

CHAPTER V

A CHALLENGE TO CONVENTIONAL SYSTEMS: ACTIVITY BASED COSTING AND ACTIVITY BASED COST MANAGEMENT

Introduction

Changing manufacturing environments forced many US companies to employ new cost and management accounting techniques such as ABC to achieve success in costing and manufacturing. As discussed in the second chapter, costing methods have evolved as production environments have been improved over centuries. Production processes and machines have changed enormously as a result of increasing computerisation and automation in the last three decades. Also, overhead cost has gradually increased as manufacturing companies installed computerised and automated production systems. This change, however, has not been managed properly by many companies in the US, as described in chapter four, and has resulted in the introduction of ABC to overcome what management has failed to do with the traditional methods.

The aim of this chapter is to discuss Activity Based Costing, and to draw attention to the logic of this method, which differs from that of traditional techniques. The terms “traditional” and “conventional” will be used interchangeably to distinguish the cost systems described in chapter three from the ABC method.

This chapter is composed of four sections. In the first, after giving definitions of some terms, reasons for product cost distortions and the use of Activity Based Costing system will be discussed in detail. Also in this section, ABC will be described and compared to traditional systems. The second section is devoted to cost drivers - their importance, determination, and use. The third section discusses how ABC affects product and overall company profitability. The final section considers Activity Based Cost Management, the utilisation of ABC cost information for managerial purposes. In that section, activity analysis, value-added and non-

value added concepts, activity based budgeting and variance analysis, and customer profitability analysis will also be discussed.

1. Activity Based Costing

Although the term Activity based costing was coined by two professors, Robin Cooper and Robert S. Kaplan*, from Harvard Business School during the late 1980s, the concept itself is not new. It is a well known and defended idea that overhead costs should be allocated to products depending upon the main cause of their incurrence. For example in 1952, a committee of the American Accounting Association stated that “overhead cost allocations should be related in a logical manner to the basic activity which give rise to these costs” (Brummet, 1957:48). In this statement, cause and effect relationships between the overhead and cost objects are emphasised. However, it remained an idea without having an application or detailed analysis.

In 1971, Staubus published his book “*Activity Costing and Input-output Accounting*” in which he defined a cost object as “an activity that costs something”; and costing as “the process of determining the cost of an activity” (p. 6). He also classified the activities into four sub-groups as acquisitions, internal operations, dispositions, and holding assets. In the mid-eighties, two researchers, Miller and Vollmann, published an article, “*The Hidden Factory,*” (1985: 142-150) claiming that production volume was not the main cause of a large group of overhead costs. They said that a great amount of overhead costs were driven by certain transactions, namely: logistical, balancing, quality, and change which were defined in chapter two; and introduced a new method, which was referred to as Transaction-based costing. In this system, the underlying issue is to discover how to control transactions to manage overheads. The authors also stated that there are three approach to manage the overheads. The first is the analysis of transactions to discover which one is necessary and how it can be improved; the second is to increase the stability of operations; and the third is to rely on automation of transactions.

*Kaplan stated (1990:5) that the name was used by John Deere Company, and they studied the company to learn about ABC. He also stated that the system was developed independently in several other companies in the world. Cooper and Kaplan (1987:204-227), had similar findings about overhead cost structure in some electronics and machinery manufacturing companies. Later, they

improved transaction based costing, and formulated a radically different approach from the traditional costing methods (1988b). This new method, they argued, could be a better way of evaluating, understanding and assigning overhead costs to products much more accurately than had been done. The following sections define, describe, and discuss their approach, Activity Based Costing.

1.1. Definition of Activity Based Costing and Some Related Concepts

Activity based costing may be defined as a cost system in which costs are attributed to cost units on the basis of benefit received from indirect activities such as ordering, set-up and quality assurance (CIMA, 1991:30). Another and more detailed definition is that ABC is a system which focuses on activities as the fundamental cost objects and utilises the cost of these activities as building blocks to obtain the costs of other cost objects (Horngren and Foster, 1991:150). An activity is any action or movement, which facilitates the accomplishment of a certain amount of work.

ABC employs cost drivers to assign costs to and from the activities and then to cost objects. The concept of a “cost driver” in ABC is different from the concept of cost allocation in the traditional methods. The traditional approach is that these bases are utilised because, one way or another, overhead costs should be allocated to products (Cooper, 1987a:48). In contrast, ABC treats a cost driver as the basic reason for cost incurrence in the manufacturing (and also service) environments. Therefore, a cost driver may be defined as any factor, change of which can cause a change in the total cost of a cost object (Horngren and Foster, 1991:150). For example, if expending labour or machine hours causes overhead costs to be incurred, labour or the machine hour will be the cost driver. On the other hand, setting-up a machine, production runs, material movements or inspection can also be cost drivers if any of them cause some overhead costs to be incurred.

There are some differences in the use of the term *cost driver*. Some researchers (e.g. Raffish and Turney, 1991:53), although they use the term *cost driver* in general, prefer to separate the term into two segments, as *resource* and *activity driver*. The first deals with assigning the cost of resources to activities, and the second is used for tracing the cost of activities to products manufactured. Cooper (1990b; 1992), on the other hand, uses the terms first and second stage cost drivers

(that correspond to resource and activity drivers respectively) only if the cost drivers of those stages need to be identified and emphasised. Some other researchers, for instance, Innes and Mitchell (1990b; 1992), generally employ the term cost driver, as Cooper does. Since it is widely accepted in the ABC literature, in this chapter, the meaning of the term *cost driver* will be used to encompass both resource and activity drivers.

Terms such as *value added* and *non-value added* activity are also employed in the ABC literature. Value added activity is any activity which adds something to products that customers are willing to pay for; whereas the non-value-added activity adds nothing to products from the customer's perspective, although it consumes time and resources (FMN, 1991:37), e.g. set-up a machine, quality inspection, and material movements. Most companies, therefore, try to reduce those non-value added activities.

1.2. Distorted Cost Information

In a multi-product environment a number of low and high volume products are manufactured together in small and large-sized batches. Products that are manufactured in small batches may demand the same (if not more) number of production runs, set-up, material movements and similar support activities as their high volume counterparts. However, these activities do not vary with production volume, but vary with product diversity, complexity, and the number of production batches. Moreover, these overhead resources tend to grow bigger in many industries when the number, or duration of those non-volume-related activities increase. Since the traditional systems allocate these non-volume-related overhead costs to products according to production volume, the products in the small batches will receive the same amount of overhead cost as their large-batch counterparts if both small and large batches require the same amount of direct labour. Therefore, high volume products will subsidise the cost of their low volume counterparts since most of the overheads regarding low volume products is charged to the high volume products because of volume-based cost drivers (Shank and Govindarajan, 1988:77). This leads traditional systems to producing distorted cost information in product costing, decision-making, and individual product profitability. Cooper (1989) explained symptoms that signalled inadequacy of cost accounting systems, and

emphasised the necessity of re-designing the cost systems if those symptoms existed.

1.3 The Mechanism and Structure of Activity Based Costing

Activity based costing offers a radically different approach from that of traditional systems. Most cost categories, which are considered as period costs in the traditional systems, are regarded as product costs in ABC. Cooper and Kaplan (1988b:96-7) stated that almost all of the activities of a company were to support the production and delivery of goods and services; therefore, they should be regarded as product costs. Moreover, unlike the traditional systems, in which costs are split into fixed and variable components, ABC classifies all overhead costs as variable, however in a different way. This difference will be explained later in this chapter.

The objective of ABC is to connect the cost of an activity to a product which demands that activity (Troxel and Weber, 1990:14). Therefore, it employs two stages to assign costs to products. In the first stage, costs of the activities are aggregated into a number of different but homogenous cost pools. In the second stage, costs, which are collected in the cost pools, are assigned to products by using cost drivers. Cooper (1990b:78; 1992:D2-11-13) states that there are five steps in this assignment procedure. The following section describes this procedure in detail.

a- Aggregating actions into activities: In a production environment there are so many actions to be performed that it cannot be possible or economically feasible to use a different cost driver for each. Thus, it is necessary to aggregate related actions into one activity cost pool for which a single cost driver can be used and represents all of the actions aggregated. For example, some of the actions related to setting up a machine can be aggregated into one activity which may then be called 'set-up'. However, there is a danger in aggregating the cost of the activities if the homogeneity assumption of cost pools is violated. In other words, if the cost of the activities collected in a pool are not appropriate to the function of that pool, the ability of a cost driver to accurately trace the resources consumed by products will decrease. Cooper (1987b:45) pointed out that cost systems report accurate product costs only when the behaviour of the cost being traced is similar to the behaviour of the cost driver.

b- Reporting the cost of activities: When the major or representative activities are selected, it is easy to report resources that each activity consumes. It is also possible to report the cost of actions separately, which may sometimes be very important from the management's point of view. Receiving separate reports for each different activity can provide management with a detailed and clear understanding of resource consumption as well as enabling them to take timely corrective actions when those reports signal some variances. Moreover, if the cost of an activity among the aggregated ones grows bigger, then a new cost pool and cost driver may be required, or the existing one may be modified to reflect this new situation.

c- Identifying activity centres: An activity centre can be defined as a segment of the production process for which management wants to report the cost of the activities performed separately. Different departments may be designed as different activity centres and their costs can be reported separately. For example, a purchasing department may be designed as an activity centre 'purchasing', and thus, cost of a product can be either reported total or separately. For instance, if the total cost of product A is £25, it can be either reported as £25 or can be split into components and reported, say, £3 for purchasing, £2 for receiving, £10 for production, and so on. Reporting costs by activity centre gives managers an ability to understand activities better. Furthermore, understanding the nature and the cost of activities can assist managers to control activities and, therefore, the decision-making process becomes much more effective.

d- Selecting first stage cost drivers: In the first stage, cost of inputs are assigned to cost pools, each of which comprises an activity or activities. Every cost pool should demonstrate the consumption of resources by activities. Thus, the accuracy of the first stage is dependent on the number of cost pools in each activity centre. For example, if the cost pool is for setting up a machine, all set-up related costs are assigned to that pool. Labour hours and material costs, for instance, may be used as cost drivers in the first stage if labour hours are expended and materials are consumed in re-adjusting and cleaning the machine respectively.

e- Selecting second stage cost drivers: The second stage is very important in an ABC system. In this stage, costs of the activities are traced to products that demand these activities. For example, if a machine requires a set-up activity for every batch

of products, the cost of a set up is traced to each of these batches produced in that machine. However, the nature of the resources consumed during a set-up affects the type of the cost driver. In other words, if the cost of a set-up is equal for each batch, then, 'number of set-up' will be the cost driver. On the other hand, if the cost of the set-up differs from batch to batch, for instance as a result of time expended in re-adjusting the machine, the 'number of set-up hours' will be the cost driver. If the number of cost drivers is increased, accuracy of product costs to be reported increases. Thus the more accurately product costs are desired, the greater the number of cost drivers are used in the second stage.

1.3.1. Activity Based Costing: A Resource Consumption Model

The traditional cost systems allocate overhead costs to products simply because those costs have been incurred and they have to be charged. For this purpose, the traditional methods employ some cost allocation bases, most of which may not represent the resources used since the traditional practice does not necessarily select cost drivers according to resource consumption. Moreover, those resources may not be proportionally consumed by products manufactured. In contrast, ABC assumes that activities consume resources and products consume activities (Innes *et al*, 1993:110; Jeans and Morrow, 1989:42; Turney, 1989:25). Also, ABC estimates the cost of resources used during the manufacturing and non-manufacturing processes. For this estimation, Cooper and Kaplan (1992:3) devised the following formula:

Activity Availability = Activity Usage + Unused Capacity

OR

Cost of Activity Supplied = Cost of Activity Used + Cost of Unused Activity

This model of resource consumption differs from the traditional cost accounting models in two ways (Kasanen and Malmi, 1994:8). First, different measures of capacity are determined for each activity rather than simply adopting production volume. Furthermore, cost driver rates for the second stage are identified by using these capacity measures. Therefore, this ABC model distinguishes between resource usage and resource spending (King, 1991:23). Resource spending is an acquisition of capacity to perform activities, whereas resource usage is the amount of activity utilised from this capacity acquisition. For example, a company employs four men, with a monthly wage of £1,250 each, to have its 10,000 products

inspected every month. The capacity is 10,000, on which £5,000 is spent; and the capacity usage is the actual performance of those four men in inspecting the products manufactured. If those men inspect 9,000 products in a particular month, the cost of capacity usage will be £4,500 ($\text{£}5,000/10,000 @ 9,000$). However, the spending for this month is £5,000, and the cost of unused capacity is, therefore, £500.

In the traditional approach, however, the denominator volume depends on budgeted volume rather than practical capacity. Although this type of denominator volume may be useful in stock evaluation, it is not relevant in the decision-making process, because it can only show attained level of expected volume rather than the actual productivity of the activities. In other words, variance analysis performed for the budgeted and the actual volume will only point out the difference between them rather than the difference between the actual ability of that activity to produce and actual output. By contrast, ABC can produce more realistic cost figures than a traditional method since, according to Cooper and Kaplan (1992:3), denominator volume in ABC has to be the practical capacity of the activity supplied, not the expected volume.

1.3.2. Hierarchy of Costs In Activity Based Costing

The Activity Based Costing system has been designed to explain costs in a hierarchical manner under which costs are collected in one of four major groups (Cooper, 1990a:4-14). These groups are: unit, batch, product, and facility level costs and activities. This classification of activities can demonstrate the important differences between the logic of ABC and that of traditional systems that only rely on volume based allocation bases. As is shown below, only unit and facility level costs and activities and their allocation over products resemble those of the traditional methods. Batch and product level costs and activities and their assignment onto products are performed in a radically different way. Moreover, those two levels are considered as the most important categories in the hierarchy, which capture the basics of ABC (Cooper, 1990a). This hierarchy can be described as follows.

a- Unit Level Activities: Some resources are consumed in proportion to the number of units produced, number of machine hours run or number of direct labour hours

expended. Therefore, activities that are performed when a unit is produced (or machine hours run, or labour hours expended) can be defined as unit level activities, and the costs related to them, as unit level costs. Drilling a hole, machining a surface may be given as the example of unit level activities (Cooper and Kaplan, 1991:131). Also, the direct labour, materials, machine and energy costs belong to the unit level classification. Innes *et al.* (1993:113) consider depreciation costs to fall into this category as well.

b- Batch Level Activities: Those activities performed when only a batch of products is produced, are referred to as the batch level. Setting up a machine, batch inspection, ordering a group of parts or materials, and handling a group of materials may be given as examples of the batch level activities. The importance of activities in this category is that they are not affected by volume of production or number of units produced, but they change as the number of batches changes. In other words, these activities and their costs cannot be controlled by changes in the unit level. Also, their costs are regarded as variable only in the batch level of production. Therefore, batch level cost assignment to products is as follows. First, cost of the activities for this level is calculated (cost of a set-up or per hour of set-up, inspection and material movement) and then this total amount per batch is divided by the number of units in the batch and is assigned to individual products.

c- Product Level Activities: Product level activities are those which are performed to support different products manufactured in a company's product line. Customer liaison, performing engineering change notices, developing special testing routines, expediting products, purchasing and part administration can be given as examples of the activities falling into this category. Costs of these activities are not affected by the changes in the unit level, nor do batch level modifications affect them, as the activities in this category should be performed for all product lines that exist in the manufacturing environment. The cost of the activities falling into this category can be controlled by changing the number of different types of products rather than by changing the batch size or number. Therefore, costs in this category are variable in the sense that they change depending on the number of different types of products produced. As a result, costs of product level activities are first assigned to different product lines and then the amount of expense per product line is divided by the number of products in that line yielding cost per product.

d- Facility Level Activities: These activities are performed to support the overall production and administration capabilities of a manufacturing environment. Examples of costs in this category are plant management, occupancy costs of buildings and grounds, heating and lighting.

The facility sustaining category of ABC is somewhat problematic. While the links between resource consumption and activities can be established (first stage) in this category, connecting activities to products (second stage) in a logical manner is difficult -- if not impossible. In other words, the general logic of ABC does not apply to the facility level activities. Therefore, the lack of causal-based relationships between activities and products may cause cost distortion if the costs incurred in this category account for a large amount.

Cooper (1990a:4-14) suggested that costs falling into this category may be allocated to products on the basis of value added. However, Cooper and Kaplan (1991:132-3) later recommended that these costs should be kept at plant level and not allocated to products: only unit, batch and the product level expenses should be assigned to products. Alternatively, Innes *et al* (1993:114-9) allocated the facility level expenses of their ABC example on the basis of prime cost (direct material plus direct labour).

The hierarchical design of ABC provides managers with an understanding of how supposedly fixed costs of traditional systems will vary in batch and product levels. Moreover, the hierarchy demonstrates that different types of costs should be controlled in different ways. While reduction of unit level activities may result in a decrease in the unit level costs, modifying the number of batches and the number of different products assists managers to change the level of expenses for batch and product level activities respectively. Moreover, ABC reduces the level of distortion occurring in multi-product companies that have adopted the traditional product costing methods.

1.3.3. An Illustration of Activity Based Costing

To illustrate how ABC works in a manufacturing environment, a simplified example* can be given below. As this example is designed to emphasise major differences between ABC and traditional systems, detailed analysis is beyond its scope.

Dillon Company manufactures two products known as product A and product B. Product A is a low volume item, on which sales are only 5,000 units each year. However, product B is a high volume item, on which sales are 20,000 units each year. Both products require two direct labour hours for completion. Therefore, the company should work 50,000 direct labour hours each year, computed as follows:

	<u>Hours</u>
Product A: 5,000 units x 2 D.L.hours.....	10,000
Product B: 20,000 units x 2 D.L.hours.....	<u>40,000</u>
Total direct labour hours	50,000

Total manufacturing overhead cost is £1,000,000.

$$\text{Overhead rate} = \frac{\text{Manufacturing OH cost, £ 1,000,000}}{\text{Direct labour hours, 50,000}} = \text{£20 /DLH}$$

In the traditional costing approach, since both products A and B require the same amount of direct labour hours, they will be assigned the same amount of overhead cost (£20@2 DLH =£40).

 (*) This example is adapted from: Garrison, Ray H.,1991, Managerial Accounting, sixth edition.

Consider how an ABC system changes this situation; assume that some managers in this company analysed the overhead cost structure and activities taking place, and identified five major activities acting as cost drivers in the incurrence of overhead costs.

- 1- Unit level activities: machine hours run (40,000 hours).
- 2- Batch level activities: machine set-ups (5,000 set-ups), quality inspections (8,000 inspections), production orders (600 orders).
- 3- Product level activities: purchase orders (750 orders).
- 4- Facility level activities: D.Labour Hours for heating and lighting (50,000 DL hrs)

Data related to these activities are shown below:

Activities	Traceable Costs	Number Of Activities			Rate per Activity
		Total Number	Product A	Product B	
Machine Hr	£314,000	40,000	12,000	28,000	£ 7.85
Set-up	£230,000	5,000	3,000	2,000	£ 46.00
Inspection	£160,000	8,000	5,000	3,000	£ 20.00

Prod ordrs.	£ 81,000	600	200	400	£135.00
Purch ordrs	£ 90,000	750	150	600	£120.00
Heat&Light	£125,000	50,000	10,000	40,000	£ 2.50

By using the data above, the overhead cost can easily be assigned to the products A and B, as shown below.

Activities and Costs	PRODUCT A		PRODUCT B	
	No.Of Activity	Total £	No. Of Activity	Total £
Machine Hr (£7.85/hr)	12,000	94,200	28,000	219,800
Set-up (£46/set-up)	3,000	138,000	2,000	92,000
Inspection (£20/inspection)	5,000	100,000	3,000	60,000
Production Ordrs(£135/ordr)	200	27,000	400	54,000
Purchase Orders(£120/ordr)	150	18,000	600	72,000
Heat &Light (£2.5/DLHr)	10,000	25,000	40,000	100,000
Total Overhead Assigned (£)		402,200		597,800
Overhead cost per unit	402,200/5,000	£80.44	597,800/20,000	£29.89

In this company, if direct labour is used as an allocation basis, overhead applied for both products will be £40 as illustrated above. On the other hand, if the ABC method is adopted, then the cost of overhead, which will be applied to products A and B, will be £80.44 and £29.89 respectively. ABC-based calculations show that the previous cost system underestimates the cost of product A, and overestimates the cost of product B. Therefore, it can be concluded that the product B subsidises product A, distorting cost information and related decisions in Dillon Company.

2. Cost Drivers in Activity Based Costing

The cost drivers are essential tools of ABC. They represent the cost pools, in which costs of homogeneous activities are aggregated. However, to be truly representative, cost drivers should be chosen carefully and be highly correlated with other activities collected in the same cost pool. In other words, changes in the level of one activity should be accompanied by proportional change in the other activities (Roth, 1991:39). The following sections describe some factors that affect cost driver structure and determination.

2.1. Diversity Factors and Cost Drivers

The factors that determine the number and type of cost drivers should be considered by management in detail. According to Cooper (1988a:45-54; 1988b; 1990c:88; 1991a:375-9), there are certain factors that require the cost system adopted to have a number of cost drivers, and which affect the cost information. These are product diversity and volume (batch size) diversity.

a- Product Diversity: This type of diversity occurs when products consume activities in different percentages. Introducing new products, adopting new marketing strategies, and improving production processes increase product diversity (Cooper, 1991b:71). The importance of this concept becomes significant when two or more different products, which require the same amount of machine or labour hours (or any other volume based cost driver), demand overhead resources in different proportions.

For example, consider products A and B, each of which is manufactured in batches of 100 units. Each batch requires 5 machine hours to complete. After completion, products A and B require different amount of inspection time: 1.5 hour for a batch of product A and 0.5 hour for B. At this point a volume-based allocation system introduces cost distortion. Even though product A consumes three times as much inspection time as product B, both of the products are allocated the same amount of inspection cost since they each require five machine hours to manufacture. Thus, the level of distortion for these products is quite high. Product A is allocated an amount of cost which is 33% less than what it actually demanded from the inspection activity, whereas product B is allocated 100% more cost than it consumed. Therefore, this machine hour-based cost allocation system reports distorted cost information since it is not able to represent the cost of non-volume related activities - inspection activity in this example.

b- Volume (batch size) Diversity: Products are usually manufactured in batches, the size of which may vary. If batch sizes vary among different products, or even for the same product, then volume diversity can distort the cost of products in companies that employ traditional allocation bases. For example, two products - A and B - are manufactured in batches of 50 and 200 units respectively. Thus, the volume diversity is four (one batch of product B is four times as large as that of product A). Both of the products require machine hours in proportion to their sizes, one and four hours for A and B respectively. However, setting up the machine for

every batch of each product demands the same amount of resources (i.e. labour hours for setting-up, cleaning the machine, etc.). The traditional allocation bases depending on volume (machine hours run in this example) trace 20% of the total set-up costs to product A, and 80% to product B simply because product B requires four times as many machine hours as product A although the set-up cost for each batch of products is the same (i.e. product A consumes the same amount of set-up cost as B). Therefore, the volume based system causes a distortion due to the batch size diversity.

2.2. Determination of the Cost Drivers

Cost driver determination is one of the most important stages in ABC. In a manufacturing environment, there are hundreds of different activities taking place, some of which have significant effects on products. An ABC system aggregates the costs of them into homogeneous cost pools and then traces the costs into products. However, tracing these costs to products manufactured is subject to certain factors such as the cost of measurement, degree of correlation, and behavioural effects. First, a decision on desired accuracy should be made - which determines the number of cost drivers to be selected, then the above factors are taken into account (Cooper, 1991a:383).

a- Cost of Measurement: To trace the cost of activities to products accurately, an ABC system requires more cost drivers than its traditional counterparts. This requires an extensive data collection that may be a difficult and an expensive task in most manufacturing environments. Fortunately, the use of computers has reduced the cost of data collection, classification, and reporting. A manufacturing company with adequate computers is able to process a great amount of data in minutes. Moreover, most of the cost information that a manager needs to run an ABC system may already exist in the company records. It could be either under a different classification, or was collected for other purposes but not used before since it might have been considered unnecessary for accounting purposes. For example, set-up time and other necessary materials used during a set-up are always measured and recorded by production engineers. Hence, a manager can readily receive and use this information. On the other hand, if setting-up a machine always requires almost the same amount of time and material, ABC can employ 'number of set-up' rather than 'set up hours' as the cost driver. The same applies for inspections, production

runs, material movements, purchasing and ordering. This reduces the running cost of the system.

b- Degree of Correlation: In an ABC system, various activities may be aggregated in the cost pools. One of the ABC assumptions requires homogeneity among the activities aggregated in a cost pool. Hence, the pool can be represented by a single cost driver. However, aggregating some important activities that are not perfectly correlated with the cost pool can also distort product cost information (Babad and Balachandran, 1993: 565).

On the other hand, sometimes it may not be possible or economically feasible to create many cost pools for different activities. In such situations, if the nature of the activities are the same but their completion time is different, the time factor of the activities should be taken into account. For example, if setting-up a machine requires a varying degree of hours for different batches, 'set up hours' can correlate well with the cost of resources aggregated rather than the cost driver 'number of set-ups'. In this situation, using the number of set-ups as a cost driver distorts cost of products, because, there may be some product batches set-up time which are significantly shorter than others. On the one hand, the cost driver 'number of set-up' undercosts some products which require long set-up hours; on the other, it overcosts the ones which necessitate short set-up hours.

Briefly, if the cost driver captures the actual resource consumption of the activities aggregated in a cost pool, it can trace the costs of the activities to products accurately. By contrast, if the correlation between the cost drivers and the activities represented declines, then the distortion in reported product costs increases and affects the managerial decisions.

Degree of correlation and the cost of measurement also have effects on determining the number of cost drivers. The former requires a higher number of cost drivers, the latter forces management to reduce it. The level of desired accuracy plays an important role in this process. With reference to recent surveys performed in the UK, the number of cost drivers used has not been high. Innes and Mitchell (1991a:28), for example, found in their survey conducted among CIMA members that the number of cost drivers employed was usually less than 20. Another survey (Bailey, 1991:31) involving the large manufacturing companies in the UK, such as

Evans Medical, Hewlett-Packard, IBM, Jaguar Cars and Nissan Yamoto, revealed that the average number of cost drivers used is 15 - the lowest is 7 and the highest is 45.

c- Behavioural Effects: Behavioural factors may also affect cost driver determination. ABC is not only a product costing method but is also a management technique that is employed to manage activities. It is used to identify and eliminate non-value-added activities to reduce the costs of products and processes. Therefore, if employees regard ABC as a threat to their work, or a way of evaluating their performance, some of them may not report accurate data. There may be some companies for which a decision - whether or not to implement an ABC system - should only be made from a behavioural perspective (Cooper, 1991a:384) since implementing the system may not produce an expected outcome as a result of employee resistance that was described in the previous chapter.

3. Profitability and Activity Based Costing

It has been claimed recently that ABC is a very useful guide for management to point out the ways of how to increase product and company profitability (Cooper and Kaplan, 1991:130-5). The following sections discuss how ABC assists managers to increase company profits.

3.1. The Impact of ABC

Most traditional cost systems allow managers to analyse the cost of resources consumed in aggregate levels. By those systems, it is easy for management to find out how much a support or production department demands from overhead resources. However, as the cost of resources is accumulated and then allocated to products, it becomes impossible to link those resources with the products manufactured. Even though these different demands on the resources can be explained in an aggregate level on the financial reports, they may not be analysed in individual product, product line, and customer levels. For example, Srinidhi (1992:199) states that firms with speciality products have very high overhead costs. Low volume or speciality products demand more resources since their production requires to be in small batches. If the number of batches increases, the number of set-ups, material movements, production runs, purchase and sales orders increase

accordingly. In such a manufacturing environment, reporting costs in gross amounts does not provide management with adequate information; in contrast, costs on an individual product basis are useful for most managerial decisions.

ABC, on the other hand, provides such information. ABC analysis helps managers to segment all overhead costs so that each part can be analysed in detail from different perspectives. The method also identifies manufacturing and non-manufacturing processes in detail, and assists managers to pinpoint inefficiencies that cause waste or excessive resource consumption. However, ABC does not reduce the waste or cost of products by itself. It only directs managers' attention to the underlying causes of cost and profit (Johnson, 1988: 24). For example, one UK company that implemented an ABC system reduced 20% of its overhead costs three months after the system had been installed (Aitken, 1991:42). Therefore, according to Cooper and Kaplan (1991:130), managers not only link the activities with the resources that those activities consume, but also understand the general and specific structures of products/customers that produce revenues and consume resources.

3.2. Profit Improvement

Profit improvement is two-fold. It can be improved either by reducing costs of existing products and customers, or by increasing revenues. ABC provides essential information for both.

3.2.1. Cost Reduction

The resource consumption model of ABC, which was discussed earlier in this chapter, provides clear insights on activities in a manufacturing environment. By using this model, spending on resources and the actual consumption of those resources by various activities can be identified. Once the difference is determined, then the ways that lead to elimination of waste should be investigated. If the activity is setting-up a machine, for example, the cost of this set-up can be reduced by diminishing the set-up time. When this reduction is performed, spending on resources for set-up should be re-adjusted so that reduction can be transformed into profits. For example, one of the biggest Japanese car manufacturer, Toyota, focused on set-up time and reduced it by eliminating waste (Sutton, 1991:74).

Nevertheless, failure to cut off the spending on those resources that wasted will not increase profits since expenditure still exists. On the other hand, increasing lot sizes can also lead to a reduction in the number of set-ups, and hence cost per product (Turney, 1991:31). Simplifying product designs; designing products with fewer and more common parts; standardising products; and reducing the number of different products produced can also lead to reductions in resource consumption of set-up costs as well as other batch and product level activities.

3.2.2. Profit Increase

Traditional systems report high volume, standardised products as less profitable than low volume, speciality or complex products. While this type of cost information is encouraging production of the low volume customised products, it increases the spending on overhead resources (Rolfe, 1992:35). Utilising this type of cost information will reduce net profit of a firm since its total overhead cost grows as a result of increasing non-value-added activities such as set-up, inspection and material movements. Johnson and Kaplan (1987b:41), for example, conducted research in a company that had a diverse product line containing many different products. They found that 85% of dollar sales of the product line were produced by 23% of products, which accounted for 400% of the company's profit. The remaining products (77%) were losing money. Also, Sharman (1991:24) stated that there were many companies possessing hundreds of unprofitable products or customers; however, they did not have appropriate cost systems to warn and display symptoms that those products/customers were unprofitable.

ABC, by contrast, helps managers to determine how much a product or customer demands from resources. Moreover, it shows clearly when a low volume product is undercosted and the high volume is overcosted; and points out underlying reasons for the distortion. It also demonstrates which customers and products are less profitable than others. Therefore, management can take the following necessary actions.

According to Cooper and Kaplan (1991:134-5), managers should attempt to re-price products. They should increase the prices of those products which make heavy demands on support resources, and decrease the prices of the high volume products, which subsidise others, to more competitive levels. Existing product mixes

may be modified by replacing the products that demand more resources with the ones that consume less resources and produce more revenues. Moreover, low volume or speciality products can be priced higher since their customers, as a result of the nature of those products, may be willing to pay. However, the same does not apply to the high volume products, which may be competing in price-sensitive markets. Such high volume products are able to increase company profits only if they are costed accurately and priced carefully.

When management accomplishes the essence of redeploying facilities and labour force; reducing or eliminating waste; modifying product mixes; dropping the losing products and customers, they can increase company profits. Therefore, a reduction on spending will increase profits although the company may continue to produce the same level of revenue.

4. Activity Based Cost Management (ABCM)

Since 1990, (especially after 1992) academics and practitioners have realised that ABC can be adopted not only for product costing needs but also for managerial purposes (Johnson, 1990b). The following sections discuss the importance and the uses of activity based cost information for managerial purposes. However, the content will be limited to activity analysis, budgeting and variance analysis, and customer profitability analysis, all of which are regarded as the basics of ABCM.

4.1. Definition, Aim and Importance of ABCM

Activity Based Cost Management (ABCM) can be defined as a system which is designed to inform management about the economics of its past, current and future operations (Kaplan, 1992:58). Turney (1992:20) alternatively defines ABCM as using ABC information to improve business processes; and states that it assists management to adapt business strategies to meet competitive pressures as well as to improve business operations. Thus, the aim of ABCM is to provide management with cost information related to every level of manufacturing and non-manufacturing processes. The cost information produced by an ABC system can illuminate how resources are consumed by a number of various activities, such as purchasing, designing products, setting-up machines, material movements and manufacturing, as described in the previous sections. It points out which activities are inefficient and

consume more resources than they normally require; and assists management to control and manage those activities to reduce excess resource consumption.

ABCM necessitates continuous improvement by focusing on activities and processes, which lead to improving quality, lowering costs, and increasing profits (Clark and Baxter, 1992:55). The decision-making process may become easier and more understandable for managers; product cost classification may become more informative and meaningful by using this information. Moreover, managers can know clearly which activities or resources will be affected by their decisions. For instance, if they decide to increase the number of customised products, managers will know exactly the effect of this decision on the cost of these products, with an increasing number of set-ups, material movements, production scheduling, and inspection. As a result, product mix strategies may be established intelligently for future periods, and existing ones can be scrutinised and modified.

4.2. Activity Analysis

One of the targets of ABCM is the analysis of activities. In a manufacturing environment, value-added and non-value added activities are identified for further cost reductions and quality improvements. If the activities add value, efforts should be made to improve them to a more efficient level; but if they do not, essential actions should be taken to the extent that those non-value-added activities could be eliminated. According to Brimson (1991:78), activity analysis is used to:

- Understand the current cost and performance of significant activities.
- Provide a basis for determining alternative activities to lower costs and/or improve performance.
- Provide a basis for improving methods to streamline current activities.
- Identify discretionary, secondary and non-value-added activities
- Identify cross-organisational issues.

Swenson (1994), who has conducted a research in 35 manufacturing firms in which ABC systems have been implemented for product costing and managerial needs, reports that 92% of the firms searched have been using ABC information to support process improvement. In these firms, through ABC information, high cost, non-value-added activities were identified and new procedures developed to reduce

and/or eliminate cost and duration of time to perform these activities. Similarly, Innes and Mitchell (1995a:144) found in their survey that 87.8% of ABC users employ the method for cost reduction purposes.

According to Turney (1992:22-23) there are several guidelines to analyse existing activities. These guidelines should be considered carefully to eliminate waste and to strengthen the strategic position.

a- Identifying non-essential activities: The first action is to question the necessity of an activity. If it is identified that the activity is unnecessary, ways to eliminate it can be sought. On the other hand, if an activity is necessary for customers, or it is a prerequisite for another activity or process, that means it has value and it should be improved until maximum efficiency can be obtained.

b- Analysing significant activities: There may be hundreds or thousands of activities performed in a manufacturing environment. Some of these activities might be of minor importance, or analysing them is not economically feasible at all. Therefore, only those activities, expected benefits of which will exceed costs of analysis and further measurements, should be investigated

c- Comparing activities to the best practices: Activities should be compared to similar activities in other companies, or another part of the organisation. This can help managers to improve the activities within manufacturing and non-manufacturing processes.

d- Examining the links between activities: There may be a lot of activities which follow one another, like the rings of a chain. The links between activities should be established so that time and duplication of work can be minimised.

4.3. Budgeting and Variance Analysis in ABCM

Budgeting is an essential aspect of any modern business. Nevertheless, traditional costing systems that are adopted for budgeting and variance analysis suffer from certain inadequacies. First, according to Innes *et al.* (1993:134), preparation of budgets and variance analysis are performed by utilising volume based cost drivers such as labour hours, machine hours and labour cost. Therefore, similar distortions

that have been described in the beginning of this chapter are anticipated to occur. For example, if machine hours are used to allocate overhead costs to products, although budgeted and realised machine hours are exactly the same at the end of the period, there may still be some overhead cost unrecovered. Because, if customised products that require small batches have been manufactured during that period - although the same machine hours have been expended in total - consumption of batch and product level resources would have increased. A second inadequacy, which is closely connected to the first, is that traditional systems treat standard overhead costs as if they were variable, in the sense that these costs are accumulated in the same manner as variable costs (Horngren, 1967b:257; Innes *et al*, 1993:134). While variable costs do not have volume variances, since required and applied variable costs are equal, fixed costs have volume variances and cannot be divided like variable costs in the traditional context. Therefore, reliability of a budget and variance analysis may be quite questionable if they depend only on volume based cost allocation methods.

On the other hand, an ABCM system, in which ABC cost information is employed, can overcome these inadequacies because of its different treatment of the overhead costs. According to Innes *et al* (1993:135-136), who exemplified an ABCM variance analysis and contrasted it with a traditional one, ABCM provides management with information that improves this situation. For example, depending on types and expected demands of products to be manufactured, management are able to calculate the number (or hours) of set-ups, material movements, material handling, quality controls and production required for a given volume. Therefore, manufacturing budget will demonstrate such numbers as 120 set-ups (or set up hours), 175 material movements, 250 inspections etc., for product A, 250 set ups and so on for product B, etc. When the budget is prepared to show this information, it is not difficult to evaluate resources demanded by these activities. The next step will be a comparison between the budgeted and actual resource consumption. This analysis illustrates the amount of variances associated with each cause (Cashell and Presutti, 1992:29). By this comparison, it can be readily discovered which sections, processes, and activities are inefficient or need improvement. Therefore, where necessary, machinery and labour can be redeployed, distances between machines may be decreased, and the duration of activities may be shortened to eliminate variances.

4.4. Customer Profitability Analysis

In the context of ABCM, customer profitability analysis may be performed successfully by using the ABC information. The purpose of the customer profitability analysis is to trace revenues and expenses of an organisation to customers who cause them (Howell and Soucy, 1990:44). Thus, the cost object of the ABC information is the customer. To evaluate these objects, according to Innes and Mitchell (1993:89), the following factors that affect the cost of each customer to the organisation should be taken into account: delivery patterns, location of customers, quality provided, after sales services, sales and promotion efforts and discounts given. The authors suggest that the costs of these factors should be assigned to related activities and then to customers in the same manner, as previously described, that an ABC system traces costs to products.

In this very competitive business world, on the one hand customer satisfaction is a very important aspect for the companies, on the other making enough profit is vital. Therefore, it is essential that a balance should be established between customer satisfaction and earning profit. However, it is impossible for a company to satisfy all its customers. For example a manufacturer of heating wire, Kanthal (Cooper and Kaplan, 1991:134), analysed its customers and found that a small proportion (20%) of its customers were generating most of the profits (225%). By contrast, 10% of the customers were causing a loss of 125%, and 70% is around break-even point. Unlike some advocates who prioritise customer satisfaction, Kaplan (1992:62) points out that the aim of a company is not to delight all of its customers, particularly those who cause it to lose money. To meet everything that a customer wants is different from meeting them profitably. Management, on the one hand, may standardise most of the customer's demand; on the other, they may drop some customers as a last possible action if they do not agree on a price increase.

5. Criticisms of Activity Based Costing

Although successfully implemented by US and UK/European companies (Berlant *et al*, 1990; Haavind, 1991; Innes and Mitchell, 1990b; Bhimani and Pigott, 1992; Innes and Mevellec, 1993), ABC has also been criticised since it was first publicised in the late 1980s. Piper and Walley (1990), for example, questioned validity of the fundamental assumption of ABC: 'activities cause costs and products consume

activities'. They argued that a change in activity could not necessarily result in a change in differential costs. To reinforce their argument, they gave an example: a reduction in production volume might not reduce indirect costs, therefore, activities did not have clear causal relationships with costs. Also, they compared ABC with the contribution approach, implying that the latter provided more decision-relevant information than the former; however, they failed to give any example to support their argument.

On the other hand, Cooper (1990d) replied that the basic assumption of ABC, activities cause costs and products consume activities, was not an empirically testable statement; however, it was established theoretically to design ABC systems. He also explained the two stages of ABC: relating the first one to the assumption that activities cause costs and the second to products/customers consume activities. Cooper (1990d) also justified ABC, stating that it was a resource consumption model rather than a spending model. Referring to Piper and Walley's (1990:41) example about cost reduction, Cooper (1990d) pointed out that if cost was defined in terms of consumption, rather than spending, then relationships between activities and costs could be constructed.

Nevertheless, Piper and Walley were not satisfied with Cooper's explanations and published another article (1991). They defended their previous views (1990) on the logic of ABC and stated that it was another absorption costing technique, which, therefore, bore the inadequacies of it. They also said that ABC did not provide useful information, but decision-relevant approaches, like contribution analysis did. On the other hand, they stated that ABC did not increase company profits since there was no real-life example to prove its superiority in doing so.

Other researchers, e.g. Johnson *et al.* (1991), point out the dangers of using cost driver information to manage operating costs. The authors appreciate the usefulness of ABC in assigning costs to activities and then products; marketing and pricing decisions; assisting managers to understand cost structure of products and product mixes; analysing product profitability; and dropping products which have low margins or are losing money. To manage operating costs, they consider using this information as dangerous when customers desire high quality and customised products, and when flexibility is required. Moreover, they argued that while long production runs and large batches may reduce the cost of those activities and

hence the products, nevertheless these reductions may not increase the company profitability simply because customers want differentiated products, which require fast changeovers and small batches.

Johnson (1992:35) states that competitiveness is not gained by performing an activity analysis that leads to calculating ABC product costs, but it is achieved by focusing on customers' demands and reducing lead time in work. Johnson also claimed in an interview (Jayson, 1992:28) that any type of accounting system could not tell managers whether or not customers were satisfied: in other words, accounting systems concentrate managers' attention only upon final results, but do not stress capabilities of processes and the importance of customers.

Some other researchers, Foster and Gupta (1990), examined cost drivers empirically in 37 plants of an electronics company. They discovered that volume based cost drivers (e.g. direct labour dollars) were significantly important in assigning manufacturing overhead costs to products. Also, most sub-categories of manufacturing activities (e.g. materials purchasing and process engineering) were highly labour intensive. Therefore, they stated that volume based variables were important manufacturing overhead cost drivers, some of which were driven by complexity or efficiency variables (which were related to product design, procurement, manufacturing process, product range; and time based and non-value-added activities, respectively). They concluded that complexity and efficiency variables were less significant cost drivers than volume based variables within the 37 plants of that electronics company.

5.1. Benefits of ABC

Benefits of ABC may be summarised as follows (Innes and Mitchell, 1990b:27; 1990c:29; Bailey, 1991)

a- If the product and the batch size diversity (i.e. non-volume driven overheads) exist, ABC can produce more accurate product costs than traditional costing methods.

b- It assists managers to analyse products, customers, processes, and more importantly, activities taking place .

c- It increases visibility of overhead costs by controlling the activities, and links resource consumption to activities and then activities to products.

d- ABC assists managers to design new products in a cost effective way; to modify product mixes to a maximum profitable level; and to provide a knowledge of cost behaviour from cost driver analysis.

5.2. Limitations of ABC

Since it is a new technique, there are some limitations of ABC, which may be solved or improved over time. The following are the limitations of ABC, which have either been experienced or theoretically proposed by some researchers (Cooper and Kaplan, 1988b:101; Cobb *et al*, 1992b; Innes and Mitchell, 1990b; 1990c;1991b; Bailey, 1991).

a- Cooper and Kaplan (1988b) stated that two types of costs should be excluded from an ABC system. First, unused capacity costs should be treated as period costs since they incur as a result of inefficiencies of a production environment. The authors say that products - and customers - should not be charged with the costs that they have not deserved. Second, research and development (R&D) costs of new products should be considered separately. Total R&D costs can be split into two categories: one category that relates to the existing products should be assigned to them according to the ABC principles; the other category, which relates to new products, should be regarded as investments for the future.

b- ABC uses historical costs and, therefore, cost information produced is strongly related to the past. However, historical information can be used in the decision-making process with caution. In defence of ABC, Kaplan (1992:59) says that an ABC system is not necessarily based only on historical cost data, but it may also be based on budgeted, replacement, or targeted cost

c- Cost driver selection is reported by companies as one of the most difficult tasks in the implementation of ABC. Also, collecting and using relevant data from existing financial accounting systems for ABC purposes are reported to be difficult (Cobb *et al*, 1992b).

d- There are not enough real life examples to indicate whether or not implementing ABC improves company profitability. However, cost reduction and profit improvement, as discussed before, is not something that an ABC system accomplishes by itself. The system only shows where inefficiencies take place and cost reduction is possible. Therefore, it is left to managers to take appropriate action on the basis of the ABC information.

Apart from the deficiencies of ABC, it can be concluded that ABC may be needed in many companies since it shows the ways of how to make factories more efficient, and how to capture the essence of FMSs.

Summary

Recent studies have identified that a large portion of overhead costs is driven by transactions or activities in most companies in the electronics and machinery equipment/parts industries. Traditional product costing systems adopted within these companies, however, are not able to reflect accurate costs of products manufactured. Therefore, a costing approach referred to as ABC is introduced as producing more accurate product costs than its traditional counterparts. This approach treats overhead costs in a different way from the other cost systems: its basic assumption is that activities consume resources and products utilise these activities. Moreover, the system splits costs depending on the activity levels as unit, batch, product and facility sustaining. Then, the costs of activities in these levels are assigned to products.

On the other hand, ABC-based cost information, which is referred to as ABCM, is considered appropriate for managerial purposes. ABC-based cost information is used for activity analysis, budgeting and variance analysis, customer profitability analysis, as well as designing new products and continuous improvement programs. ABCM does not correct cost distortions by itself, but it points out areas where inefficiencies take place and the basic causes of them. Managers, then, are responsible for taking necessary corrective actions.

Nevertheless, ABC has faced criticism from some academics. Some of them opposed the basic assumption of ABC that activities cause costs and products

consume activities. They also claimed that decision relevant systems, such as contribution approach, produced better cost information for decision-making needs. Others criticised ABC claiming that it underestimated customers since the system only attempted to reduce costs and standardise products, which may not be appropriate from the customers' perspective. Others criticised the cost drivers of ABC claiming that manufacturing overhead cost drivers were highly correlated with production volume.

Although there may be some limitations of ABC, there is a growing interest among manufacturing companies to implement the method either in some parts or whole of their organisations. The underlying reason is that ABC and cost information produced by that method makes managers in the western world be more cost conscious and aware of the activities that lead overhead costs to increase. Therefore, it can be concluded that ABC is expected to assist managers in many multi-product organisations to understand their costs and activities, and to manage those activities to become more competitive and profitable than before.