system	Indirect	Indirect
Home delivery service costs for supermarket	Indirect	Indirect
Cashiers wages	Direct	Indirect
Facilities managers salary	Indirect	Indirect

Solution 2.3

a) **Calculate the direct materials cost per meal.**

Ingredients	Quantity required			Total cost
Steak	0.33 kg	€400	60 portions =	€6.67
Mixed salad	1 bag	€30	100 bags =	€0.30
French fries	0.20 kg	€60	150 portions =	€0.40
Onion rings	5	5 rings x (€5	100) =	€0.25
Total cost per meal				€7.62

b) **Calculate the direct labour cost per meal.**

Staff	Hours worked	Rate per hour €	Total cost €
Chef (1 person)	3	40	120
Commi chefs (2 persons)	6	15	90
Waiting staff (4 persons)	12	10	120
Total direct labour cost			330

Total direct labour cost is €330 for a total of 70 meals. Thus the direct labour cost per meal amounts to €4.71

c) ***If the direct expenses relating to the wedding function amount to €300, calculate the prime cost per meal.***

	€
Direct materials	7.62
Direct labour 330/70	4.71
Direct expenses 300/ 70	4.29
Prime cost per meal	16.62

Solution 2.4

a) Explain what you understand by 'cost behaviour' using an example to illustrate.

Cost behaviour refers to a cost classification system primarily used for management planning decisions. It is a crucial classification in that it allows an insight into how costs react to different circumstances. In trying to predict and plan for the future, it is essential to understand costs and what drives and creates costs. In particular, this classification looks at the relationship between costs and sales volume / production output. When planning to increase output (sales volume), it is important to understand and appreciate how costs will react to this. What is meant by sales volume / production output is for example, a restaurant selling more covers, or a hotel selling more bedrooms, or a furniture shop selling more furniture as distinct from increasing sales by simply increasing the selling price. Cost behaviour analysis focuses on how costs react to increases in sales volume. Fixed costs are those that do not react to sales volume fluctuations, whereas variable costs increase as sales volume increases. For example if a restaurant is expecting sales volume to increase then it must plan for certain costs to increase as well. These costs would be considered variable costs and would include such costs as food, beverages and part-time labour. Other costs such as fixed costs would not be expected to change as sales volume fluctuates. These costs would include rent, rates, depreciation, salaries, light and heat, advertising, and insurance.

b) Explain the concept of the relevant range.

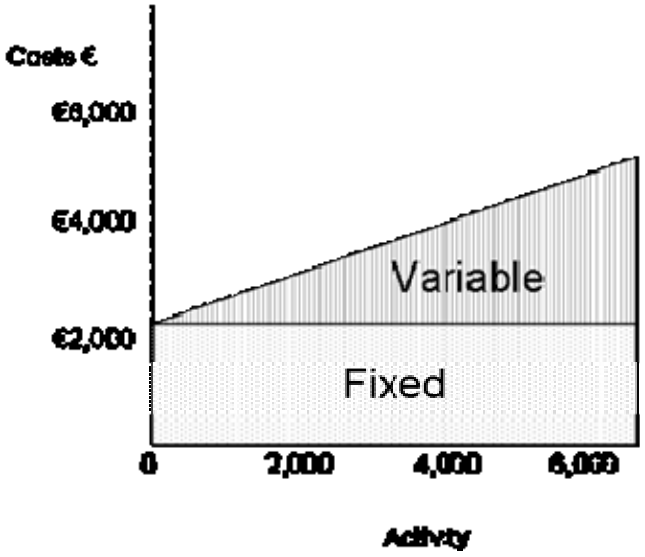
The concept of relevant range refers to situations where increases in sales activity can lead to increases in fixed costs. Take for example a situation where sales volume increases to a level that a new manager or supervisor is required to support this extra volume of activity. In this case fixed costs will be affected and will increase. Thus we have the concept of *'the relevant range of activity'* which states that fixed costs will be unaffected by sales volume fluctuations as long as these fluctuations ensure sales activity remains within a certain range. For example the fixed costs of a restaurant may remain at €20,000 per week as long as sales activity remains with a certain volume of activity range of 0 and 2,100 covers per week. Should sales increase beyond 2,100 covers then maybe an extra supervisor is required, or if opening times are extended additional staff may be required. The relevant range concept is critical when management is considering significant increases or reductions in activity levels.

Solution 2.5

a) Explain the term 'semi-variable costs' giving at least two examples.

Semi-variable costs are costs that have both a fixed and variable component. For example telephone charges include a rental cost, which would be considered fixed and the cost of the number of phone calls which could be considered variable. When one analyses these costs further, part of the 'phone call costs' could be considered fixed as the phone would be used even if sales were non-existent. Thus a phone bill would be considered predominantly fixed, with a variable element. Another example would be light and heat. In a restaurant light and heat is required even if there are no customers in the restaurant. However as the restaurant gets busier more cookers will be needed and this would be classified as the variable element. Thus light and heat could be considered a predominantly fixed cost with a variable element. The following diagram graphically presents a typical semi-variable cost pattern relating to a landline telephone charge.

Semi-variable cost patterns



b) Why is it necessary to distinguish between fixed and variable costs.

In trying to predict and plan for the future, it is essential to understand costs and what drives and creates costs. By classifying costs into a fixed or variable category management gain an insight into how costs will behave or react to changes in sales volume. When planning to increase output (sales volume), it is important to understand and appreciate how costs will react to this. Cost behaviour analysis focuses on how costs react to increases in sales volume. Fixed costs are those that do not react to sales volume fluctuations, whereas variable costs increase as sales volume increases. For example if a restaurant is expecting sales volume to increase then it must plan for certain costs to increase as well. These costs would be considered variable costs and would include such costs as food, beverages and part-time labour. Other costs such as fixed costs would not be expected to change as sales volume fluctuates. These costs would include rent, rates, depreciation, salaries, light and heat, advertising, and insurance. This distinction can help management plan and make decision for the future. The cost-volume-profit model (CVP) uses cost behaviour analysis to provide management with information with can support

their planning and decision-making roles. This would include information relating to various strategies such as

- The forecast profit or loss
- The forecast break-even point
- The forecast number of products to be sold to make a required profit
- The forecast margin of safety

c) Classify the following expense items according to whether they are a fixed or variable cost.

Cost	**Fixed or variable**
Salary of restaurant supervisor	Fixed
Rent of shop unit	Fixed
Depreciation of computer reservation system	Fixed
Sales commission	Variable
Purchase of goods for resale in a shop	Variable
Paint for each product	Variable
Oil for central heating system	Fixed
Home delivery service costs for supermarket	Variable
Cashiers wages	Fixed
Facilities managers salary	Fixed

Solution 2.6

A hotel offers the following quotations from its banqueting menu to companies enquiring about their annual Christmas dinner

Number of covers	*Selling price per cover*
100	*€25.00*
150	*€20.00*
200	*€15.00*

Explain in your own words how the hotel can reduce its selling price based on the number of covers and still maintain or even increase its net profit percentage.

Where a business has high fixed costs and low variable costs there is great scope for a business to reduce price to stimulate demand. The increase in demand can compensate for the reduce price and reduced profit per person and as fixed costs do not react to sales volume fluctuations then profit can be at least maintained.

For example in the above scenario if variable costs amounted to 30% and fixed costs amounted to €1500 for the Christmas dinner then the profit statement would look as follows for all three prices.

	Selling price €25	Selling price €20	Selling price €15
Sales volume	100	150	200
Sales	2,500	3,000	3,000
Less variable costs	750	900	900
Contribution	1,750	2,100	2,100
Less fixed costs	1,500	1,500	1,500
Net profit	250	600	600
Net profit percentage	10%	20%	20%
	250/2500	600/3000	600/3000

As one can see although prices have fallen volume sales have increase and although variable costs have also increased contribution has increased and with fixed costs remaining the same, overall profit has increased. Thus the increase in volume sales and the fact that the businesses costs are mainly fixed has compensated for the reduced selling price.

Solution 2.7

a) ***Use the high-low method to separate the fixed and variable cost elements of the security costs presented above.***

The high-low method involves the following steps:

1. Identify the high and low activity levels and record the cost at each level.
2. Calculate the difference in activity levels and the difference in costs.
3. Divide the cost difference by the difference in activity levels. This gives us the variable cost per room sold (*b*).
4. Take either the high or the low activity level and input the data including (*b*) as calculated in step 3 and solve the equation by finding the fixed cost element.

Step 1

	Activity	Cost
High	280	€20,400
Low	216	€18,480
Step 2 Difference	64	€1,920

Step 3 €1,920 64 = €30 (the variable cost per unit)

Step 4 Total cost = fixed costs + (variable cost per unit x number of units sold)

y = a + b(x)

20,400 = a + 30 (280)

20,400 = a + 8,400

12,000 = a (the fixed cost amounts to €12,000)

Thus the cost function for the security costs is Y = 12,000 +30 (x)

b) ***As the complex manager plans on increasing opening hours by 10 per cent, re-calculate the costs for the four months presented above, based on the cost function calculated in (a).***

	Hours	Y= a+b(x)	Total cost €
January	308	Y = 12,000 + 30 (308)	21,240
February	246	Y = 12,000 + 30 (246)	19,380
March	264	Y = 12,000 + 30 (264)	19,920
April	238	Y = 12,000 + 30 (238)	19,140

Solution 2.8

a) Compute the maintenance cost function based on the high-low method.

		Activity	Cost
Step 1	High	900	€2,500
	Low	300	€1,800
Step 2	Difference	600	€700

Step 3 €700 600 = €1.17 (the variable cost per unit)

Step 4 Total cost = fixed costs + (variable cost per unit x number of units sold)

y = a + b(x)

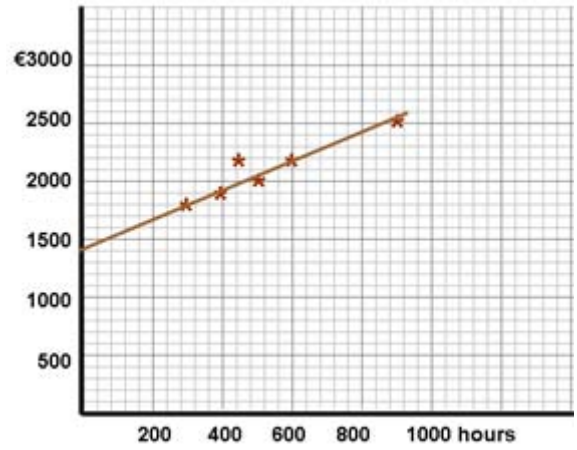
2,500 = a + 1.17 (900)

2,500 = a + 1053

1,447 = a (the fixed cost amounts to €1,447)

Thus the cost function for maintenance as per the high-low method is y = 1,447 + 1.17(x)

b) Draw a scatter diagram of the above data and draw a line of best fit through the data. From the graph, calculate the maintenance cost function.



c) Compute the maintenance cost function based on least squares regression analysis.

The calculations required to determine the total cost function for maintenance using least squares regression analysis are as follows:

Month	Activity x	Cost € y	xy	x^2	y^2
1	500	2,000	1,000,000	250,000	4,000,000
2	600	2,200	1,320,000	360,000	4,840,000
3	900	2,500	2,250,000	810,000	6,250,000
4	400	1,900	760,000	160,000	3,610,000
5	300	1,800	540,000	90,000	3,240,000
6	450	2,000	900,000	202,500	4,000,000
	3,150	12,400	6,770,000	1,872,500	25,940,000

The linear regression equation, which meets the above requirement, is obtained from solving simultaneously two equations. This gives us values for both *a* (fixed costs) and *b* (variable cost per unit) in the total cost function. The equations are as follows

1. $y = na + b\ x$

2. $\mathbf{xy = a(\ x) + b\ \ x2}$

a = fixed cost, **b** = variable cost per unit, **n** = number of observations, **x** = Sum of the observations of the independent variable, **y** = Sum of the observations of the dependant variable, **xy** = Sum of the product of each pair of observations and $\mathbf{x^2}$ = Sum of the squares of the x observations.

Equation 1 $12{,}400 = 6a + b3150$

Equation 2 $6{,}770{,}000 = a3{,}150 + b1{,}872{,}500$

By multiplying equation 1 by 525 we bring the number of (a)'s to the same number in each equation and thus cancel the (a) variable.

Equation 1 $6{,}510{,}000 = a3{,}150 + b1{,}653{,}750$

Equation 2 $6{,}770{,}000 = a3{,}150 + b1{,}872{,}500$

Subtract equation 1 from equation 2

$260{,}000 = b218{,}750$

$1.19 = b$

Substituting 1.19 for b in equation 1 should give us a value for a

$12{,}400 = 6a + 1.19(3{,}150)$
$12{,}400 = 6a + 3{,}748.5$
$8{,}651.5 = 6a$
$1{,}442 = a$

Thus according to the least squares regression method the repairs and maintenance costs for the leisure centre show a fixed element of €1,442 and a variable element of €1.19 per person or user.

d) Outline the main reasons for the differences in the maintenance cost function calculated by each of the methods.

As can be seen below, each method will give a different cost function.

1. High-low Y = 1,447 + 1.17(x)
2. Scatter-graph Y =
3. Linear regression Y = €1,442 + €1.19 (x)

The main reasons for the different cost functions are connected to the limitations of each approach. For example the main limitation of the high-low method is that the two sets of data selected may not be representative of the real behaviour patterns of the costs. For example, the highest and lowest activities may have occurred during exceptional circumstances and hence this method can provide a misleading cost function.

The main difference between the scatter-graph and high-low method lies with the sample data used to ascertain the cost function. The scatter-graph approach uses all the data in the sample to estimate the line of best fit and hence the cost-function. The high-low method uses only two extreme points within the sample to estimate the cost function. The main weakness of the scatter-graph approach is that once all the data is plotted on a graph, deciding on a line of best fit is still a subjective judgement.

Of the three methods, the linear regression model is considered to have the least number of limitations. This method is a statistical approach to determine the line of best fit for a given set of data. It is an extension of the scatter-graph approach and is based on the principle that the sum of the squares of the vertical distances from the regression line to the plots of the data points is less than the sum of the squares of the vertical distances from any other line that may be determined. In other words a truly objective line of best fit is calculated which minimises the squared deviations between the regression line and the observed data.

e) What is the advantage in calculating a cost function for a cost item?

The cost function can be used in the intelligent prediction of future costs based on forecast sales activity. This can provide more accurate forecast cost information which supports management planning and decision-making