CHAPTER 6 - Competitive strategies

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6.6 Activity-based costing (ABC)

Active reading. Note how a total absorption costing method can distort product costs and lead to incorrect decisions.

Video link ABC - A basic introduction

[https://www.youtube.com/watch?v=6ykFkK0AGCs&t=11s]

Video link ABC - An example using more than one product

[https://www.youtube.com/watch?v=CofJQy3j51I&t=1s]

The total cost of a product will include the direct costs of production plus an element of fixed costs. Therefore, the fixed (overhead) costs need to be allocated across the various products in some meaningful way. The full absorption product cost is required for inclusion in the financial accounts prepared under the U.S. GAAP (Generally Accepted Accounting Principles), and U.K. GAAP. Unfortunately, these are not useful for decision-making (Datar and Gupta, 1994). To arrive at the full absorption product cost, traditionally, manufacturing overheads might have been allocated to products on a single company-wide basis, such as labor hours, machine hours, material kilograms used, or simply based on the number of units produced.

An overhead absorption rate based on labor hours would be calculated as follows:

$$\frac{\text{Total overhead costs}}{\text{Total labor hours}} = \text{overhead rate per labor hour}$$

$$\frac{\$400{,}000}{200{,}000\ hrs} = \$2\ per\ labor\ hour$$

The cost of a product would then be calculated, as shown in Table 6.3.

Table 6.3 Calculation of product cost

		$
Materials	2 kg @ $2 per kg	4
Labor	1 hour @ $12 per hour	12
Total direct costs		**16**
Overhead costs	1 labor hour @ $2	2
Total cost		**18**

When overheads are allocated using a single absorption rate, for example, direct labor hours, the effect could be to penalize those products that are labor-intensive; or if allocated on a machine hour basis, it penalizes products that are machine-intensive. The danger is that, depending on the basis used, different cost allocations could arise and encourage an incorrect decision.

For example, suppose XYZ Company manufactures three products.

The following basic information is provided about the price, material and labor usage and costs, and volumes, associated with the three products, shown in Table 6.4. The fixed costs, or overheads, are given as $12,000.

Table 6.4 Basic information for products A, B, and C

	A	B	C	
Selling price	$20	$20	$20	
Materials $2 per kg	1 kg	2 kg	3 kg	
Labor $5 per hour	3 hrs	2 hrs	1 hr	
Volumes	1,000	1,000	1,000	
Total materials	1,000 kg	2,000kg	3,000kg	6,000kg
Total fixed costs				$12,000

If we use the materials usage as a basis for allocating the fixed costs to the products, we calculate a rate of $2 kg would be appropriate. The total number of materials kgs has been derived in Table 6.4.

Overhead absorption rate per kg:

$$\frac{\$12{,}000}{6{,}000kg} = \$2\ per\ kg$$

To calculate the fixed costs allocated to each product, the number of kgs used for each product is multiplied by the $2 per kg for fixed costs. The product costs and profits are shown in Table 6.5.

Table 6.5 Costs and profit for products A, B, and C using materials as the basis for allocating fixed costs.

	A	B	C	Total profit
	$	$	$	
Selling price	20	20	20	
Less materials	2	4	6	
Less labor	15	10	5	
Contribution	**3**	**6**	**9**	
Less fixed costs per kg of materials	2	4	6	
Net profit	**1**	**2**	**3**	
Volumes	1,000	1,000	1,000	
Profit	**$1,000**	**$2,000**	**$3,000**	**$6,000**

Now suppose we were to use the labor hours to allocate fixed costs instead of material usage. The rate is still $2 per hour, but the cost of each product changes once the fixed costs are allocated based on labor hours used. As a first step, we need to calculate the total number of labor hours required, as shown in Table 6.6.

Table 6.6 Total labor hours required to produce products A, B, and C.

	A	B	C	
Selling price	$20	$20	$20	
Materials $2 per kg	1 kg	2 kg	3 kg	
Labor $5 per hour	3 hrs	2 hrs	1 hr	
Volumes	1,000	1,000	1,000	
Total labor hours	3,000 hrs	2,000 hrs	1,000 hrs	6,000 hrs

Overhead absorption rate per labor hour would be:

$$\frac{\$12{,}000}{6{,}000hrs} = \$2\ per\ hour$$

The direct costs are unchanged so that the contribution per product is the same, but table 6.7 shows the new profits/(losses) calculated using the labor hours as the basis for fixed costs.

Table 6.7 – Profits calculated using labor hours as the basis for allocating fixed costs.

	A	B	C	Total profit
	$	$	$	
Contribution – as before	**3**	**6**	**9**	
Fixed costs labor hours	6	4	2	
Net profit/(loss)	**(3)**	**2**	**7**	
Total profit/(loss)	**($3,000)**	**$2,000**	**$7,000**	**$6,000**

If we compare the profits per product from the material overhead absorption rate per kg and the labor hours overhead absorption rate per hour in Table 6.8, we can see that the total is the same, but the allocation between products is entirely different.

Table 6.8 Comparison of profits calculated using materials and labor to allocate fixed costs.

	A	B	C	**Total profit**
Profit – from material kg basis	$1,000	$2,000	$3,000	**$6,000**
Profit (loss) – from labor hour basis	($3,000)	$2,000	$7,000	**$6,000**

The only difference between the two calculations is the basis we have used to allocate the fixed costs. It is, therefore, dangerous to make decisions on full product costing using a single overhead absorption rate. The analysis in Table 6.7 might indicate that XYZ Company should cease production of product A, as a loss is made after allocating fixed costs. However, the product still contributes towards fixed costs and profit, and the fixed costs will remain the same whether product A is produced or not. If product A is not produced, the fixed costs will be reallocated across products B and C only, reducing the profit from each. This example illustrates further that product mix decisions are best made using the contribution as the financial input to the marketing and operations dimensions of the decision. Remember that decisions should not be made solely based on the numbers.

6.6.1 Why use ABC?

Active reading. Note the rationale behind the development of activity-based costing. Think about how it aids decision-making and provides additional information for cost management.

ABC is a method of allocating overheads to products using multiple bases on which to allocate the costs to products. The technique was proposed by Cooper and Kaplan (1988) but has met with limited take up in some areas. It is said that activities create costs and, therefore, the logical way to allocate costs to products is via the activities that are undertaken to create and provide the products or services. ABC looks at costs from the micro-level where the activities cause

the costs and therefore help managers to understand how the activities are linked to generate revenue and consume resources (Cooper and Kaplan, 1991). It is one reason why ABC fits well with the analysis of the value creation system in determining and sustaining competitive advantage as both are concerned with identifying activities that add value. ABC helps managers focus on improving activities that have the most significant impact on the bottom line (Cooper and Kaplan, 1991).

Several studies demonstrate that ABC has a positive effect on performance, by allowing managers to improve efficiencies of activities and reduce costs (see, for example, Jelsy and Vetrivel, 2012; Hardan et al., 2013). Rezaie et al. (2008) found that ABC was particularly useful in estimating costs and negotiation specifications of products with customers to improve performance for both parties, particularly in flexible manufacturing environments. For example, working with customers in the design of components and products, designing parts for ease of handling, or selecting materials and processes can help to reduce the cost of manufactured products (Ong et al., 1993). Complex manufacturing processes have an impact on the labor required, inventory management, and capital investment, which in turn can impact the number of orders placed, the purchasing activity, production control, and so forth (Gunasekaran and Sarhadi, 1998). ABC enables managers to understand the impact of the product design on these activities and the ultimate cost/price in negotiations. Discussing operational changes with customers, such as shipping and order processing, can help to reduce the costs of both parties.

Wegmann (2009) notes two broad types of analysis. Firstly, a customer-driven ABC system which is aimed at helping managers to make better decisions regarding customer relationships. It is achieved primarily via a review of the activities within the internal value creation system. Secondly, an inter-organizational cost management system that recognizes the use of ABC throughout the whole value system. For example, working backward from a market selling price at which customers are willing to buy, and deducting the desired profit of the selling organization, arrives at a target cost (section 7.8). This cost includes the costs (and profit margins) of members of the supply chain or the whole value creation system. Using ABC, organizations can work together to ensure that the end price can be achieved for the customer and all members of the supply chain receive an adequate reward for their input. This sharing of profits does require cooperation between parties and the exchange of information but can benefit all parties concerned (Carey et al., 2011). It can also work towards reducing the incidence of buyer/supplier power within the supply chain as it encourages cooperation and collaborative working.

As ABC uses a range of different bases, more appropriate and directly aligned to the activity that creates the cost, it is said to produce a fairer allocation of overhead costs. It has the added benefit of highlighting the cost of activities that could stimulate management action. The banking industry was allegedly shocked to realize how much it cost to process a cheque when ABC was applied. Hence a push towards encouraging customers to adopt online banking.

The technique is also beneficial for industries that have high fixed overhead costs, but that undertake a range of activities, such as banking, universities, and hospitals. It is worth noting that when implementing ABC, the volume of information and data required about activities, as

well as costs, increases. Modern information systems, however, ease the burden of collecting information about activities as they can collect nonfinancial and financial data in a shared database that can then be analyzed across products.

Ideally, costs and activities should be based on forecast/estimated (budgeted) levels of activity as there is no guarantee using historical data will be an accurate representation of the costs and activities of the next year. Therefore, as with all cost systems based on forecast data, the accuracy will depend on the degree of certainty that can be applied to the forecasts. It can be used as part of the target-setting process, that is, setting targets for costs, and then monitoring against these so that experience is built up over time, which results in more accurate forecasts, as with most aspects of planning the better the understanding, the better the plan.

6.6.2 The process of ABC—an Example

Active reading. Note that there is a logical series of steps involved in calculating the product costs under ABC. Create a list of the data required and the sequence of steps involved as you follow the process through the example provided.

Basic data

ABC Inc. is considering producing a range of picnic tables. The accountant has been asked for input on the pricing decision. The following information shown in Table 6.9 has been collected.

Table 6.9 Overhead costs analyzed by cost pool

Activity	Cost driver (basis of allocation)	Cost pool ($)
Assembly	Number of labor hours	55,998
Purchasing department	Number of purchase orders	1,989
Delivery costs	Number of deliveries	30,000
Machine maintenance	Number of machine hours	46,500
Inspection and quality and control	Number of inspections	25,000
Total overhead costs		159,487

There are three styles of table proposed: round, square, and octagon. Information relating to the production process is provided in Table 6.10 as follows:

Table 6.10 Product information for ABC

	Round	Square	Octagon
Direct material costs per unit	$120	$105	$115
Number of machine hours required per individual product	0.75 hour	0.5 hour	1.0 hour
Number of labor hours required per individual product	2 hours	2 hours	2.1 hours
Number of purchase orders received from central purchasing	3	4	6
Number of deliveries made to the central warehouse	10	30	40
Number of inspections	150	150	200
Production (number of units)	1,500	1,500	2,000
Mark-up on cost to be applied	30%	30%	40%
Labor is paid at $10 per hour including social charges			

The ABC calculation

The total activity level is calculated for each activity using the information in Table 6.10. For example, multiplying the labor hours for each product by the production volumes provides the total number of labor hours required. Adding the number of purchase orders raised concerning each product gives the total number of purchase orders raised, and so on, as shown in Table 6.11

Table 6.11 Calculation of total activity

Activity	Round	Square	Octagon	Total
Number of machine hours	1,125	750	2,000	3,875
Number of labour hours	3,000	3,000	4,200	10,200
Number of purchase orders	3	4	6	13
Number of deliveries	10	30	40	80
Number of inspections	150	150	200	500
Production units	1,500	1,500	2,000	5,000

The result is shown in the column header “Total activity” in Table 6.12. By dividing the total cost of each activity (shown in Table 6.9) by the total activity (Table 6.11) provides a rate per activity, as shown in the column headed “Activity rate” in Table 6.12.

Table 6.12 Cost driver rate per activity

Rate per cost driver	From Table 6.9	From Table 6.11	
	$	Total activity	Activity rate ($)
Assembly—activity of labor hours	55,998	10,200	5.49
Purchasing—activity of purchases	1,989	13	153.00
Delivery—activity of deliveries	30,000	80	375.00
Machine maintenance—activity of machine hours	46,500	3,875	12.00
Inspection—activity of inspections	25,000	500	50.00
Total	159,487		

The next step is to calculate the overheads assigned to each product by multiplying the activity per product (shown in Table 6.10) by the cost driver rates (shown in Table 6.12) and ascertain the overhead cost per product. The result of this step is shown in Table 6.13.

Table 6.13 Overhead rate per product

	Round	**Square**	**Octagon**	**Total**
	$	$	$	$
Assembly	16,470	16,470	23,058	55,998
Purchasing	459	612	918	1,989
Delivery	3,750	11,250	15,000	30,000
Machine maintenance	13,500	9,000	24,000	46,500
Inspection	7,500	7,500	10,000	25,000
Total overheads per product	41,679	44,832	72,976	159,487
Production units	1,500	1,500	2,000	
Overhead rate per product ($)	27.79	29.89	36.49	

Finally, the total cost can be calculated by adding the materials, labor, and overheads together, as shown in Table 6.14. The mark-up can then be calculated to arrive at the selling price.

Table 6.14 Calculation of selling price per product

Product cost and selling price using ABC			
	Round	Square	Octagon
	$	$	$
Materials	120.00	105.00	115.00
Labor	20.00	20.00	21.00
Overheads	27.79	29.89	36.49
Total cost	**167.79**	**154.89**	**172.49**
Mark-up	50.34	46.47	69.00
Selling price	**218.13**	**201.36**	**241.49**

Learning activity. Using the data provided below, follow the same steps as in Tables 6.11 – 6.14 to calculate the ABC for the three types of the picnic table. The solution is provided at the end of section 6.6.5.

Overhead costs

	$
Assembly	93,000
Purchasing	1,400
Delivery	15,075
Machine maintenance	23,500
Inspection	16,250
Total	149,225

Data on picnic tables

	Round	Square	Octagon
Direct material costs per unit	$100	$80	$120
Number of machine hours required per individual product	0.8 hour	0.5 hour	1.0 hour
Number of labor hours required per individual product	1 hour	1 hour	1.5 hours
Number of purchase orders received from central purchasing	4	4	6
Number of deliveries made to the central warehouse	12	25	30
Number of inspections	200	200	250
Production (number of units)	2,000	2,000	2,500
Mark-up on cost to be applied	30%	30%	40%
Labor is paid at $12 per hour including social charges			

6.6.3 Benefits and drawbacks of ABC

Active reading. Think about how ABC is used strategically. Note any difficulties associated with the practical application of ABC.

The use of multiple rates based on the actual activities provides a fairer allocation of overheads associated with each product, as it takes account of the use made of various activities. For example, Octagon uses more inspection resources and, therefore, is charged more of the cost incurred for inspection. The ABC method also highlights the costs of handling orders and

delivery as well as inspection, and these areas could be targeted for further investigation. For example, there may be more efficient ways of operation or allocation of resources that could potentially reduce the costs of these activities, improving the profitability of all products. In this way, ABC supports the maintenance of a cost leadership strategy.

It is also worth noting that with ABC, if the level of activity changes on the delivery, order handling, and inspections, then the allocation of costs would also change. It can be dangerous to put too much emphasis on the accuracy of ABC costs, as if they are based on previous years, then these are only valid if the activity in the next year is similar. Also, if based on estimates of next year's activity, they rely on the degree of accuracy in the forecast. It should also be noted that ABC is still a form of full absorption costing and can still lead to incorrect decisions (Geiszler et al., 2017). ABC does, however, provide more detailed information on which to make an informed pricing decision, but consideration should also be given to other factors such as market price, complementary products, degree of marketing support, production capacity, and the overall pricing objective. It is important to discuss the figures with the marketing department, as well as production managers, and undertake some sensitivity analysis around the volumes, as pricing decisions can change the mix of products sold, which in turn will influence the level of activity, such as order handling and delivery, thus affecting the ABC costs.

ABC can also aid the maintenance of a differentiation strategy by providing a more informed cost associated with the functionality or service elements provided as part of the product or service offering. This information can be invaluable not only in determining the pricing strategy but also in evaluating the value added to the product in real terms. Differentiators invariably have a higher cost base, and therefore understanding the costs of the differentiation factors is significant for the sustainability of the strategy in a competitive market.

Despite the benefits of ABC, the adoption rates have been relatively low (Chenhall and Langfield-Smith, 1998; Innes et al., 2000; Kiani and Sangeladji, 2003; Al-Omiri and Drury, 2007; Askarany and Yazdifar, 2007; Byrne et al., 2009). The chief reasons appear to be the degree of complexity, compatibility, and observability of results (Askarany and Yazdifar, 2007), the vast amounts of time and resource commitments required (Kaplan and Anderson, 2004), the lack of integration with other systems in the organization (Sharman, 2003) and a lack of top management support (Kiani and Sangeladji, 2003; Cohen et al., 2005). Baird et al. (2004) noted that ABC is sometimes used to make improvements to an existing system but was not adopted as a long-term solution, that is, not updated regularly.

6.6.4 Time-drive activity-based costing (TDABC)

Active reading. Note the reason why TDABC was introduced, and the benefits claimed over ABC.

Video link [Time driven activity-based costing]

[https://www.youtube.com/watch?v=o2TQyrmGsd4&t=1s]

Kaplan and Anderson (2004) promoted the use of time-driven activity-based costing as a way of reducing the burden of implementing ABC. The ABC process can be reduced to just two parameters, the cost per time taken for each unit of resource consumption of the activity, and the length of time each activity takes.

The best way to illustrate this is to use an example of a customer service department that undertakes three basic activities — handling customer orders, conducting customer credit checks, and dealing with customer complaints. The first parameter that needs to be estimated is how long each activity takes. This data can be collected via a detailed time and motion study or determined based on the experience of the members of the department. Table 6.15 shows the length of time taken by each activity.

Table 6.15 – Time taken by each activity

Activity	Time taken
Order handling	1.5
Credit checks	5
Dealing with customer complaints	8

The total capacity of the department needs to be ascertained to calculate the cost per hour.

To keep the numbers simple, assume that there are 10 workers, who each work a 40-hour week for 50 weeks of the year. This gives a capacity of 20,000 hours. Managers have the option to use the number of hours based on the practical capacity, as the estimate used here does not allow for breaks and so forth. What we are really looking for is the available hours for performing the activities.

Based on management accounting costing records, the costs associated with the department amount to $800,000 per annum. The rate per hour can be calculated at:

$$\frac{\$800{,}000}{20{,}000\ hours} = \$40\ per\ hour$$

Suppose the volumes of activities performed within the department during the year are shown in table 6.16.

Table 6.16 Number of activities undertaken by the department in the year.

Activity	Number performed
Order handling	6,000
Credit checks	600
Customer complaints	500

We can now calculate the costs associated with the activities, as shown in table 6.17.

Table 6.17 – Costs associated with each activity and cost of unused capacity

	Time taken in hours	Cost per activity at $40 per hour $	Activity volumes performance	Cost allocated to the activity $
Order handling	1.5	60	6,000	360,000
Credit checks	5	200	600	120,000
Customer complaints	8	320	500	160,000
The total cost of activities performed				640,000
The total cost of the department				800,000
Cost of unused capacity				160,000
Hours unused				4,000 hours

The benefit of this approach is that it highlights the unused capacity within the department (Anderson and Kaplan, 2004; Kaplan and Anderson, 2007). This knowledge aids resourcing decisions as it might mean that the department is overstaffed, with the possibility of redeploying staff to other value-adding tasks. As with the original ABC, it highlights the costs of activities and prompts inquiry, for example, should it really take so long to deal with customer complaints or credit checks. The processes involved can be reviewed to see if improvements in the systems, training, or other factors could be changed. The added benefit of the approach is that when changes are made to the operation, there are limited changes to be made to revise the ABC process. The two factors to change are either the rate per hour or the time taken per activity. As experience is gained, it provides for better budgeting of the resources required to undertaken activities.

The time-driven approach can also deal with complex operations in that processes can be broken down into their constituent activities. For example, dealing with a customer complaint could involve several processes within the investigation and resolution process. The time taken for each element can be determined, and the total time, which may be an average time for the procedure, can be calculated. The TDABC system could also be made more complicated if an organization found it beneficial to track constituent parts of a process as individual elements, rather than aggregate them into a single operation. For example, customer complaints could be analyzed as to the type of complaint as depending on the nature of the complaint, certain elements, such as return an item to stock, may not be required. Many Enterprise Resource Planning (ERP) systems used by organizations are capable of tracking detailed nonfinancial data and amalgamating this with cost data. The system then provides the information to understand the activities and the associated costs, which makes for more informed decision making.

Linking the ERP data with financial data is the basis of "resource consumption accounting," which is a system that combines the advantages of ABC with the German managerial accounting's emphasis on resources. The system uses detailed data from the ERP systems to track, maintain, and group, accurate information to integrate the operational data with the financial information. Like TDABC, it highlights the use of ideal or underutilized capacity and does not allocate these to products but treats them as a variance. The idea is to make the unused capacity visible to promote accountability for capacity utilization and to facilitate resource acquisition decisions (Van der Merwe and Keys, 2002).

6.6.5 Activity-based management (ABM)

Active reading. Note that activities do not manage themselves but require management to act. Would ABC work without ABM?

When considering ABC, it is worth noting that undertaking an ABC exercise achieves nothing if it is not followed up by management action. It is, therefore, necessary to implement activity-based management systems at the same time. ABM and ABC go together as ABM is concerned with the management of activities to improve the performance of the organization. ABC effectively puts a cost on these activities.

ABM is also useful if used in conjunction with the analysis of the value creation system in that the organization can actively manage the activities. It is a requirement of sustaining a competitive advantage. The value system facilitates the identification of competitive advantage, while ABM can facilitate the management of the activities to maintain the position. ABC provides information that can aid the identification of areas where costs need further investigation as well as valuable information that can feed into pricing strategies, make or buy, and outsourcing decisions.

6.6.6 A solution to ABC learning activity

Step 1 – Calculate the total activity

Activity	Round	Square	Octagon	Total
Number of machine hours	1,600	1,000	2,500	5,100
Number of labour hours	2,000	2,000	3,750	7,750
Number of purchase orders	4	4	6	14
Number of deliveries	12	25	30	67
Number of inspections	200	200	250	650
Production units	2,000	2,000	2,500	6,500

Step 2 – Calculate cost driver rates

Rate per cost driver			
	$	Activity	Activity rate
Assembly	93,000	7,750	12.00
Purchasing	1,400	14	100.00
Delivery	15,075	67	225.00
Machine maintenance	23,500	5,100	4.61
Inspection	16,250	650	25.00
Total	149,225		

Step 3 – Calculate the overheads allocation to products

	Round	Square	Octagon	Total
	$	$	$	$
Assembly	24,000	24,000	45,000	93,000
Purchasing	400	400	600	1,400
Delivery	2,700	5,625	6,750	15,075
Machine maintenance	7,376	4,610	11,525	23,511
Inspection	5,000	5,000	6,250	16,250
Total overheads per product	39,476	39,635	70,125	149,236
				Rounding*
Production units	2,000	2,000	2,500	
Overhead rate per product $	19.74	19.82	28.05	

* Note – the rounding is due to the use of 2 decimal places on the machine maintenance rate

Step 4 – Calculate the product cost and selling price

Product cost and selling price using ABC			
	Round	Square	Octagon
	$	$	$
Materials	100.00	80.00	120.00
Labour	12.00	12.00	18.00
Overheads	19.74	19.82	28.05
Total cost	**131.74**	**111.82**	**166.05**
Mark-up	39.52	33.55	66.42
Selling price	**171.26**	**145.37**	**232.47**