



## Activity-based costing

### *Solutions to Chapter 10 questions*

The answer to this question should describe cost allocation, cost apportionment and absorption within a traditional product costing system. Both traditional and ABC systems use the two-stage allocation procedure. In the first stage costs are assigned to cost centres and in the second stage costs are charged to products passing through the cost centres using appropriate overhead absorption rates.

The terms 'cost allocation' and 'cost apportionment' are often used interchangeably to describe methods that are used in the first stage to arbitrarily share out costs to cost centres on some logical basis (e.g. rent may be apportioned on the basis of floor area of each department and works management on the basis of number of employees in each department). However, some textbooks distinguish between the two terms. Allocations are used to describe those overheads that can be specifically attributed to a cost centre (e.g. depreciation of machinery or the wages of a supervisor located in a specific cost centre). The term 'apportionment' is used where a cost cannot be specifically attributed to a cost centre and the costs have to be apportioned on some logical basis (e.g. rent apportioned to cost centres on the basis of floor area).

The term 'absorption' is normally used to refer to the second stage of the two-stage overheads process by which cost centre overheads are charged to products (i.e. absorbed by products) passing through the cost centre. Direct labour hours or machine hours are the most widely used absorption methods to assign the cost centre overheads to products.

The answer should then go on to describe activity-based-costing systems and also the limitations of traditional product costing systems (see Chapter 10 for a description of ABC).

#### **Solution IM 10.1**

For the answer to this question see 'A comparison of traditional and ABC systems' and 'volume-based and non-volume based cost drivers' in Chapter 10.

#### **Solution IM 10.2**

(a) See 'The emergence of ABC systems' and 'Costs versus benefits considerations' in Chapter 10 for the answer to this question.

#### **Solution IM 10.3**

(b) Organizations may decide not to use or to abandon ABC for the following reasons:

- (i) the high cost of operating an ABC system
- (ii) the lack of sufficient employees with the necessary expertise
- (iii) the lack of a 'champion' and top management support to promote ABC
- (iv) the resources required to set up an ABC system may not be available
- (v) difficulty in replacing existing systems that have become embedded in the organization and the resistance to change by employees
- (vi) employee hostility if it is viewed purely as a cost reduction technique that will be accompanied by redundancies
- (vii) a low proportion of costs that can be more effectively controlled and assigned to cost objects using ABC techniques.

(c) The usefulness of distinguishing between value-added and non-value-added activities is discussed in Chapter 22.

## Solution IM 10.4

(a) *Production cost per unit (conventional method)*

	Product X	Product Y	Product Z
	(£)	(£)	(£)
Direct labour at £6 per hour	3	9	6
Direct materials	20	12	25
Production overhead at £28 per machine hour	42 (1½ hours)	28 (1 hour)	84 (3 hours)
	<u>65</u>	<u>49</u>	<u>115</u>

(b) The total production overhead is derived from the overheads allocated to the product in part (a):

	(£)
Product X	31 500 (750 × £42)
Product Y	35 000 (1250 × £28)
Product Z	588 000 (7000 × £84)
	<u>654 500</u>

Overhead costs traced to cost pools:

	(£)
Set-up cost	229 075 (35%)
Machining	130 900 (20%)
Materials handling	98 175 (15%)
Inspection	196 350 (30%)
	<u>654 500</u>

Cost driver rates:

	(£)
Cost per set-up	341.903 (£229 075/670)
Cost per machine hour	5.60 (£130 900/23 375 <sup>a</sup> )
Cost per material movement	818.125 (£98 175/120)
Cost per inspection	196.35 (£196 350/1 000)

*Note*

<sup>a</sup> Machine hours = (750 × 1½) + (1250 × 1) + (7000 × 3) = 23 375

Overhead cost assigned to each product:

	Product X	Product Y	Product Z
	(£)	(£)	(£)
Set-up costs at £341.903	25 643 (75)	39 319 (115)	164 113 (480)
Machining at £5.60 per machine hour	6 300 (1125)	7 000 (1250)	117 600 (21 000)
Materials handling at £818.125 per movement	9 817 (12)	17 181 (21)	71 177 (87)
Inspection at £196.35 per inspection	29 453 (150)	35 343 (180)	131 554 (670)
	<u>71 213</u>	<u>98 843</u>	<u>484 444</u>
Number of units	750	1250	7000
Overhead cost per unit	£95	£79	£69

*Production cost per unit (ABC principles)*

	Product X	Product Y	Product Z
	(£)	(£)	(£)
Direct labour	3	9	6
Materials	20	12	25
Production overhead	95	79	69
	<u>118</u>	<u>100</u>	<u>100</u>
Change (compared with traditional method)	+82%	+104%	−13%

- (c) The traditional method allocates overheads in proportion to machine hours to products (4.8% to X, 5.3% to Y and 89.9% to Z). However, when overheads are assigned on the basis of number of set-ups, movements of materials and inspections the proportion of overheads assigned to product Z are 72% (480/670) for set-up costs, 72% (87/120) for materials handling costs and 67% (670/1000) for inspection costs. In contrast, the traditional method allocates approximately 90% of all costs to product Z. Therefore the unit cost for product is higher with the traditional method. The opposite situation applies with products X and Y and, as a result, unit costs are lower with the traditional method.

(i) *Tradition volume-based system*

The first stage of the two-stage overhead allocation procedure requires that the service department overheads are reallocated to the production departments (Machinery and Fittings). Typical allocation bases are:

Materials handling	– Direct material cost
Material procurement	– Direct material cost
Set-up	– Direct labour hours
Maintenance	– Machine cost or maintenance hours
Quality control	– Direct labour hours

It is assumed that the £10 500 service department costs will be apportioned as follows:

	(£000)
Machinery	6500
Fittings	4000

(Note that students will require details of the above allocation since the details are not given in the question.)

The computation of the departmental overhead rates is as follows:

	Machinery department (£)	Fitting department (£)
Original overhead allocation	2 500 000	2 000 000
Service department reallocations	6 500 000	4 000 000
Total production overhead cost (£)	<u>9 000 000</u>	<u>6 000 000</u>
Total direct labour hours	1 100 000	350 000
Overhead rate	£8.182 per DLH	£17.143 per DLH

**Solution IM 10.5**

*Product costs*

	Product A (£)	Product B (£)
Machinery department:		
500 000 DLH × £8.182	4 091 000	
600 000 DLH × £8.182		4 909 200
Fitting department:		
150 000 DLH × £17.143	2 571 500	
200 000 DLH × £17.143		3 428 600
Total production overhead cost (£)	6 662 500	8 337 800
Production volume (£)	300 000	300 000
Unit product overhead cost (£)	22.21	27.79

(ii) *Activity-based costing system*

Computation of cost driver rates:

Overhead	Annual cost (£000)	Annual cost driver volume	Cost driver rate
Material handling	1500	2540 material movements	£590.55 per material movement
Material procurement	2000	6500 orders	£307.69 per order
Set-up	1500	624 set-ups	£2403.85 per set-up
Maintenance	2500	30 000 maintenance hours	£83.33 per maintenance per hour
Quality control	3000	4120 inspections	£728.16 per inspection
Machinery	2500	1 100 000 direct labour hours	£2.27 per DLH
Fitting	2000	350 000 direct labour hours	£5.71 per DLH

*Overheads assigned to part numbers*

	Material handling	Material procurement	Set-up	Maintenance	Quality control	Machinery	Fitting	Total (£000)
Part 1:								
Cost driver consumption	180	200	12	7000	360	150 000	50 000	
Cost driver rate (£)	590.55	307.69	2 403.85	83.33	728.16	2.27	5.71	
Total cost (£000)	106.30	61.54	28.85	583.31	262.14	340.50	285.50	1 668
Part 2:								
Cost driver consumption	160	300	12	5000	360	350 000	100 000	
Cost driver rate (£)	590.55	307.69	2 403.85	83.33	728.16	2.27	5.71	
Total cost (£000)	94.49	92.31	28.85	416.65	262.14	794.50	571.00	2 260
Part 3:								
Cost driver consumption	1000	2000	300	10 000	2400	200 000	60 000	
Cost driver rate (£)	590.55	307.69	2 403.85	83.33	728.16	2.27	5.71	
Total cost (£000)	590.55	615.38	721.16	833.30	1 747.58	454.00	342.60	5 305
Part 4:								
Cost driver consumption	1200	4000	300	8000	1000	400 000	140 000	
Cost driver rate (£)	590.55	307.69	2 403.85	83.33	728.16	2.27	5.71	
Total cost (£000)	708.66	1 203.76	721.16	666.64	728.16	908.00	799.40	5 763

*Product costs*

	Product A (£)	Product B (£)
Part 1	1 668 000	
Part 2	2 260 000	
Part 3		5 305 000
Part 4		5 763 000
Production overhead cost (£)	3 928 000	11 068 000
Production volume	300 000 units	300 000 units
Unit cost (£)	13.09	36.89

This answer is adapted from Innes, J. and Mitchell, F. (1990) *Activity Based Costing: A review with case studies*, Chartered Institute of Management Accountants, London.

## Solution IM 10.6

### (a) (i) Budgeted analysis of net profit based on the sales value allocation base

Operating profit	840 000	370 000	290 000
Central cost allocation in ratio 5000: 4000: 3000	416 667	333 333	250 000
Net profit	<u>423 333</u>	<u>36 667</u>	<u>40 000</u>

The report should draw attention to the following:

- Traditional costing systems allocate costs on the basis of volume measures such as direct labour hours, machine hours and sales values or volumes.
- Using sales values assumes that central costs are caused by sales values thus departments with the higher sales values are allocated with higher proportions of central costs. The result is that the high sales value stores will be overcosted and low sales values stores will be undercosted if central costs are caused by factors unrelated to sales volumes or values.
- Central costs should be traced to stores on the basis of cost drivers that are the cause of the costs being incurred. Cost drivers are the events or forces that are significant determinants of the warehousing activities and the activities undertaken at head office.
- In many cases it is the complexity of dealing with different products, customers or stores locations that are the cause of overhead costs, rather than volume. Activity-based-costing systems attempt to capture complexity by using cost drivers such as the number of dispatches. For example, some warehousing costs will be caused by the number of dispatches. Thus, if a low sales volume store dispatches many small orders and a high sales volume store dispatches a small number of high volume orders using the number of dispatches as the cost driver will capture the greater complexity and the warehouse resources consumed by the low sales volume store. In contrast, using sales values as the cost driver will not capture the complexity and high sales value stores will be overcosted and low sales values stores will be undercosted.

### (a) (ii) Budgeted analysis of net profit based on the revised allocation bases

Warehouse operations					
	Total		A	B	C
	(£)	(£)	(£)	(£)	(£)
Head Office					
Salary <sup>a</sup>	200 000	20 000	60 000	60 000	60 000
Advertising <sup>b</sup>	80 000	—	33 333	26 667	20 000
Establishment <sup>c</sup>	120 000	12 000	36 000	36 000	36 000
		<u>32 000</u>			
Warehouse					
Depreciation <sup>d</sup>	100 000	—	40 000	30 000	30 000
Storage <sup>e</sup>	80 000		32 000	24 000	24 000
Operating and despatch <sup>f</sup>	152 000		55 000	45 000	52 000
Delivery <sup>g</sup>	300 000		100 000	71 429	128 571
			<u>356 333</u>	<u>293 096</u>	<u>350 571</u>
Operating profit			840 000	370 000	290 000
Net profit/(loss)			483 667	76 904	(60 571)

#### Notes

<sup>a</sup> Allocated on the basis of note 1 in the question

<sup>b</sup> Allocated on the basis of note 2 in the question

<sup>c</sup> Allocated on the basis of note 1 in the question

<sup>d</sup> Allocated on the basis of storage space occupied

<sup>e</sup> Allocated on the basis of storage space occupied

<sup>f</sup> £120 000 given in the question plus £32 000 allocated to warehousing operations in the above analysis

<sup>g</sup> Allocated on the basis of delivery distances

The revised allocations show that the costs identified to store C exceed the current level of operating profit and an overall loss is disclosed. Stores B and C show improved results based on the revised allocations. The allocation bases selected bear a closer cause-and-effect relationship than the current method of cost allocation. However, for some costs (e.g., advertising and depreciation) it is difficult to establish meaningful cause-and-effect relationships. Nevertheless, the revised basis provides more meaningful profitability analysis attention directing information. It shows that the viability of maintaining store C should be subject to a more detailed special study. Some of the costs, such as depreciation, may represent facility or business-sustaining costs that are unavoidable and that would still continue if C were closed. Such factors should be taken into account when the special study is undertaken. If the special study still suggests that C is unprofitable steps should be taken to reduce costs by reducing the demand for activities, such as by reducing the number of low volume dispatches so that resource consumption is reduced without reducing sales revenues. In addition, direct deliveries from some suppliers and the more efficient routing of deliveries should be considered. The important point to note is that the revised profitability analysis has highlighted issues for investigation which were not highlighted by the previous allocation method.

- (b) Regression analysis and tests of reliability can be used to examine the relationship between some of the costs and the allocation bases (cost drivers) proposed. Details of the costs of activities and the potential cost drivers should be accumulated at frequent intervals (e.g. monthly) and a regression equation established and reliability tests undertaken. For a more detailed explanation of these issues you should refer to Chapter 24.

## Solution IM 10.7

- (a) (i) *Preliminary workings*

### *Making*

Estimated minutes for the making activity	
(5000 × 5.25) + (3000 × 5.25)	42 000
Variable conversion costs absorption rate	
(£350 000/42 000 minutes) per minute	£8.333
Fixed conversion costs absorption rate	
(£210 000/42 000 minutes) per minute	£5
Variable conversion costs charged to both products	
(5.25 minutes × £8.333)	£43.75
Fixed conversion costs charged to both products	
(5.25 minutes × £5)	£26.25
Product specific fixed conversion costs charged to both products	
(40% × £26.25)	£10.50

### *Packing*

Estimated minutes for the packing activity (5000 × 6) + (3000 × 4)	42 000
Variable conversion costs absorption rate	
(£280 000/42 000 minutes) per minute	£6.666
Fixed conversion costs absorption rate	
(£140 000/42 000 minutes) per minute	3.333
Variable conversion costs charged to product VG4U	
(6 minutes × £6.666)	£40
Variable conversion costs charged to product VG2	
(4 minutes × £6.666)	£26.67

Fixed conversion costs charged to product VG4U (6 minutes × £3.333)	£20
Fixed conversion costs charged to product VG2 (4 minutes × £3.333)	£13.33
Product specific fixed costs are 40% of £20 for VG4U and 40% of £13.33 for VG2	

The unit cost calculations are as follows:

	VG4U (£)	VG2 (£)
Direct material	30	30
variable conversion cost – Making	43.75	43.75
– Packing	40.00	26.67
	<u>113.75</u>	<u>100.42</u>
Product specific fixed costs:		
Making	10.50	10.50
Packing	8.00	5.33
	<u>132.25</u>	<u>116.25</u>
Total product specific (relevant) cost		
Company fixed cost:		
Making	15.75	15.75
Packing	12.00	8.00
	<u>160.00</u>	<u>140.00</u>
Total cost		

- (a) (ii) The management suggestion is presumably based on the fact that the reported cost for VG4U exceeds the selling price. However, the relevant or avoidable costs for the product are £132.25 and if the company fixed costs remain unchanged if the product is discontinued then the company will lose a contribution of £17.75 (£150 – £132.25) on sales of 5000 units. This will result in profits for the period being reduced by £88 750 (5000 × £17.75) unless there is an alternative opportunity for the production capacity.
- (b) Costs are charged to each activity in the estimated proportions and then to each product using the cost driver proportions given in the question.

		Total	VG4U 5000	VG2 3000
Product units	(%)	(£)	(£)	(£)
Variable conversion cost:				
Moulding (temperature)	(60)	210 000	140 000	70 000
Trimming (consistency)	(40)	140 000	40 000	100 000
Packing (time)	(70)	196 000	117 600	78 400
Packing material (complexity)	(30)	84 000	21 000	63 000
			<u>318 600</u>	<u>311 400</u>
Cost per product unit			63.72	103.80
Product specific fixed costs:				
Moulding (60% × (40% of £210 000))		50 400	33 600	16 800
Trimming (40% × (40% of £210 000))		33 600	9600	24 000
Packing (70% × (40% of £140 000))		39 200	23 520	15 680
Packing material (30% × (40% of £140 000))		16 800	4200	12 600
			<u>70 920</u>	<u>69 080</u>
Cost per product unit			14.18	23.03
Company fixed costs = 60% × £350 000 total fixed costs = £210 000				

$$\begin{aligned}\text{Overall average cost per unit} &= £210\,000/8000 \\ &= £26.25\end{aligned}$$

Hence amended unit costs are as follows:

	VG4U (£)	VG2 (£)
Direct material cost	30.00	30.00
Variable conversion costs	63.72	103.80
	<u>93.72</u>	<u>133.80</u>
Product specific fixed costs	14.18	23.03
	<u>107.90</u>	<u>156.83</u>
Relevant costs	26.25	26.25
Company fixed cost	<u>134.15</u>	<u>183.08</u>

- (c) The ABC unit costs should provide a more accurate measure of resource consumption by the products because several different cost drivers are used that are related to the resources consumed by the products for the different activities. A different message emerges from the reported product costs. Product VG2 appears to be a loss making product. A more detailed analysis indicates that the selling price exceeds the relevant costs and VG2 should not be discontinued unless discontinuation enables company fixed costs to be reduced by an amount in excess of the product's current contribution to these fixed costs.
- (d) For the answer to this question you should refer to 'Target costing' in Chapters 11 and 22. In particular, the answer should stress that the existing selling prices, costs and volumes results in a net profit margin on sales of approximately 5%. If existing selling prices cannot be changed, or they have been determined by market forces, and volumes are to remain unchanged the focus will be on cost reduction to meet the target profit. This might be achieved by product redesign (such as the use of fewer component parts and eliminating non-standard materials) and the elimination or reduction of activities. For an illustration of the approach you should refer to Chapter 22. Note that *kaizen* costing is applicable here rather than target costing. Target costing is applied to new products whereas *kaizen* costing is applied to existing products.