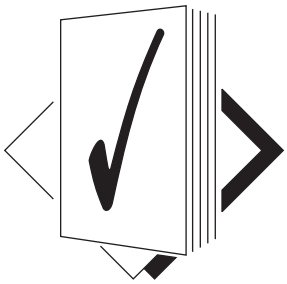

Cost assignment

Solutions to Chapter 3 questions

Solution IM 3.1

(a) For the answer to this question see 'Budgeted overhead rates' in Chapter 3.
(b) A lower production overhead rate does not necessarily indicate that factory X is more efficient than factory Y. The reasons for this are:
  (i) Factory Y's operations might be highly mechanized, resulting in large depreciation costs, whereas factory X's operations might be labour-intensive. Consequently products produced in factory Y will incur higher overhead and lower labour costs, whereas products produced in factory X will incur lower overhead and higher labour costs.
  (ii) Factory Y may have invested in plant with a larger operating capacity in order to meet future output. This will result in larger fixed costs and a higher overhead rate.
  (iii) Both factories may use different denominators in calculating the overhead rates. For example, if factory Y uses normal capacity and factory X uses maximum practical capacity then factory Y will have a higher overhead rate.
  (iv) Current budgeted activity might be used by both firms to calculate the overhead rate. The level of budgeted sales will determine budgeted activity. The lower overhead rate of factory X might be due to a higher sales volume rather than efficient factory operations.
  (v) Different cost classification might result in different overhead rates. Factory X might treat all expenditure as a direct cost wherever possible. For example, employers' costs might be charged out by means of an inflated hourly wage rate. Factory Y may treat such items as overhead costs.

Solution IM 3.2

See answer to Question 3.22 in the text for the answer to this question.

Solution IM 3.3

(a) For the answer to this question see 'Blanket overhead rates' in Chapter 3.
(b) For the answer to this question see Learning Note 3.1 on the open access website.

Solution IM 3.4

(a)

	Production department						*Service department*		*Total*
	A		B		C				
	(£)		(£)		(£)		(£)		(£)
Direct	261 745		226 120		93 890		53 305		635 060
Indirect	135 400	(40%)	118 475	(35%)	67 700	(20%)	16 925	(5%)	338 500
Service dept appointment	23 410	($\frac{1}{3}$)	23 410	($\frac{1}{3}$)	23 410	($\frac{1}{3}$)	(70 230)		
	420 555		368 005		185 000		—		973 560
Allocation base (1)	17 760 =£23.68 per direct labour hour		5 760 =£63.89 per m/c hour		148 000 =£1.25 per hour				

Note:

1. Dept. A direct labour hours
   = 10 × 37 × 48
   = 17 760
   Dept. B machine hours
   = 5 × 24 × 48
   =5760
   Dept. C units
   = 148 000

(b)

Dept A	£
9 direct labour hours at £23.68	213.12
Dept B	
3 m/c hours at £63.89	191.67
Dept C	
100 units at £1.25	125.00
	529.79

Cost per unit = £5.30 (£529.79/100)

Solution IM 3.5

(a) *Overhead analysis sheet*

		Production			Service		
	Total (£)	Cutting (£)	Tents (£)	Bags (£)	Stores (£)	Canteen (£)	Maintenance (£)
Indirect wages	147 200	6 400	19 500	20 100	41 200	15 000	45 000
Consumable materials	54 600	5 300	4 100	2 300	—	18 700	24 200
Plant depreciation	84 200	31 200	17 500	24 600	2 500	3 400	5 000
Power[a]	31 700	5 389	12 046	10 144	951	2 536	634
Heat and light[b]	13 800						
Rent and rates[b]	14 400	11 120	13 900	9 730	2 085	3 475	1 390
Building insurance[b]	13 500						
	359 400	59 409	67 046	66 874	46 736	43 111	76 224
Reapportionment:							
Stores[c]	–	29 210	5 842	5 842	(46 736)	—	5 842
Canteen[d]	–	2 694	18 476	21 941		(43 111)	—
Maintenance[e]	–	1 887	37 731	42 448			(82 066)
	359 400	93 200	129 095	137 105			
Machine hours	87 000	2 000	40 000	45 000			
Labour hours	112 000	7 000	48 000	57 000			
Machine hour rate		£46.60	£3.23	£3.05			
Overheads per labour hour		£13.31	£2.69	£2.41			

Notes

Bases of apportionment: [a] estimated power usage; [b] area; [c] value of issues; [d] direct labour hours; [e] machine hours. Actual basis for other costs.

(b) See section on budgeted overhead rates in Chapter 3 for the answer to this question. In addition the following points should be made:

(i) It draws attention to the under/over recovery of overheads arising from changes in production levels.

(ii) There is difficulty in determining estimated overheads and an appropriate level of activity when calculating predetermined overhead rates.

Solution IM 3.6

(a) Percentage of direct labour cost method = (£600 000/£200 000) × 100
= 300% of direct labour cost
Direct labour hour method = (£600 000/40 000 direct labour hours)
= £15 per direct labour hour
Machine hour method = (£600 000/50 000 machine hour)
= £12 per machine hour

(b) See 'Predetermined overhead rates' in Chapter 3 for the answer to this question.

(c) The question states that the company has become machine-intensive and implies that in the long term there is a closer association between overhead expenditure and machine hours than the other two methods. Therefore the best measure of overhead resources consumed by jobs or products is machine hours.

(d)

Job Ax	(£)
Direct material	3788
Direct labour	1100
Direct expenses	422
Prime cost	5310
Production overhead (120 machine hours × £12)	1440
Factory cost	6750
Administrative overheads (20% × £6750)	1350
Total cost	8100
Profit (£8100/0.90 − £8100)	900
Selling price	9000

Workings
Administration overhead absorption rate = Total admin. overheads/total factory cost
= £328 000/£1 640 000
= 20% of factory cost

(e) The general characteristics of incentive schemes should ensure that:
(i) the scheme is simple to understand and administer;
(ii) payment should be made as quickly as possible after production;
(iii) there should be no limit on earnings and employees must be safe-guarded from earning lower wages than time rate wages arising from problems which are outside their control.

The advantages of incentive schemes are:
(i) increased production and lower average unit costs;
(ii) increased morale of the workforce;
(iii) attraction of more efficient workers to the company.

Solution IM 3.7

(a) Predetermined machine hour rate = $\frac{\text{machine department overheads (£1 080 000)}}{\text{machine hours (80 000)}}$

Machining department = £13.50 per machine hour
Hand finishing department = £760 000/120 000 labour hours
= £6.33 per labour hour

(b) (i)

	Machine department (£)		Hand finishing department (£)	
Overhead incurred	84 500		67 100	
Overhead absorbed	81 000	(6000 × £13.50)	60 800	(9600 × £6.33)
Under recovery of overheads	3 500		6 300	

(ii) Overheads that are apportioned to cost centres tend to be on an arbitrary basis and are unlikely to be controllable by the cost centre manager. Managers should be held accountable for only those overheads that they can control. See 'Guidelines for applying the controllability principle' in Chapter 16 for a more detailed discussion of controllable and non-controllable costs.

(c) Absorption costing is used by companies to ensure that all products/services bear an equitable share of company overheads. The Statement of Standard Accounting Practice (SSAP 9) requires that stocks should be valued at full production cost. Therefore absorption costing is required to allocate overheads to products in order to meet financial accounting requirements.

Solution IM 3.8

(a) In order to ascertain the actual overhead traced to the production departments, it is necessary to allocate the service department overheads to the filling and sealing departments:

	Filling (£)		Sealing (£)		Maintenance (£)		Canteen (£)	
Allocated	74 260		38 115		25 050		24 375	
Reallocation of:								
Canteen	14 625	(60%)	7 800	(32%)	1 950	(8%)	(24 375)	
Maintenance	18 900	(70%)	7 290	(27%)	(27 000)		810	(3%)
Canteen	486	(60%)	259	(32%)	65	(8%)	(810)	
Maintenance	47	(70/97)	18	(27/97)	–		–	
	108 318		53 482					

Predetermined overhead rates:

	Filling (£)		Sealing (£)	
Budgeted overheads	110 040		53 300	
Budgeted direct labour hours	13 100		10 250	
Direct labour hour overhead rate	8.40		5.20	
Overhead incurred	108 318		53 482	
Overhead allocated	107 688	(12 820 × £8.40)	52 390	(10 075 × £5.20)
(Under)/over recovery	(630)		(1 092)	

(b) The objectives of overhead apportionment and absorption are:

(i) To meet the stock valuation and profit measurement requirements for financial accounting purposes. Financial accounting regulations in most countries require that all manufacturing overheads be traced to products for stock valuation purposes.

(ii) For various decisions, such as pricing decisions, management require estimates of the total product costs.

(iii) Overhead costs may be traced to different segments of the business, such as product groups or geographical regions, in order to assess the performance of each segment.

Overhead apportionment and absorption can be criticized on the following grounds:

(i) The process includes many arbitrary apportionments and does not provide an accurate indication of the resources consumed by each product. In tracing overheads to products, the allocation procedure assumes that all overheads are related to volume. This is inappropriate for many fixed overheads, since they are fixed in the short term, and tend to be caused by factors other than volume, such as the diversity of the product range, number of set-ups and range of component parts which the firm stocks.

(ii) Fixed overheads are sunk costs, and will tend not to change in the short term. Hence they are unaffected in the short term, irrespective of which decisions are taken. Arbitrary overhead allocations should not be used for decision-making purposes.

(iii) Overhead allocations are normally undertaken for stock valuation purposes. The procedures are not intended to meet other requirements, such as decision-making and performance evaluation.

(iv) Individuals should not be held accountable for costs which they cannot control. Arbitrary apportionment of overheads is therefore inappropriate for cost control and performance measurement purposes.

Solution IM 3.9

(a) (i) An over-absorption of overheads occurs because the actual overhead charged to products (or clients) exceeds the overheads incurred. Therefore £747 360 (£742 600 actual overheads + £4760 over-absorption were charged to clients during direct hours worked, the actual professional staff hours worked during the period were 99 648 (£747 360/£7.50 hourly overhead rate). Therefore budgeted professional staff hours = 98 288 (99 648 − 1360).

(ii) Budgeted overhead expenditure
= Budgeted hours (98 288) × Overhead rate (£7.50)
= £737 160

(b) To determine the overhead rate the senior staff hours should be weighted by a factor of 1.4 and the junior staff hours by a factor of 1.0:

Senior staff= 21 600 × 1.4 =	30 240
Junior staff= 79 300 × 1.0 =	79 300
	109 540

Allocation of overheads:

Senior staff= 30 240/109 540 × £784 000 =	£216 434
Junior staff= 79 300/109 540 × £784 000 =	£567 566
	£784 000

Senior staff overhead allocation rate = £216 434/21 600
= £10.020 per hour
Junior staff overhead allocation rate = £567 566/79 300 hours
= £7.157 per hour

(c) Presumably the senior staff consume a greater proportion of the overhead costs than the junior staff and the revised method is an attempt to reflect this difference in resource consumption. For example, senior staff are likely to require more office space and make greater demands on secretarial time, telephones, etc. The revised method creates two separate cost centres and overhead rates whereas the previous method used a single blanket rate for the whole organization.

(d) See the section on under- and over-recovery of overheads in Chapter 3 for the answer to this question. Differences between overhead incurred and overhead absorbed may be due to:
(1) differences between actual and budgeted expenditure;
(2) differences between actual and budgeted activity level.

Solution IM 3.10

(i) With the step-wise method the costs of the first service department (Department G specified in the question) are reapportioned to the second department but return allocations are not made from the second department back to the first department.

	Production depts				Internal services		
	1		2		G	H	
	(£000)		(£000)		(£000)	(£000)	
Overheads	870		690	Costs	160	82	
G apportioned	96	(60%)	48	(30%)	−160	16	(10%)
						98	
H apportioned	61	($^{50}/_{80}$)	37	($^{30}/_{80}$)		−98	
	1027		775				

(ii) Let G = Service Department G overheads
Let H = Service Department H overheads

$$G = 160 + 0.2H$$
$$H = 82 + 0.1G$$

Rearranging the above equations

$$-0.2H + G = 160 \quad (1)$$
$$1H - 0.1G = 82 \quad (2)$$

Multiply equation (1) by 1 and equation (2) by 10

$$-0.2H + G = 160$$
$$10H - G = 820$$

Add the above equations together:

$$9.8H = 980$$
$$H = 100$$

Substituting for the value of H in equation (1)

$$-0.2\,(100) + G = 160$$
$$G = 180$$

Internal Services	Total (£000)		Production depts 1 (£000)		2 (£000)
G (180 × 90%)	162	($\frac{6}{9}$)	108	($\frac{3}{9}$)	54
H (100 × 80%)	80	($\frac{5}{8}$)	50	($\frac{3}{8}$)	30
	242		158		84
Overheads (given)			870		690
			1028		774

(iii) The simultaneous equation method will yield more accurate allocations because it takes into account the fact that service departments serve each other whereas the step-wise method ignores such reciprocal usage. The step-wise method involves simpler computations and, in this question, does not give a significantly different answer. However, the step-wise method may yield inaccurate results where service costs are high and there are more than two service departments with significantly different usage ratios between the departments.

Solution IM 3.11

(a)

		Overhead analysis (ignoring reciprocal allocations)			
	General factory overhead	Service cost centres		Production cost centres	
		1	2	A	B
	(£)	(£)	(£)	(£)	(£)
Primary allocation	210 000	93 800	38 600	182 800	124 800
Apportionment of general factory overhead [a]	(210 000)	10 500	21 000	31 500	147 000
	—	104 300	59 600	214 300	271 800
Charges by service cost centre 1 [b]		(104 300)	—	91 262	13 038
		—	59 600	305 562	284 838
Charges by service cost centre 2 [c]			(59 600)	8 221	51 379
			—	£313 783	£336 217
Budgeted direct labour hours				120 000	20 000
Absorption rates				£2.61	£16.81

Notes

[a] General factory overhead is apportioned to service cost centres before reallocation to production centres as indicated in note (i) of the question.

[b] Because reciprocal allocations are not made, the costs allocated to service cost centre 1 are reallocated as follows:

£91 262 (63/72 × £104 300) to production cost centre A
£13 038 (9/72 × £104 300) to production cost centre B

[c] Reciprocal charges are not made. Therefore the allocation is as follows:

4 000/29 000 × £59 600 = £8 221 to production cost centre A
25 000/29 000 × £59 600 = £51 379 to production cost centre B

(b) The difference may be due to the following:
   (i) Changes occurred in projected overhead expenditure compared with expenditure which was used to determine the current year's overhead rate.
   (ii) Current overhead rates do not include a proportion of the service cost centres overhead.
   (iii) Budgeted activity for the next year is greater than the current year for production cost centre A. If this is not matched by a corresponding increase in overhead expenditure then the hourly overhead rate will decline. Budgeted activity for production cost centre B is lower than the current year, resulting in an increase in the overhead rate. Because fixed overheads do not change in relation to activity, the hourly overhead rate will fluctuate whenever changes in activity occur. (See Example 3.2 in Chapter 3 for an illustration.)

(c) This question can be answered by using either the repeated distribution or simultaneous equation methods. Both methods are illustrated in Appendix 3.1 to Chapter 3. The simultaneous equation method is illustrated below:

Let X = total overhead of service cost centre 1
Y = total overhead of service cost centre 2

Then

$X = 104\,300 + \frac{1}{30}Y$ (i.e. 1000/30 000 hrs of service cost centre 2 overheads)
$Y = 59\,600 + \frac{1}{5}X$ (i.e. 18% out of total of 90% of service cost centre 1 overheads)

Rearranging the above equations:

$$X - \tfrac{1}{30}Y = 104\,300 \quad (1)$$
$$-\tfrac{1}{5}X + Y = 59\,600 \quad (2)$$

Multiply equation (1) by 1 and equation (2) by 5:

$$X - \tfrac{1}{30}Y = 104\,300$$
$$-X + 5Y = 298\,000$$

Adding the above equations together:

$$\frac{149}{30}Y = 402\,300$$
$$Y = \frac{402\,300 \times 30}{149}$$
$$Y = 81\,000$$

Substituting for Y in equation (1) results in the following equation:

$$X - \tfrac{1}{30} \times 81\,000 = 104\,300$$
$$X = 107\,000$$

The service cost centre overheads of £107 000 (service cost centre 1) and £81 000 (service cost centre 2) are now apportioned to the production cost centres as follows:

	General factory overhead (£)	Service cost centre 1 (£)	Service cost centre 2 (£)	Production cost centre A (£)	Production cost centre B (£)
Primary allocation	210 000	93 800	38 600	182 800	124 800
Apportionment of general factory overhead	(210 000)	10 500	21 000	31 500	147 000
	—	104 300	59 600	214 300	271 800
Charges by service cost centre 1 [a]		(107 000)	21 400	74 900	10 700
Charges by service cost centre 2 [b]		2 700	(81 000)	10 800	67 500
		—	—	£300 000	£350 000
Budgeted direct labour hours				120 000	20 000
Absorption rates				£2.50	£17.50

Notes

[a] 18/90 × £107 000 = £21 400 to service cost centre 2 (18% out of 90%)
63/90 × £107 000 = £74 900 to production cost centre A
9/90 × £107 000 = £10 700 to production cost centre B

[b] 1000/30 000 × £81 000 = £2700 to service cost centre 1
4000/30 000 × £81 000 = £10 800 to production cost centre A
25 000/30 000 × £81 000 = £67 500 to production cost centre B

(d) The answer should include the following points:

(i) The overhead rate calculations do not distinguish between fixed and variable elements. Such an analysis is necessary for decision-making purposes.

(ii) The majority of service cost centre 1 costs are variable. It is preferable to determine an activity measure which exerts most influence on the variable costs and apportion the costs on the basis of this measure. The present method of apportionment appears to be inappropriate.

(iii) Service cost centre 2 is the maintenance department and the majority of costs are fixed, thus suggesting preventive maintenance be undertaken. The question does not make it clear which hourly base is used for allocating overheads (direct labour hours or machine hours). Machine hours should be used for allocating variable costs, since these costs are likely to vary with this activity base. Preventive maintenance should be apportioned on the basis of the planned hours which the maintenance staff intend to allocate to each department.

(iv) Production cost centre B is highly mechanized, thus suggesting that a machine hour rate might be preferable to the present direct labour hour rate.

Solution IM 3.12

(a)

Department cost statement

	Belts (£000)	Braces (£000)	Administration (£000)	Maintenance (£000)	Warehousing (£000)	Total (£000)
Direct variable costs:						
Materials	120	130	—	20	30	300
Labour	80	70	50	80	20	300
	200	200	50	100	50	600
Factory-wide indirect cost per floorspace	400	400	50	100	50	1000
	600	600	100	200	100	1600
Service departments						
Administration [a]	40	40	(100)	10	10	—
	640	640	—	210	110	1600
Maintenance [b]	79	79	—	(264)	106	—
Warehousing [b]	108	54	—	54	(216)	—
	£827	£773	—	—	—	£1600

Cost per unit: Belts $\frac{£827\,000}{100\,000} = £8.27$

Braces $\frac{£773\,000}{50\,000} = £15.46$

Notes

[a] Administration does not receive any charges from the other service departments. Therefore the reciprocal basis does not apply.

[b] The simultaneous equation method is used to allocate the maintenance and warehouse costs.

Let M = total cost of the maintenance department
W = total cost of the warehousing department

Then
$$M = 210 + 0.25W \quad (1)$$
$$W = 110 + 0.4M \quad (2)$$

Multiplying equation (1) by 4 and equation (2) by 1, and rearranging the resulting equations:

$$\begin{aligned} 4M - W &= 840 \\ -0.4M + W &= 110 \\ \hline 3.6M &= 950 \\ M &= £263.89 \end{aligned}$$

Substituting the value of M into equation (2):

$$W = 110 + 0.4 \times 263.89$$
$$W = £215.56$$

(b) Kaminsky Ltd has spare capacity, and therefore any sales revenue in excess of variable costs will provide a contribution towards fixed costs and profit. Therefore it is necessary to calculate the variable cost per unit for belts and braces. The calculations of the unit variable cost are as follows:

	Belts (£000)	Braces (£000)	Administration (£000)	Maintenance (£000)	Warehousing (£000)	Total (£000)
Direct variable costs:						
Materials	120	130	—	20	30	300
Labour	80	70	50	80	20	300
	200	200	50	100	50	600
Service departments						
Administration	20	20	(50)	5	5	—
	220	220	—	105	55	600
Maintenance [a]	39.6	39.6	—	(132)	52.8	—
Warehousing [a]	53.9	26.9	—	26.95	(107.8)	—
	313.5	286.5	—	—	—	600

Variable cost per unit: Belts $\frac{£313\,500}{100\,000} = £3.135$

Braces $\frac{£286\,500}{50\,000} = £5.73$

Note

[a] The simultaneous equation method is used to allocate the service department costs as follows:

Let M = maintenance department variable costs
W = warehousing department variable costs

Then $M = 105 + 0.25W$ (1)
$W = 55 + 0.4M$ (2)

Multiplying equation (1) by 4 and equation (2) by 1:

$$\begin{aligned} 4M - W &= 420 \\ -0.4M + W &= 55 \\ 3.6M &= 475 \\ M &= 131.94 \end{aligned}$$

Substituting in equation (2):

$$W = 55 + 0.4 \times 131.94$$
$$W = 107.8$$

Camfan order

	(£)
Contract price	5000
Variable costs (1000 belts at £3.135)	3135
Contribution	1865

If this order is accepted, profits will increase by £1865, provided that better opportunities are not available and the normal selling price will not be affected. It is unlikely that such a small order will affect the normal selling price.

Mixon Spenders contract

The normal unit cost based on a normal activity of 100 000 belts is £8.27. If this unit cost is used as the basis for determining the 'cost-plus' selling price then the agreed selling price will be £9.10 (£8.27 + 10%). The normal selling price will be £9.92 (£8.27 + 20%). The contribution from supplying 100 000 belts will be £596 500 [(£9.10 − £3.135 variable cost) × 100 000]. Total demand will now be 200 000 belts, but maximum output is 150 000 belts. Therefore existing sales will be reduced by 50 000 belts. The lost contribution is £339 250 [50 000 × (£9.92 − £3.135)]. Consequently total contribution will increase by £257 250.

Alternatively, Kaminsky might base selling price on unit costs at maximum capacity of 150 000 units. The revised unit cost will be as follows:

Fixed costs apportioned to belts	= £513 500 (£827 000 total cost − £313 500 variable cost)
Fixed costs per unit (£)	= 3.42 (£513 500/150 000 units)
Variable cost per unit (£)	= 3.135
Total cost per unit (£)	= 6.555
Selling price for contract	= £7.21 (£6.555 + 10%).

The total contribution from the contract will be £407 500, consisting of 100 000 units at a contribution per unit of £4.075 (£7.21 − £3.135). This will still cover the contribution sacrificed on existing business. On the basis of the above quantitative information, the contract should be accepted. However, before acceptance, the following qualitative factors should be considered:

(i) Will the long-term disadvantages from a loss of customer goodwill from depriving normal customers of 50 000 units outweigh the short-term advantage of taking on the contract?

(ii) An attractive feature of the contract is that it will result in certain sales of 2000 units per week, thus enabling production, cash flows etc. to be forecasted more accurately.

(c) For the answer to this question see 'alternative denominator level measures' in Chapter 7. In addition the answer should emphasize that normal overhead rates reflect a long-term planned activity base which is expected to satisfy demand levels over a series of years. Over this period, fluctuations in customer demand, seasonal and cyclical changes will be incorporated into an annual rate. A normalized overhead rate recognizes that the company's overhead cost commitment is related to the long-run demand for its products. A normalized overhead rate is preferable for pricing purposes, since the alternative of basing overhead rates on the activity for next year will result in higher selling prices when demand is low if cost-plus pricing is used. Prices should be lower when demand is depressed. A normalized overhead rate should avoid such inconsistencies.

Airport Complex[1]

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Background

Airport Complex was founded in Northern Europe in the late 1940s, and at the time it primarily served as a domestic airport. During the 1970s, flights to foreign destinations became an ever more vital activity for the airport. Today, the airport functions as a hub for a large portion of Nordic air traffic. The fact that the airport is a hub means that a great deal (approximately 35-40 per cent) of the airport's passengers only touch down at the airport to catch another plane to a new destination. The airport remained state property until the mid-1990s when the airport was transformed into a private company, though the state held on to a substantial ownership share.

EXHIBIT 1

Key figure development: Airport Complex

(All amounts in 1000 Euro)	(budget) 1995	1996	1997	1998	1999
Turnover	203 800	207 876	214 112	222 677	218 223
Pre-tax profit	61 140	61 751	61 751	62 492	60 118
Assets	680 000	748 000	782 000	802 400	816 000
Profit margin	30%	30%	29%	28%	28%
Return on investments (ROI)	9%	8%	8%	8%	7%

Naturally, this generated an increased focus on the airport's financial performance, which, however, boosted healthy profit margins. This also constituted the background for the continued extension of the airport, which today has placed itself as an airport entering the medium-size class of Nordic airports. The profit margins of the airport (see Exhibit 1) have suffered a decline over the past few years due to a combination of deteriorating income as a result of a fall in domestic traffic and costs that have not decreased correspondingly. At the same time, tax-free sales were abolished in 1999. This has contributed heavily to the decline in revenue.

Investors have consequently requested that the airport commit itself more to a focus on the overall profitability measured against the invested capital. Accordingly, the management has now decided that the efficiency of the airport should be subject to assessment. An airport is characterized by the fact that almost all costs are capacity costs. This is partly due to significant investment in buildings, runways and technology, but also to the large staff which handles the administration, operation and maintenance of the airport. The management suspects that the costs are not sufficiently adjusted to the income. In particular, the management finds it difficult to get an overview of how the various business areas utilize the airport's resources and services and thus contribute to the bottomline of the airport.

Business areas

The revenue of Airport Complex derived from five different areas; take-off duties from air traffic, passenger fees, rental income from property, licensing income from the airport's shopping centre and

[1] This case is written by Peter Nordgaart, part-time lecturer, and Carsten Rohde, associate professor, Copenhagen Business School. Airport Complex is a fictitious case, and the information in the case is thus constructed on the basis of the authors' knowledge about and interest in European airports. The case has been simplified for teaching purposes, and thus it cannot serve as a basis for comparison with specific airports.

sundry income related to provision of services in the airport. Each of the five business areas is briefly outlined in the following discussion.

Take-off duties

Every time an aircraft departs from the airport, the airline pays a take-off duty. The duty is calculated on the basis of the type and weight of the aircraft. The income is related to the airline's use of the airport's control of the air space, runways, technical equipment such as runway lights, meteorological equipment, facilities on the gate for cleaning the aircraft, changing the air in the aircraft, fuelling, de-icing, etc. After the aircraft has landed, it is guided to a gate. If the pilot does not know the airport, airport personnel will guide the aircraft to its gate. There are two types of gates: gates served by a building, i.e. the gate is connected to one of the airport's terminals allowing passengers to leave the aircraft and enter the terminal directly, and remote gates where the aircraft is parked somewhere else in the airport area from where passengers are subsequently transported by buses to one of the airport terminals. Airlines are in broad consent that building-served gates service passengers far better than remote gates. Still, prices for building-served and remote gates are currently not differentiated, though the management has discussed this question. In addition to the take-off duties, a stopover duty is also payable depending on how long the aircraft stays in the gate. The first hour, however, is free.

Passenger fees

Take-off and stopover duties are complemented by a passenger fee per passenger on the aircraft. These three sources of income are collectively referred to as traffic income. Passenger fees depend solely on the number of passengers. The passengers' points of departure and final destination are thus not relevant to the calculation of the fee. In principle, passenger fees relate to the passengers' use of the airport area and services. This covers for instance buildings, transport to the terminal, service information, luggage handling and passenger areas in the airport. A differentiation on the prices for domestic passengers and those travelling to destinations abroad was previously in force, but EU competition rules have now put an end to this differentiation. It has been discussed whether there should be different passenger fees for passengers who merely touch down at the airport, but never leave the aircraft (transit passengers) as opposed to passengers who only land at the airport in order to get on a new plane (transfer passengers), as these passengers do not use the airport's landside areas. Every year, the relation between take-off duties and passenger duties is also discussed, as there are occasional imbalances in the case of small aircraft with many passengers and large aircraft with few passengers.

Rental income

Parts of the airport buildings are let out to airlines, travel agencies and shops. This revenue is collectively referred to as rental income. Prices are fixed as per square metre and vary with the use of the rented premises and its location within the airport area. Besides yielding a reasonable profit margin, rental income must in principle cover wear and tear, maintenance, use of common facilities such as toilets, lifts, etc.

Services

In connection with renting of buildings, supplementary services such as cleaning, security guard surveillance of rooms and shops, access to canteens and to the airport's computer network are also offered. This income is collectively referred to as income from provision of services and is of course related to the airport's costs in connection with these services. In recent years, this income has seen a rapid increase as a result of the airport seizing ever more opportunities for expanding the range of its services offered to the airport's customers.

Licensing income

Finally, the airport generates income from licensing agreements entered into with shops and agencies that rent premises in the airport. In addition to rent for the premises, a duty is payable for running a shop within the airport's area. The licensing agreements are based on the payment of a certain share of the turnover of shops and agencies to the airport. This income is collectively referred to as licensing income. In return, the airport takes on costs for decoration and marketing of the shopping centre such as signs, brochures, campaigns and information staff. Campaigns are budgeted separately, though there is no connection between the budgeting of campaigns and that of licensing agreements. The revenue of Airport Complex is shown in Exhibit 2.

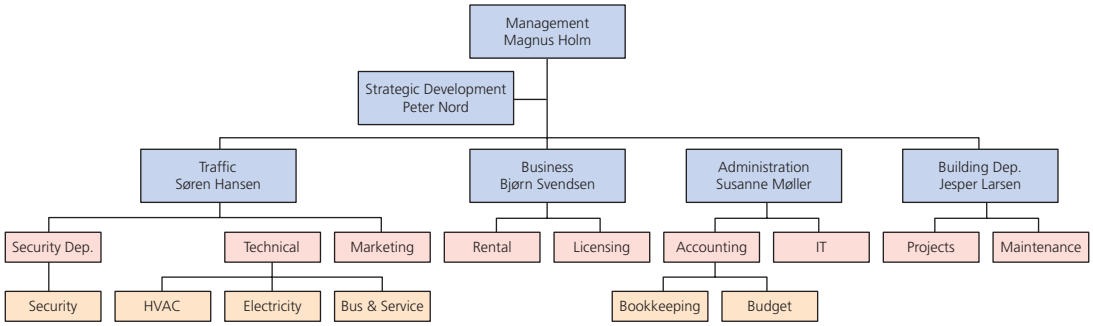
EXHIBIT 2

Revenue of Airport Complex

All amount in 1000 Euro	(budget) 1995	1996	1997	1998	1999
Aeronautical revenue	73 368	78 993	83 504	89 071	93 836
Non-aeronautical revenue	38 722	41 575	44 964	46 762	52 374
Revenue from provision of services	4 076	8 315	8 564	11 134	17 458
Licensing revenue	87 634	78 993	77 080	75 710	54 556
Total revenue	203 800	207 876	214 112	222 677	218 223

Figure 1

Organization of Airport Complex A/S



Organization

The organization of Airport Complex is a result of a continuous development of the company. Originally, everything was collected under the traffic department, as there were no other business activities. As other commercial activities and letting out of premises were developed, the business area was isolated. Immediately after this separation, the need for a distinct building department was recognized, and the new department was established. In connection with the transfer from a state enterprise to a private undertaking, the administrative activities were collected under their own organizational area. Figure 1 shows the organization plan of Airport Complex.

Financial management

The accounting department handles the company's financial control. The bookkeeping department takes care of the day-to-day invoicing and bookkeeping of the company's transactions and of the company's financial accounting and tax accounting. The budget department is in charge of the co-ordination of budgets, whereas part budgets are prepared in the individual departments, which subsequently report their budget to the budget department. The budgets are entered into the airport's

financial control system, which at the same time ensures that the individual department is only able to view its own budgets. Subsequently, the total budget is subject to approval first by the management and then by the board. The exact budgeting is of course very different from one department to the other, depending on the functions of each department and the people responsible for the budget of the department. Nevertheless, some general comments can be made on the airport's budget procedure. Staff budgets are normally prepared on the basis of a combination of price and amount per staff category. The remaining costs are predominantly provided for in the budget as a fixed amount. Depreciation is not allocated to the individual departments, but is estimated as a total amount by the budget department. The budget for traffic income is based on a forecast of the number of different types of aircraft. For each type of plane, the average weight and the average number of passengers are calculated and subsequently multiplied by the current take-off and passenger fees and the number of planes of that type. Rental income is estimated on the basis of the number of square metres relative to the average rent per square metre. Different prices per square metre are used depending on the type of building, use and location. The buildings may typically be divided into terminal buildings, office buildings, workshops, hangars, and warehouses. The income from provision of services is estimated on the basis of expected sales measured as an amount, and finally, the licensing income is estimated as expected turnover per shop type multiplied by the licence percentage.

Outline of departments

Strategic development

The department is situated in the administrative office building. It was established three years ago with the task of supporting the management and the board in their work with strategic development of the airport. The department employs 4-5 people who make analyses of the operation of the airport and perform benchmarking analysis of the company compared to other airports. The department typically works on 3-4 projects at a time. Examples of projects are:

- the profitability of future extension projects;
- analyses of traffic statistics and forecasts of future traffic development;
- strategies for the information structure in the airport, including the future extension of the network and the number of services implemented in the network.

Traffic department

The traffic department has the overall responsibility for the development of the airport's traffic activities. The department handles traffic-related security and co-ordination with the aviation authorities, which are in charge of the actual control of the airspace, i.e. permission to take off and land. The traffic department is also the most wage consuming department since a major part of the airport staff is employed here.

Technical departments

The complicated technical structure of the airport such as traffic and passenger co-ordination systems, bridges from airport buildings to the aircraft, runway lights, etc. is handled by the technical department. The department has three sub-departments: electricity, HVAC, and buses and service. The department takes care of these same functions for the rest of the airport.

Electricity department

The electricity department employs 125 employees on an annual basis. The department is divided between five area managers, each responsible for specific parts of the airport. However, the department seeks to maintain a certain degree of job rotation to ensure that the employees acquire a high level of knowledge within all job functions in the department. Apart from vehicles, the department is

responsible for a great deal of technical equipment, cranes, lifts, etc. The tasks in the department vary from mounting and repairing of control and marking equipment in connection with the runways, to maintenance of the airport's technical equipment and more ordinary electricity work in connection with the airport buildings. Work in connection with the airport buildings is co-ordinated by the building department, apart from work in connection with the airport's rented property, which is co-ordinated by the rental department. The electricity department is naturally also involved in the implementation of the airport's network, which is performed on the basis of requirements from the IT department.

HVAC department
The HVAC department employs approximately 150 people annually, and the department is divided on the basis of geographical areas in the airport. The division is as follows: airside undeveloped areas, airside developed areas, terminals, and finally, other landside buildings. Each area has its own head of department. Like the electricity department, the HVAC department has at its disposal a large amount of technical equipment used in its daily work. The major part of the tasks of the department is co-ordinated with the building department.

Bus and service department
The bus and service department is responsible for transporting the passengers to the terminals and for servicing the runways and other outdoor areas. The service primarily consists of maintenance of the green areas of the airport and of snow removal, and the service department employs 25 people. The bus department employs approximately 50 chauffeurs who are responsible mainly for transporting the passengers to and from the aircraft, but who sometimes also function as guides for aircraft whose pilots do not know the airport.

Marketing department
The marketing department is in charge of conducting negotiations with both airlines that already use the airport and airlines that wish to use the airport in the future. This applies to passenger traffic as well as freight traffic. The department employs six people on average.

Security department
Traditionally, airports are always associated with large security risks. Therefore, security is an important work area. The security department is thus responsible for monitoring the security in the airport. The main tasks of the security department are outdoor area surveillance, indoor security check of passengers and screening of luggage, and security service in connection with the airport's own premises and rented premises. This includes security checking of all passengers and screening of luggage. If the airport uses external artisans in connection with the activities of the building department or the technical department, these will be constantly monitored by a security guard. Furthermore, the security personnel are responsible for security surveillance of rented premises.

On an annual basis, the area surveillance function employs 30 people who always work together in teams of two. Each team has at its disposal a cross-country vehicle, which enables them to turn out quickly to any place in the airport. They communicate with the central security function on a current basis via the internal communication system, which also includes GPS surveillance of all vehicles. The system has just recently been fully implemented and is controlled by the IT department. Apart from a meeting room in the terminal building, the department has at its disposal three smaller buildings located in opposite parts of the airport. There are always three teams working at the same time and their activities are co-ordinated by the central security service, which is manned by the security manager in charge and an assistant. The indoor security check function is manned in relation to the expected number of passengers during the day and employs approximately 70 people on an annual basis. The airport is divided into a landside and an airside area. The airside area can only be accessed through the

security lock with a valid ticket and after screening of hand luggage and scanning of the passenger. The landside area, on the other hand, is accessible to everybody. There are three security locks in the airport that are manned according to the expected passenger flow during the day. Each lock is manned by three security employees who are in constant radio contact with the security manager in charge. Apart from this, two to three security employees are constantly patrolling the airside of the airport as well as the landside terminal areas. Moreover, both the indoor and the outdoor security personnel also function as security service in connection with the rented premises in the airport. The most cost-intensive item in the security department is therefore staff costs and staff-related costs such as uniforms and security courses. Furthermore, the department has at its disposal considerable assets such as cars, and security equipment such as scanners, X-ray equipment, etc.

Business department

The main activities in the business department are renting of areas as well as buildings and licensing agreements with retailers, restaurants, car hire firms, etc. The eight employees in the rental department administer the rental agreements and are responsible for finding suitable premises for this purpose. Extensions, renovation and maintenance of the rented premises are co-ordinated with the technical department and the building department.

The 12 employees in the licensing department draw up agreements on how to carry on business in the airport areas, including agreements on the turnover-related fees to be paid for this. The promotion of the shopping centre is planned and carried out by the business department. The extension of the shopping centre is co-ordinated with the project department.

Administrative department

This department handles the overall day-to-day administration in connection with invoicing, book-keeping and cash. Furthermore, the IT department, which is part of the administrative department, is responsible for the airport's network which is used by the airport's own departments as well as other uses of the airport. This applies to both networks for administrative use, for traffic monitoring and for signboards in the airport. Moreover, access to the airport's network and support in this connection are let out. The administrative department employs 120 people on an annual basis of which approximately half are employed in the IT department.

Building department

The project department is responsible for the continuous extension of the airport, i.e. the strategic planning in collaboration with the management as well as the actual project management. Approximately 20 people are employed on an annual basis to perform these tasks. The operative part is placed with the maintenance department, which is responsible for the continuous maintenance of both the airport area and the buildings ,and which employs approximately 80 people. Exemptions are HVAC and technical appliances, which are the responsibility of the technical department under the traffic unit.

Requirements.

1. Comment on the financial management of Airport Complex.
2. Discuss the problems and opportunities connected with assessing the profitability of the different services offered by the airport to the airlines and their customers. You are, among other things, asked to consider whether you would recommend the use of Full Cost, Activity Based Costing or Contribution Margin Concept to the company and state the reasons for your recommendation.
3. Draw up a reasoned suggestion for how an assessment of the productivity of selected departments can be organized, including an indication of the financial and non-financial measures that can be used.
4. Discuss the methods used by Airport Complex for budgeting revenue and costs and give reasoned suggestions for improvements.

AIRPORT COMPLEX: Teaching note

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Airport Complex is a general case providing material for a discussion of several aspects involved in the management control of a service company which is mainly characterized by mass services. The case formulates four specific requirements that can be used individually or collectively depending on the teaching setting. It opens up a discussion of concepts and methods within management control rather than training students in specific principles and methods. Some of the themes that the case deals with are discussed below.

Requirement 1:

This subquestion aims to guide the students through the carrying out of a problem analysis of the current management control of the company.

The discussion may for instance spring from Exhibit 1 which provides a summary description of the development in the company's performance and key figures. The exhibit clearly illustrates that the company is very capacity-intensive, compare the connection between the profit margins, the return on investments (ROI) and consequently the asset turnover. Exhibit 2 focuses on the development in the company's earnings distributed among the different business areas. However, as mentioned in the case, the problem is that the management finds it difficult to get an overview of how the various business areas utilize the company's resources. At present, it is thus not possible to measure and assess the profitability of the different business areas of the company.

The financial management section in the company description indicates that the revenue and costs of the company are not, or are only to a limited extent, considered as a whole in connection with the company's budgeting. The revenue is estimated on the basis of a number of different methods per segment, which seems quite appropriate. The costs are controlled by the individual department, which thus acts as a responsibility centre. The lack of co-ordination between the departments as well as the missing relation between certain departments and the revenue segments seem inappropriate with respect to the management control of the company. This is also reflected in the methods chosen for the budgeting, see also requirement 4.

Requirement 2

The question is formulated as a continuation of requirement 1 to open up for discussion the extent to which a connection can be established between the company's revenue and the costs for the different business areas. In the following, the discussion will be based on the individual business areas as described in the case.

As appears, the constituent parts of the traffic income are take-off and stopover duties, and passenger fees. The take-off duty for an aircraft is partly related to its use of the airport control, which is an independent enterprise, and partly to a network of Airport Complex's own capacities and functions. The passenger fees are the same for all passengers, and in a broad sense they cover the use of buildings and various forms of services. Finally, the stopover duty is calculated on the basis of how long the aircraft stays in the gate. A calculation of the costs connected with the use of the airport's resources in relation to the take-off duty and the passenger fees will require extensive measures of resource consumption for the capacities involved in the servicing. It is thus not likely that the contribution margin model or a simple full cost allocation model will prove satisfactory to solve this task. The company should, on the contrary, define relevant resource consumption measurements, which could for instance be done using Activity Based Costing. The model and its potential and limitations should be discussed in relation to the problem mentioned.

However, one of the essential questions is whether, and if so, how, the capital investments can be traced back to the individual business areas. Examples include costs in connection with terminal complexes, which in principle are related to the business areas

of traffic, renting and licensing. One possibility could be to try to assess the quantity of square metres per area. The actual delimitation of space between the business areas constitutes a practical problem, however. Are areas outside shops there to benefit the shops or the passengers on their way to the aircraft? In order to be able to measure the profitability in relation to space as a capacity, it should consequently be determined how much the different business areas control the costs outside the areas that relate directly to the business area. In this connection, the potential for solving this problem through either contribution margin, full cost or activity based costing can be discussed.

Requirement 3

As previously described, Airport Complex is characterized by large capital investments for buildings, runways and technical equipment. At the same time, however, the staff capacity is also comprehensive because of the substantial number of tasks connected with servicing passengers and airlines and with maintaining buildings and technical equipment. Therefore, one possibility is to discuss the management of staff capacity.

The technical department, with the three sub-departments Electricity, HVAC, and Bus and Service, can be used as an example. It appears from the case that these sub-departments have relatively comprehensive staffing, and therefore in the initial situation a high degree of variability. An important issue is to decide on the number of staff required for the respective departments to be able to solve their tasks with a satisfactory level of quality and service. This partly depends on the number of tasks and projects per time period as well as the productivity expected from the respective employees per staff group. But at the same time, the quality level must be determined, as it is absolutely decisive for the resource requirements. Measures for and measuring of the service level may thus be discussed for selected areas and departments. The company must aim to uncover these connections, for instance on the basis of relevant measurements and registrations *ex post*.

A model for discussing the possibilities of dimensioning the number of staff on the basis of activity is illustrated in Figure 1. In cases where the company wants to dimension its staff capacity on the basis of activities, the type and extent of these must be mapped out per department and per time period. The next step is to convert this into time consumption per activity. In principle, this can be calculated as the expected time consumption related to the activity (duration driver) or the number of activities performed per time unit (intensity driver). The use of the intensity driver implies that the activities are homogeneous from time to time, which means that they have approximately the same duration.

In order to convert this into a resource requirement, in this case for staff, the company must establish the effective working hours during which the employee can be expected to perform tasks. This depends for instance on rules on working hours, rate of work, absence due to sickness, level of service and quality, etc. Once the effective working hours per employee are known, the performance can be converted into number of ‘whole’ employees. By multiplying the number of employees with pay per employee, it is possible to calculate the expenses per period.

The relevance of using activities as a basis and dimensioning the organization accordingly, should of course be discussed. This can partly be done on the basis of the company’s knowledge *ex ante* of the activities that need to be performed. Moreover, it should be based on the possibilities and limitations in terms of measuring which are connected with creating a relation between activity and costs in the figure. The alternative is to include the staff capacity of a department in a dimensioning independent of the activity. This can also be included in a discussion of the three lower boxes in Figure 1.

Requirement 4

The section ‘Financial management’ gives a summary description of selected budgeting methods in the company. The methods applied for budgeting of the company’s revenue seem relevant, though of course the reliability of the forecast varies with the methods. For instance the budgeting of rental income is based on the knowledge of the number of square metres and the price per square metre per type of building, which makes the

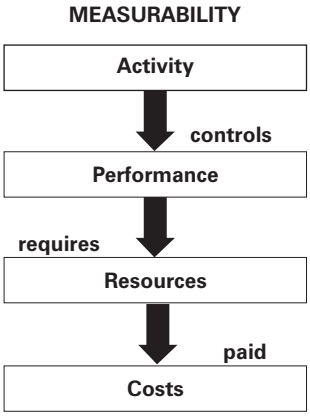

Figure 2 Control of capacity costs based on activities requiring *resources*

method very precise. Budgets for traffic income require forecasts on the number of aircraft that take off from the airport, the average weight of the aircraft and the average number of passengers, which is necessarily connected with some uncertainty. This also applies to licensing income where it may be difficult to make an exact forecast of the turnover per type of shop. In this connection, the number of passengers, age distribution, the purpose of the trip, etc. will be factors influencing the turnover of the individual type of shop. Budgeting of services as a purchase total is indeed a summary method. Here, it could be an ambition for the company to get a clearer picture of the number of services per type as well as their prices.

Salaries, which account for a considerable expense item, are estimated as the number of employees × salary per employee. The method seems relevant for part of the salary costs. At the same time, the number of employees as well as the average salary cost per employee may appear as a key figure. However, particularly in cases of large departments where many employees perform the same task, the possibility of deducing the staff requirement on the basis of the activity ought to be considered, as was also discussed under Requirement 3. This circumstance can be discussed for the individual departments in the company.

The remaining costs are provided for in the budget as a fixed amount. This is a method which is easy to apply, and which allows responsible staff a certain margin within the limits of the fixed amount. On the other hand, the extent of control and follow-up is limited, since control and follow-up only is made in amounts. For some costs this is sufficient, but for others it is too limited. The relevance of the method can thus be discussed on the basis of frequent types of cost in Airport Complex. It should be noted that a larger extent of control can be achieved through the fixed amount method, if it is combined with different forms of action plans.