8

CHAPTER 8

ACTIVITY-BASED COSTING

LEARNING OBJECTIVES

After completing this chapter, you should be able to:

1 explain the problems associated with conventional costing systems, resulting from a failure to adapt to the changing business environment;

2 recognise common indicators of an outdated product costing system;

3 describe both the costing view and the activity-management view of the activity-based costing (ABC) model;

4 evaluate the costs and benefits associated with some of the different approaches to activity-based costing, which include different subsets of costs;

5 use the activity-based model to measure the costs of activities, and assign activity costs to products;

6 explain the differences between product costs prepared under activity-based costing and those prepared under conventional costing systems;

7 recognise what types of organisations can gain the greatest benefits from activity-based costing;

8 identify the impediments to implementing activity-based costing;

9 outline various design issues to be considered when implementing activity-based costing, including budgeted versus actual costs, implementation of activity-based costing as a 'project' and the inclusion of other cost objects;

10 explain the implications of spare capacity for estimating the cost of activities;

11 appreciate the importance of 'behavioural issues' in implementing activity-based costing;

12 identify the limitations of activity-based costing in providing accurate product costs;

13 describe the difficulties of implementing activity-based costing in service organisations; and

14 after studying the appendix, use a relatively simple version of activity-based costing to allocate overhead costs to products.

INTRODUCTION 8

A revolution is transforming manufacturing industries. Not since the mid-nineteenth century have changes been as sweeping and dramatic as they are today. The growth of global markets for both production inputs and for products with an increasing emphasis on customer satisfaction, in particular the emergence of China as a major source of manufactured goods, the breakneck pace of technological innovation, and startling advances in computerised systems have resulted in a new playing field for manufacturers around the world. Some manufacturers have emerged as world-class producers, while others have fallen by the wayside.

The service sector, which includes businesses such as consulting firms, banks and transportation companies, has also been through a period of dramatic change. Spectacular advances in information and communication technologies have altered the service environment. Competition has increased. Customers are demanding a greater diversity of services, more flexibility and better quality. As in the manufacturing sector, some service enterprises have adapted; others have failed.

As we discussed in Chapter 1, managers in many organisations have responded to the changing business environment by adopting new management structures and practices. Concepts such as team-based structures, employee empowerment, enterprise resource planning systems, real-time reporting and continuous improvement have gained widespread acceptance. What has happened to management accounting during this period of change? Gradually, management accountants have become aware of the deficiencies in conventional approaches and a number of techniques have developed that are more suited to the changing needs of businesses, to help them create and manage value for both their owners and their customers. Many of these techniques are still not widely used in practice. However, it is important for you to understand them because they may gain popularity as more managers and management accountants become aware of the limitations of conventional management accounting systems. These new approaches can help to provide the information that managers need to make their businesses world-class.

We begin this chapter by identifying some of the problems with conventional costing systems. Activity-based costing has been one of the most significant responses to these problems. We introduced activity-based costing in Chapter 7 when we looked at alternative methods for allocating overhead costs to products at Hot Exhausts Ltd. However, there are different approaches to activity-based costing that suit particular cost structures and problems that businesses face. In this chapter we look at an actual implementation of activity-based costing at the South Australian foundry Mason & Cox, to explain the principles of activity-based costing and to describe a common approach to activity-based costing that provides useful information for cost management as well as product costing.[1]

The focus in this chapter is on using activity-based costing to assign costs to products. The role that activity-based costing (ABC) can play in managing resources is discussed in Chapter 15, where ABC is applied to the management of customers and suppliers and in Chapter 16, where the concept is extended to incorporate activity-based management. The broader implications of activity-based costing for making decisions to create value are dealt with throughout Part 4 of this book.

1 The Mason & Cox story is based on fact, although the characters are fictional, the analysis has been simplified and the numbers have been altered to maintain confidentiality. Mason & Cox was taken over by Hensley Industries (Australia Pty Ltd in 1999, which, in turn, was taken over by PAC Mining Pty Ltd in 2001. The foundry was closed in late 2003 when its Environmental Protection Authority licence expired.

PROBLEMS WITH CONVENTIONAL PRODUCT COSTING SYSTEMS

LEARNING OBJECTIVE 1

Many Australian businesses use conventional costing systems. However, since the early 1980s these systems have been widely criticised for failing to provide accurate product costs to inform management decisions. Activity-based costing has evolved as an alternative approach. Let's begin our study of activity-based costing by reviewing the key features of, and problems with, conventional costing systems.

FEATURES OF CONVENTIONAL PRODUCT COSTING SYSTEMS

conventional product costing system a product costing system that traces direct material and direct labour to products, and allocates manufacturing overheads to products using a predetermined overhead rate, which is usually based on a volume-based cost driver

Although **conventional product costing systems** vary from one business to another, they usually include the following features:

- Direct material and direct labour costs are traced to products.
- Manufacturing overhead costs are allocated to products using a predetermined overhead rate for the whole plant (or one for each production department).
- The manufacturing overhead rate is calculated using some measure of production volume—that is, using a volume-based cost driver.
- Non-manufacturing costs are not assigned to products.

In selecting an overhead cost driver we should ask: 'What causes, or drives, these manufacturing overhead costs?' There needs to be a strong correlation between the overhead costs and the cost driver to ensure that product costs are accurate—that is, that product costs do measure the cost of resources used to produce the product. However, most conventional costing systems *assume* that manufacturing overhead is driven by the volume of production, which is measured by output measures such as the number of units produced, or, more commonly, by input measures such as the number of direct labour hours worked, the direct labour cost, the number of machine hours worked or some measure of material inputs. Conventional product costing systems tend to aggregate the overhead costs into very large cost pools, sometimes with a separate cost pool for each department, but often with just one cost pool for the whole plant. Chapter 7 describes several conventional methods for allocating overhead costs to products.

FAILURE TO ADAPT TO THE CHANGING BUSINESS ENVIRONMENT

It is generally believed that the principles and practices of conventional costing systems were developed by the mid-1920s (Kaplan, 1984; Johnson & Kaplan, 1987). Chapter 1 describes the dramatic changes in the business environment since the 1980s. In many businesses, these changes have led to changes in the number of products, the types of production processes and the composition of costs, which are no longer compatible with assumptions underlying conventional approaches to product costing. The following 'Real life' indicates that by the late 1980s, managers in Australia were being frustrated by problems with conventional product costs. But what causes these problems?

Increasing levels of non-volume-driven manufacturing overhead costs

Conventional costing systems allocate manufacturing overhead costs to products, using volume-based cost drivers. However, fixed manufacturing overhead costs do not vary with production volume, although some of them do vary with other factors. That is, fixed overhead may be *non-volume driven*. Also, it is assumed that variable overhead costs vary *in proportion* to production volume. However, it is unlikely that a single cost driver (or even one cost driver in each production department) can explain the behaviour of all variable overhead costs, and while some of these costs may increase or decrease with production volume, they do not vary in proportion to volume change. In the past these problems have not always caused major

COST SYSTEMS HAVE GONE AWRY!

REAL LIFE

In 1992, Stewart Lamond, who was a partner with Coopers and Lybrand Consultants in Sydney, observed the following fundamental changes to the business environment: the development of the global marketplace, an increased customer focus on quality, increased price sensitivity, the effects of deregulation, and the 'technological explosion'. In his experience, 'Companies today have many questions to which they need answers, though usually they must seek answers from increasingly moribund traditional cost systems'. More than a decade later, these changes and outdated costing systems continue to present major challenges in many businesses.

Lamond noted a range of information needs not satisfied by current costing systems, including accurate estimates of the costs and profitability of goods and services. He described the experience of three Australian companies, Parke Davis, ICI Film Products and Comalco Rolled Products, in their search for better costing information. Each of these companies had identified a need for better product costing, in particular for better ways to allocate overhead.

Management at Parke Davis was concerned about the company's increasing level of overhead costs and its arbitrary allocation of overhead to products, which resulted in the costs of some products being understated and others overstated. ICI was troubled by product costs that were inconsistent with operations managers' views of actual costs. Products that the operations managers felt were unprofitable were reported in 'a favourable light' in the current costing system. Comalco's management faced the same sorts of problems. Their product costing system lacked credibility with managers and resulted in decisions that were inconsistent with the company's manufacturing strategy.

In many businesses, accurate product costs are essential to enable managers to make informed decisions, and relying on inaccurate costs may adversely impact on an organisation's competitiveness. Parke Davis, ICI and Comalco were amongst the companies that recognised, by the late 1980s, the problems that can arise from outdated costing systems.

Source: Lamond (1992)

distortions to product costs because non-volume-driven manufacturing overhead costs have been relatively insignificant. But is this still the case?

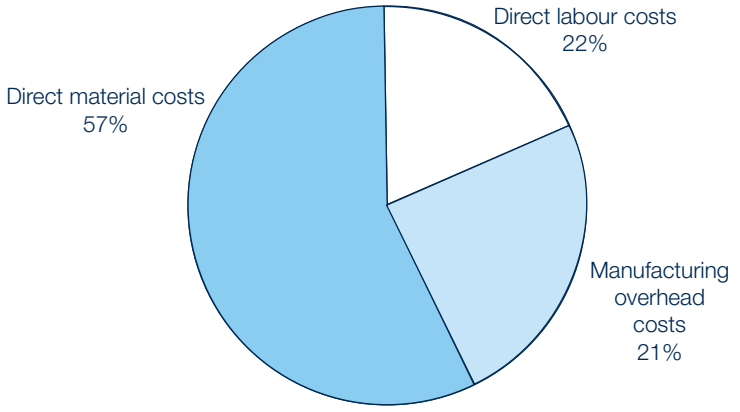
Exhibit 8.1 (overleaf) presents manufacturing cost information from a 1997 survey of Australia's 1000 largest manufacturers (Wijewardena & De Zoysa, 1999). Manufacturing overhead costs averaged 21 per cent of manufacturing costs, direct labour 22 per cent, and direct material 57 per cent, and survey respondents reported a trend of decreasing direct labour and increasing factory overhead costs. The 'machinery and computers' industry was the most overhead intensive (32 per cent of manufacturing costs) and 'food and beverages' the least overhead intensive (17 per cent). These results are consistent with a survey of Australian manufacturers in 1995, which found that manufacturing overhead costs accounted for 20 per cent of manufacturing costs, and the majority of these respondents also indicated that overhead had increased as a proportion of product cost over the previous five years (Booth & Giacobbe, 1997).[2]

Increasing proportions of non-manufacturing costs

Conventional product costing usually excludes non-manufacturing costs. However, many non-manufacturing costs can be related directly to products, and these costs have become a more significant proportion of total costs in many organisations. In today's environment of high technology, increased research and development, shortened product life cycles, increased

2 More recent information about the extent of overhead costs in Australian manufacturing businesses is not available. However, the increasing emphasis on computer integrated automation and the associated reduction in direct labour suggests that, in many businesses, manufacturing overheads are likely to be a significant cost.

Exhibit 8.1
Manufacturing costs in Australian businesses



Relative importance of material, labour and overhead costs

levels of customer support and substantial marketing costs, manufacturing overhead and non-manufacturing costs may account for a large proportion of a manufacturing entity's costs.

Causes of changes in costs

Although not clear-cut, the evidence does suggest that manufacturing overhead costs are increasing and becoming more non-volume-driven, and the proportion of non-manufacturing costs that are incurred to develop, support and promote products are becoming more substantial. What has caused these changes?

- Growing automation has certainly increased manufacturing overhead costs, relative to direct labour costs. Moreover, more machines implies more *non-volume-driven* overhead costs are incurred, such as depreciation, insurance and setups.
- Greater **product diversity** has caused increased production complexity and this has led to increased demand for manufacturing overhead support, such as production scheduling, material handling and production setups. The costs of many of these support functions do not vary in proportion to production volume. More product diversity has also increased costs in non-manufacturing areas such as research and development, product design, distribution and after-sales service.
- Increased customer demands for improved service and quality have resulted in increased manufacturing overhead and non-manufacturing costs (many of them not being driven by production volume).
- Many organisations are investing more resources in downstream areas such as customer service and marketing. The increase in customer service costs reflects an increasing emphasis on customer support. Increased marketing expenditure is also occurring as many firms engage in increased product promotion and advertising to position their products in the more aggressive market place.

product diversity the number of different products produced

Volume-based cost drivers do not drive many of the above costs, and therefore they are inappropriate to use in costing products. Yet, as discussed in Chapter 7, volume-based cost drivers are commonly used in Australian firms. Also, the wisdom of omitting, from product costs for management decision-making purposes, non-manufacturing costs that are product-related can be queried given their increased significance.

Changing product structures

The conventional approach to product costing did not cause too many problems when businesses produced a limited range of products. However, to remain competitive many

businesses have increased the number of different products they produce. Apart from its effects on the cost structure, product diversity causes cost distortions because conventional costing systems are not good at recognising different overhead consumption patterns for different products.

INDICATORS OF PROBLEMS WITH A PRODUCT COSTING SYSTEM

Conventional approaches to product costing are likely to result in inaccurate product costs when:

- proportion of direct labour costs decreases;
- proportion of manufacturing overhead costs increases;
- proportion of manufacturing overhead costs not related directly to production volume increases;
- non-manufacturing costs that are product-related become substantial; and
- product diversity increases.

Firms often experience these types of changes in the modern business environment, but how do they know when they need a new product costing system? Exhibit 8.2 outlines common indicators of an outdated product costing system.

Exhibit 8.2
Indicators of an outdated costing system

Indicator	Probable cause
■ Production managers want to drop products that the costing system claims are profitable	■ These products use more production resources than is indicated by their product cost
■ Profit margins on individual products are difficult to explain. For example, a product has a higher than expected cost, and lower margin	■ The product costing system is distorting the product's costs
■ Products that are difficult to make have high profit margins	■ The costing system understates the costs of making these products
■ Manufacturing and marketing managers develop their own 'private' systems for estimating product costs	■ Managers have lost faith in the 'official' product costing system
■ The management accountant spends a lot of time on special product costing studies	■ The costing system does not provide reliable information for product-related decisions
■ There are no competitors for products that the costing system claims are profitable	■ The costing system is understating the costs of these products
■ Competitors' prices appear unrealistically low	■ The costing system is overstating the costs of these products
■ Customers are not deterred by price increases	■ The costing system is understating the costs of these products. Competitors already charge higher prices
■ At year-end, actual overhead far exceeds overhead applied to products	■ Applying overhead to products, using the overhead application rate, understates the overhead resources consumed. Product costs are understated
■ The company consistently wins bids for products that are difficult to produce and loses bids for simple products	■ The costing system is understating the costs of complex products and overstating the costs of simple products

Source: Adapted from Cooper (1989)

When inaccurate product cost information is used by managers to make decisions, the effect on the business may be profound. The 'Real life' on page 365 provides some examples of firms that have had this unhappy experience.

PROBLEMS WITH COSTING IN SERVICE BUSINESSES

In Chapter 6 we noted the increasing size and importance of the service sector. There may also be problems with conventional costing systems in service enterprises. Many businesses do not estimate the costs of individual services, but those that do have tended to use business-wide volume-based overhead rates. As in the manufacturing sector, overhead costs have become increasingly important and increasingly non-volume driven.

In the service sector, customers are demanding a more diverse range of higher-quality services. Consider, for example, housing loans. There was once very little difference between the terms and conditions of housing loans offered by the various banks but, since the late 1980s, the range of housing loan packages has grown exponentially. Banks are seeking to differentiate their products by offering different establishment fees, different terms and flexible repayment plans. Moreover, the range of non-bank lenders in the housing market has increased dramatically. There is fierce competition over interest rates. These forces have had the same impact as in manufacturing: increased product diversity and increased overhead costs. Each of these products is part of a carefully devised marketing strategy, supported by detailed cost analysis. However, customer demands for service diversity and quality add to the level of non-volume-driven overhead costs and cast doubt on the accuracy of service costs derived from conventional costing systems. Clearly accurate costing can provide important information to assist those banks to achieve their strategies.

ACTIVITY-BASED COSTING

Activity-based costing (ABC) may be used to overcome the problems with conventional product costing systems. One Australian business that implemented activity-based costing was Mason & Cox Foundries. This foundry produced moulded metal equipment, called 'castings', for a wide range of local industries including mining, sugar refining, cement manufacture, and general engineering companies. It also produced for export markets. The company's major product lines included the 'Hensley' line of digging equipment, used in mining; the 'Canron' range of mining products; and custom-made castings.

PRODUCTION PROCESSES AT MASON & COX

To understand Mason & Cox's costing system, you need to be familiar with its production processes. Casting usually involves six main steps:

1. Product designs, called 'patterns', are drawn.
2. Moulds are built, based on the patterns.
3. The metal is melted and poured into the moulds.
4. When the metal has set, the castings are knocked out of their moulds and sent for finishing.
5. In finishing, the castings are smoothed. Any high spots are ground down, and hollow spots are welded up.
6. Last, the casting is heated.

PROBLEMS WITH THE CONVENTIONAL COSTING SYSTEM AT MASON & COX

By the early 1990s, Mason & Cox's management had become concerned about their product costing. The company used a conventional costing system. However, there were a number of managers at Mason & Cox who were sure that their product costs were inaccurate.

The product costs did not make sense to production managers

Joe Costello, the manufacturing manager, had no faith in the current system and selected two products to prove his point. Mason & Cox manufactured two types of 7.5 kilogram 'teeth' for digging up ground in the mining industry. The Hensley Tooth was one of their best sellers. It was made in batches of 250 and the company sold about 25 000 each year. The other type, a Custom Cast Tooth, was made specifically for Mount Isa Mines. It was made to order in batches of 50 about ten times a year. As shown in Exhibit 8.3, the existing conventional product costing system estimated that both these castings cost the same to produce—$36.32. Their direct costs were the same, because they used the same basic direct labour operations and the same direct materials. Manufacturing overhead was applied on direct labour hours, so they both had the same amount of applied overhead.

Yet Costello was certain that the Hensley Tooth could not cost the same as the Custom Cast Tooth. Many overhead services were provided for individual batches and, as the Custom Cast Tooth was made in much smaller batches, Costello felt that its overhead cost *per unit* should be higher. Also, the Hensley Tooth was simple to make, while custom-made products were generally more complex. For these reasons, each Custom Cast Tooth required a lot more overhead support, yet none of this showed up in its conventional product cost. This was not an isolated case. Costello was sure that the conventional product costing system was overstating the cost of the company's popular products, the high-volume lines, and understating the cost of the minor products, the low-volume lines.

Product profit margins were difficult to explain

The marketing people at Mason & Cox were also perplexed. The company had set its prices at the conventional product cost plus some 'markup', but the marketing manager, Danny

Exhibit 8.3
Conventional product costs at Mason & Cox

7.5 kg Hensley Tooth		
Direct material (metal and sand)		$12.00
Direct labour:		
Moulding (4 minutes @ $0.33 per minute)	1.32	
Metal melting (6 minutes @ $0.50 per minute)	3.00	
Finishing (20 minutes @ $0.30 per minute)	6.00	10.32
Manufacturing overhead:		
(0.5 direct labour hours @ $28 per hour)*		14.00
Product cost (DM, DL and MOH)		$36.32

7.5 kg Custom Cast Tooth		
Direct material (metal and sand)		$12.00
Direct labour:		
Moulding (4 minutes @ $0.33 per minute)	1.32	
Metal melting (6 minutes @ $0.50 per minute)	3.00	
Finishing (20 minutes @ $0.30 per minute)	6.00	10.32
Manufacturing overhead:		
(0.5 direct labour hours @ $28 per hour)*		14.00
Product cost (DM, DL and MOH)		$36.32

* Manufacturing overhead rate
= budgeted manufacturing overhead ÷ budgeted direct labour hours
= $4 880 000 ÷ 174 285 DLH
= $28 per direct labour hour

Harris, was not able to make any sense of these prices. To compete in the marketplace, Harris had found he had to cut the price of the high-volume lines like the Hensley Tooth. But with speciality products like the Custom Cast Tooth, a low-volume line, they had seemed able to charge well above the cost-based price.

Company profits were being eroded

Roy Kidman, the managing director, was also far from pleased because company profit was not meeting monthly targets. The price cuts on the high-volume lines had increased sales volume but eroded total sales revenue. The better-than-expected prices on the speciality products had not offset the poor performance of the high-volume lines.

CAUSES OF THE PROBLEMS WITH THE CONVENTIONAL COSTING SYSTEM

Eventually, Costello and Harris tackled the accounting manager, Olivia Shannon, who recognised these problems as classic indicators of an outdated costing system. Mason & Cox's costing system was developed in the 1920s and had changed little since then, despite:

- product range becoming far more diverse;
- manufacturing overhead increasing significantly, relative to direct costs, and becoming more non-volume driven; and
- non-manufacturing costs, which were product-related, increasing, relative to manufacturing costs.

Using a volume-based cost driver

Mason & Cox's product costing system had used direct labour hours, a measure of production volume, as a cost driver to apply manufacturing overhead costs to products. Yet an analysis of the company's manufacturing processes indicated that a significant part of the overhead costs was caused by factors other than production volume. For example, some of the overhead costs, such as setup costs, were incurred for each production batch regardless of the number of castings in the batch. Others, such as factory rent, were incurred each month regardless of the number of castings produced. Still others were caused by product complexity.

OUTDATED COSTING SYSTEMS IMPLY DISTORTED PRODUCT COSTS

What did this mean for the product costs at Mason & Cox? Earlier in this chapter we warned that conventional costing systems are not suited to businesses where product diversity has increased and cost structures have become more overhead-intensive, and where a higher proportion of the overhead costs are fixed costs. Under these circumstances, the costs of high-volume, relatively simple products produced in large batches are likely to be overstated, and the costs of low-volume, speciality products produced in small batches are likely to be understated. Indeed, this seemed to have happened with the Hensley Tooth and the Custom Cast Tooth.

In addition, Olivia Shannon was concerned about the non-manufacturing costs. She felt that product-related costs were not confined to the manufacturing area but were spread right across the value chain. Over time, non-manufacturing costs, both upstream and downstream, had grown. Many of them, such as product design and development costs and advertising costs, *were* related to particular products and were used disproportionately by different products. Yet, as shown in Exhibit 8.4, like many other conventional costing systems, the Mason & Cox system had not assigned these costs to product. Instead, all non-manufacturing costs were expensed in the period in which they were incurred. How could management have made rational decisions about which products to produce, and what prices to set, if these product-related costs were ignored?

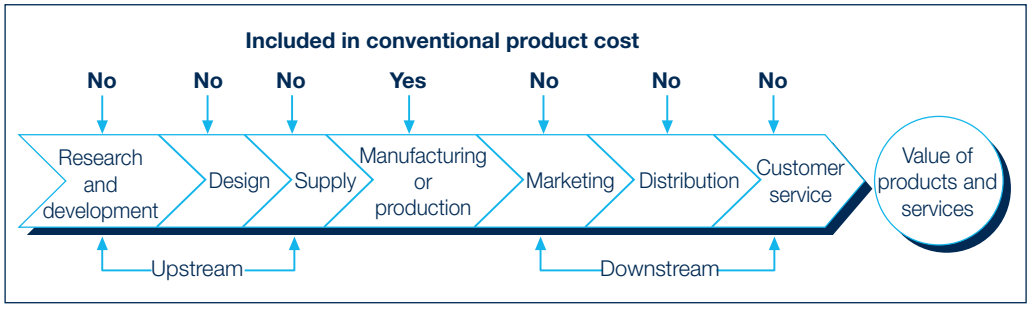


Exhibit 8.4
The value chain and conventional product costing

THE SOLUTION: ACTIVITY-BASED COSTING

Shannon had heard about activity-based costing, which has the potential to overcome many of the problems that occur with conventional costing systems. **Activity-based costing (ABC)** is a methodology that can be used to measure both the cost of cost objects *and* the performance of activities. It evolved in the mid-1980s to improve the allocation of manufacturing overhead costs to products, but it soon became apparent that activity-based costing systems could be expanded to include non-manufacturing costs.

activity-based costing (ABC) a methodology that can be used to measure the cost of cost objects and the performance of activities

From the early 1990s, many companies, including some of Australia's icons (as described in the 'Real life' overleaf), have come to realise that activities that form the basis of activity-based costing are more than mechanisms for costing products. They can be used to analyse the profitability of major customers and they provide a logical framework for managing the business through the identification and analysis of key activity characteristics such as root cause cost drivers and performance measures. We consider this broader role for activity-based costing in Chapters 15 and 16.

AN ACTIVITY-BASED COSTING MODEL

3 LEARNING OBJECTIVE

In learning about activity-based product costing, Shannon had felt overwhelmed by the many new terms she encountered.[3] The model shown in Exhibit 8.5 (overleaf) helped her to come to grips with the mechanics of activity-based costing.

The model shows that activity-based costing can be used for two purposes: costing and activity management.

COSTING VIEW

The vertical, costing view shows how activity-based costing can be used to estimate the cost of products.

Step one: Measuring the costs of activities

The first step is to measure the cost of the resources used to undertake each activity. An **activity** is a unit of work performed within the organisation—that is, activities are the 'things that are done' within the business. Common activities in the manufacturing area of Mason & Cox included 'Set up machine', 'Operate machine', 'Move material' and 'Inspect parts'. To determine the total cost of each type of activity, *resource drivers* are used to assign costs to separate cost pools for each activity. The costs of the resources are already recorded in the existing accounting system and include items such as wages, supplies and utilities costs. **Resource drivers** are cost drivers used to estimate the cost of resources consumed by an activity. Remember, **cost drivers** are factors or activities that cause costs. For example, factory area may be a cost driver for factory cleaning costs—the bigger the factory, the higher the costs of

activity a unit of work performed within the organisation

resource driver a cost driver used to estimate the cost of resources consumed by an activity

cost driver a factor or activity that causes a cost to be incurred

3 The terminology used in this section is based on: Raffish & Turney, 1991 and Turney, 1992.

REAL LIFE

ABC IN SOME AUSTRALIAN ICONS

We discuss costing at R.M. Williams in Chapter 10, when we describe standard costing. R.M. Williams is a successful designer, manufacturer and retailer of boots, clothing and accessories, initially for 'people from the bush', but over time the company has become an Australian icon, with a high profile both in Australia and overseas.

R.M. Williams

With help from a federal government industry assistance program, the company revisited the way it costed some of its key products, using activity-based costing to help to ensure maximum profitability from each major product group. In addition to providing more accurate product costs, R.M. Williams found that activity-based costing (ABC) enabled the company to identify what drives costs and to strive for future savings.

Telstra is the major provider of telecommunications services in Australia. In the early 1990s, the company completed a major review of its costing system. It discovered that managers were uncertain about product and process costs, overheads were allocated to products by algorithm, and too many decisions were based on gut feeling rather than on reliable costing information. As a consequence, Telstra was unable to identify the costs of changes in strategic direction and was at risk of making uncompetitive and inappropriate decisions. Telstra needed a costing system that would give the organisation better information for decision making, including more accurate product and process costs. It achieved this by implementing activity-based costing.

In describing real-life experiences with cost drivers in Chapter 3, we introduced you to Holden Engine Company (HEC), located at Fishermans Bend in Victoria. Holden Engine Company manufactures a range of engines and components for local and overseas vehicle manufacturers. The company had operated as a division of GM Holden, and when it was established as a separate company in 1986, it maintained its conventional approach to product costing. Manufacturing overhead was allocated to products on the basis of direct labour hours.

In that era at Holden Engine Company overheads represented 40 per cent of manufacturing cost, while direct labour was only 5 per cent. The company produced a diverse range of products that had varying levels of complexity. Production volume, machine cycle time and batch size differed significantly between products.

By 1990 the company was struggling. Profitability had declined and there was a possibility that subsidies from its parent company, General Motors Overseas Corporation, would cease. As part of the strategy for survival, HEC decided to build parts for car makers other than GMHA, but to do this the company needed more accurate information about product costs and product profitability, as well as better information for cost management. The solution for HEC was to introduce ABC.

Activity-based costing has also been used by the National Roads and Motorists' Association (NRMA) in New South Wales and, according to one published report, with great success. NRMA accounting staff identified a number of deficiencies in their management accounting system, particularly the 'blanket' overhead allocation rates, which simply spread high administrative costs across all types of services. This approach could not supply accurate service costs.

Activity-based costing was used to cost NRMA's services. The impact was dramatic, with all services altering their relative cost/profit positions. In addition, ABC was used for activity management, which enabled management to identify the costs of non-value-added activities and the impact of their total quality management (TQM) program.

From mid-1998, the Group Costing unit of Commonwealth Bank of Australia began transforming the Bank's approach to costing and cost management. Their first project focused on developing activity-based costing, which provided detailed information about processes, products and customer segments, across the entire bank.

Sources: www.isr.gov.au/industry/tcf/cs2000/case_studies/rm_williams.html (2000); Newbould (1998); Chenhall & Langfield-Smith (1999); Vogel & Crossley (1992); www.agility.com.au/clienttestimonials/text.html (2004)

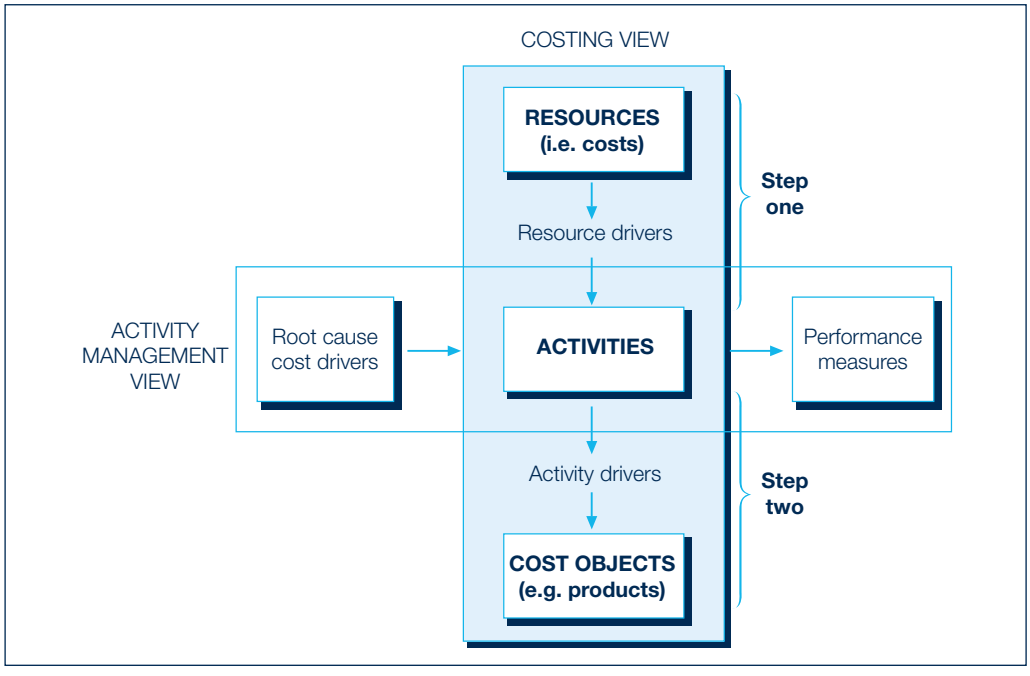


Exhibit 8.5
An activity-based costing model
Source: Turney (1991)[4]

cleaning. The 'Real life' (overleaf) describes how the police in a number of Australian states have identified the costs of various policing activities.

Step two: Assigning activity costs to products

The outcome of Step one is a list of the activities performed in the business, and total activity costs. The second step is to calculate the cost per activity and to assign these activity costs to cost objects using *activity drivers*. An **activity driver** is a cost driver used to estimate the cost of an activity consumed by the cost object. For example, the number of setups might drive the cost of the activity 'Set up machine'. The more times the machine has to be set up, the higher the total cost of the setup activity. A product that uses two setups will be assigned twice as much in setup costs as a product that uses only one setup. A **cost object** is any item for which management wants a separate measure of cost. Products, services, customers, suppliers, contracts and projects are examples of cost objects. In Chapter 15 we describe how activity-based costing can be used to estimate the costs associated with customers and suppliers. At Mason & Cox, the activity-based system was used to estimate the costs of the products. Step two produced a total cost for each product that consisted of a list of the activities used by the product and their costs.

activity driver a cost driver used to estimate the cost of an activity consumed by the cost object

cost object an item that is assigned a separate measure of cost

ACTIVITY MANAGEMENT VIEW

The horizontal, activity management view shows how activity-based information can be used to monitor and control what is happening in a business. In addition to analysing activity costs, the activity management view provides information about the root causes of activities, their value to customers, and various measures of their performance. This can provide an effective way of managing (or controlling) costs, as well as managing other sources of customer value such as quality and timely delivery. Mason & Cox actually used activity-based costing to cost

4 Adapted from page 96 of *Common Cents: The ABC Performance Breakthrough* by Dr Peter B.B. Turney, president and CEO of Cost Technology Inc., a management consulting firm specialising in ABC/ABM implementations, Cost Technology Inc., Beaverton, Oregon, 1991. Reprinted by permission of the publisher. All rights reserved.

REAL LIFE

IDENTIFYING AND MEASURING POLICE ACTIVITIES

In the past, little attention has been paid to the resources consumed by various policing activities. Since the late 1990s, the police in a number of Australian states and in New Zealand have implemented an activity measurement project to identify the key activities performed and their costs. The methods used to collect activity data have varied among jurisdictions. In South Australia, police officers were required to fill in a survey form every 15 minutes across each shift during a survey period of two weeks. The list of activities included in the survey was based on those identified in other Australian jurisdictions. A total of 126 activities were identified for general policing, including 'community patrols', 'police station services', 'traffic policing', 'traffic crash investigation', 'targeting illegal drug activity' and so on.

Police on duty at the Sydney 2000 Olympics

The activity-based data provides information for cost management, particularly when benchmarked against other jurisdictions. For example, a recent national report found that the South Australian police spent a higher proportion of their time on 'crime investigation' than other states; the Australian Capital Territory police spent most resources on 'community safety and support'; Victoria spent most on 'road safety and traffic management'; and the Western Australian police spent most on 'services to the judicial process'.

Activity information can also be used to estimate the costs of major programs. For example, the National Drug Law Enforcement Research Fund supported an activity-based study of the cost of police activities associated with alcohol-related crime in New South Wales. Based on a survey of time spent, the major activities involved responding to alcohol-related assault incidents, random breath testing and paper-work. This study found that policing alcohol-related activities cost the NSW government almost $50 million in 2005.

Source: Dadds & Scheide (2000); Donnelly et al. (2007)

products and to manage activities, but at this stage we will focus on the product costing. In Chapter 16 we will look at how Mason & Cox also used their activity-based system for activity management.

THE NATURE OF THE COST DRIVERS

root cause cost drivers the underlying factors that cause activities to be performed and their costs to be incurred

By now you will have noticed that ABC uses cost drivers in three different ways. Cost drivers called *resource drivers* are used to assign costs to activities. Cost drivers called *activity drivers* are used to assign activity costs to cost objects. And, as Exhibit 8.5 shows, cost drivers called *root cause cost drivers* are used for activity management. They are called **root cause cost drivers** because they describe the primary reason that the activity is performed. Different names are used for each of these cost drivers because they each play a different role in activity-based costing.

INITIAL DECISIONS ABOUT ABC AT MASON & COX

4 LEARNING OBJECTIVE

The starting point for any ABC implementation is to identify the problem that needs to be addressed. Shannon identified the main problem that the company was facing as distorted

product costs. She assessed three possible activity-based approaches that could be used to tackle this problem:

1 simple activity-based product costing system, which allocates manufacturing overhead costs to products;
2 activity-based product costing system for indirect costs, which allocates manufacturing overhead costs and non-manufacturing costs to products; and
3 comprehensive activity-based system for allocating all costs (except direct material) to products and for activity management.

The report she prepared for Kidman is shown in Exhibit 8.6. It demonstrates that the more inclusive the system, the greater are both the costs and the benefits.

In Chapter 7 we described three approaches to allocating *manufacturing overhead costs* to products. It is useful to think of each of these approaches as part of a continuum of costing systems, with both the accuracy of product costs and the complexity of the costing system increasing as we move along the continuum.

- The simplest and least accurate approach is to use a *plantwide overhead rate*, where all manufacturing overhead costs are accumulated in a single cost pool and allocated to products using a single volume-based cost driver.

Exhibit 8.6

Evaluation of activity-based costing for Mason & Cox

To: Roy Kidman, Managing Director
From: Olivia Shannon, Accounting Manager
RE: Evaluation of activity-based costing

I have had a look at activity-based costing. This is a tricky area because there are a number of different approaches that we could use. Since we have a serious problem with product costing, I have evaluated the simplest approach to activity-based product costing and then looked at two refinements. I have summarised my findings in the accompanying table.

		Evaluation	
ABC approach	**Costs included**	**Benefits**	**Costs**
1 Simple activity-based product costing system*	■ Manufacturing overhead	■ Product costs more accurate than existing system	■ More complex than existing system because more thorough analysis of manufacturing overhead
2 Activity-based product costing system for indirect costs	■ Manufacturing overhead and non-manufacturing costs	■ Product costs more accurate than simple ABC system as it covers wider range of costs	■ More complex than simple ABC system because wider range of costs analysed
3 A comprehensive ABC system for product costing and activity management	■ All costs, except direct material costs	■ Accurate product costs as full range of costs covered ■ Improved management of costs and performance in other strategic areas	■ More complex than including just indirect costs because an even wider range of costs is analysed and the costs are analysed in more detail

* This approach is described in Chapter 7 and the appendix to this chapter.

- *Departmental overhead rates* are more accurate than a plantwide rate, but also more complex as manufacturing overhead costs are accumulated into a separate cost pool for each production department, and each cost pool has its own volume-based cost driver.
- *Activity-based costing* further increases the accuracy and complexity of allocating manufacturing overhead costs to products. Manufacturing overheads are accumulated in a separate cost pool for each activity, and each activity has its volume- *or* non-volume-based cost driver.

Now in this chapter we have introduced two refinements to activity-based costing that expand the possible range of costs to include:

- non-manufacturing overheads; and
- direct labour costs.

While Shannon and Kidman could not have predicted the actual levels of costs and benefits identified in Exhibit 8.6 (see page 375), they felt intuitively that, at Mason & Cox, the best solution was to adopt an ABC system that could be used first for product costing, and then at a later stage for activity cost management. Thus, a comprehensive ABC system was implemented. This involved higher costs in designing, implementing and maintaining the system, but provided more accurate product costs and improved information for cost management.

WHICH COSTS SHOULD BE INCLUDED IN THE ABC SYSTEM?

Although activity management is not discussed until Part 3 of this book, it is important to understand that the decision to include activity management in its ABC system influenced the range of costs analysed by Mason & Cox. Direct labour, manufacturing overhead and non-manufacturing costs were analysed so that management could obtain useful information for *managing activities* right across the business. Also, the system was built around a long and detailed list of activities. If a simple product costing system had been chosen instead, the structure would have looked quite different. It would have covered manufacturing overhead costs only, and would have been based on a relatively short list of broadly defined overhead activities. You have encountered this simpler approach to ABC in the Hot Exhausts Ltd case study in Chapter 7, and it is described in more detail in the appendix to this chapter. Ultimately, the range of costs included in an activity-based system depends on its purpose, which, in turn, depends on the needs of the organisation.

Direct material costs were not included in the Mason & Cox ABC system. As in most organisations, the Mason & Cox's existing accounting system provided accurate estimates of direct material costs, so Shannon saw no real benefit in putting them through the activity-based system.

USING THE ABC MODEL FOR PRODUCT COSTING AT MASON & COX

5 LEARNING OBJECTIVE

In the activity-based costing model described in Exhibit 8.5 (see page 373), the costing view is used to cost products. There are two steps: measuring the cost of activities and assigning activity costs to cost objects or products. We will describe how Shannon worked through these two steps by analysing the costs and activities for the year.

STEP ONE: MEASURING THE COSTS OF ACTIVITIES

In the first step, the costs of resources are assigned to activities. This process can be simplified by using activity centres: costs are assigned to activity centres and then to activities.[5]

5 Activity centres receive inconsistent treatment in the literature. Brimson, 1991, and O'Guin, 1991, use them in this manner. In contrast, Turney, 1991, uses activity centres to aggregate activities within processes or functions for reporting purposes.

Assigning costs to activity centres

Shannon began by dividing the company into activity centres. An **activity centre** consists of a work area in which the activities have a common purpose. The types of activity centres vary from one organisation to another. At Mason & Cox, there were nine activity centres: 'Corporate management', 'Administration', 'Sales and dispatch', 'Factory management', 'Pattern design', 'Moulding', 'Metal melting', 'Finishing' and 'Quality control'.

activity centre a work area in which the activities have a common purpose

Next, Shannon assigned costs to each activity centre using resource drivers. The costs included all direct labour, manufacturing overhead and non-manufacturing costs for the past year and totalled $11.13 million. They were drawn directly from the general ledger accounts. Where costs were of a similar nature and driven by the same resource driver, Shannon combined them into a single cost category to simplify the allocation process. For example, rent, insurance, council rates and cleaning costs were combined as 'building costs'. This approach enabled Shannon to reduce the relatively large number of general ledger accounts to six cost categories: 'Wages', 'Depreciation', 'Consumables', 'Energy', 'Building costs' and 'Other costs'.

You will remember that a *resource driver* is a cost driver used to estimate the cost of resources used by an activity. It can also be used to estimate the cost of the resources used by an activity centre. Resource drivers often include the sorts of cost allocation bases used to assign indirect costs to responsibility centres, as described in Chapter 7, such as floor area, number of employees and various measures of direct inputs used. Some costs can be traced directly to activity centres rather than allocated, for example the wages of the people who work in a particular activity centre.

Exhibit 8.7 (overleaf) shows how Shannon assigned the costs to the nine activity centres, and the resource drivers used. Let's look at the costs of the Administration Centre. She identified the employees who worked in the Administration Centre and, using payroll records, estimated their wages and related on-costs at $800 000. She prepared a list of the equipment in the Administration Centre and identified depreciation expenses of $40 000 for that equipment. She reviewed the order forms for consumables and compiled a list of the orders from Administration; they totalled $50 000. She measured the floor space occupied by the Administration Centre and allocated building costs of $10 000 on that basis. Finally, she spread the 'Other costs' in proportion to the number of employees working in each centre, and Administration was assigned $7000. Exhibit 8.7 (overleaf) shows only the costs assigned to the Administration Centre, but exactly the same procedures were used to assign costs to the other eight centres.

Identifying and costing the activities performed in each activity centre

Once the activity centres had been costed, Shannon needed to assign the activity centre costs to activities. She interviewed representatives from each activity centre to identify activities and their resource drivers. While some activities may be common to most organisations, many of them will be specific to individual businesses.

Let's look at the method that Shannon used for developing the cost pool for the activity 'Process receivables' in the Administration Centre. This is illustrated in Exhibit 8.8 (see page 379). The wages assigned to Administration in Exhibit 8.7 were $800 000. The interviewees from Administration estimated that the employees within the centre spent 22 per cent of their time processing receivables, so 22 per cent of the wages cost ($176 000) was assigned to 'Process receivables'. The depreciation costs for the Administration Centre were $40 000, which related to the Centre's 10 computer terminals. One of the terminals was used exclusively and another was used about half of the time to process receivables, so 15 per cent of the *depreciation* costs ($6000) were assigned to the activity 'Process receivables'. To understand how the remaining costs were assigned to the activity 'Process receivables', review the costs assigned to the Administration Centre and the resource drivers shown for each cost in Exhibit 8.8 (see page 379). While we describe 'Process receivables' as an activity, some businesses refer to activities as cost pools, reflecting the fact that a number of costs have been pooled to estimate the cost of an activity.

Exhibit 8.7

Assigning costs of resources to activity centres at Mason & Cox

* Energy used by Administration Centre was minimal.

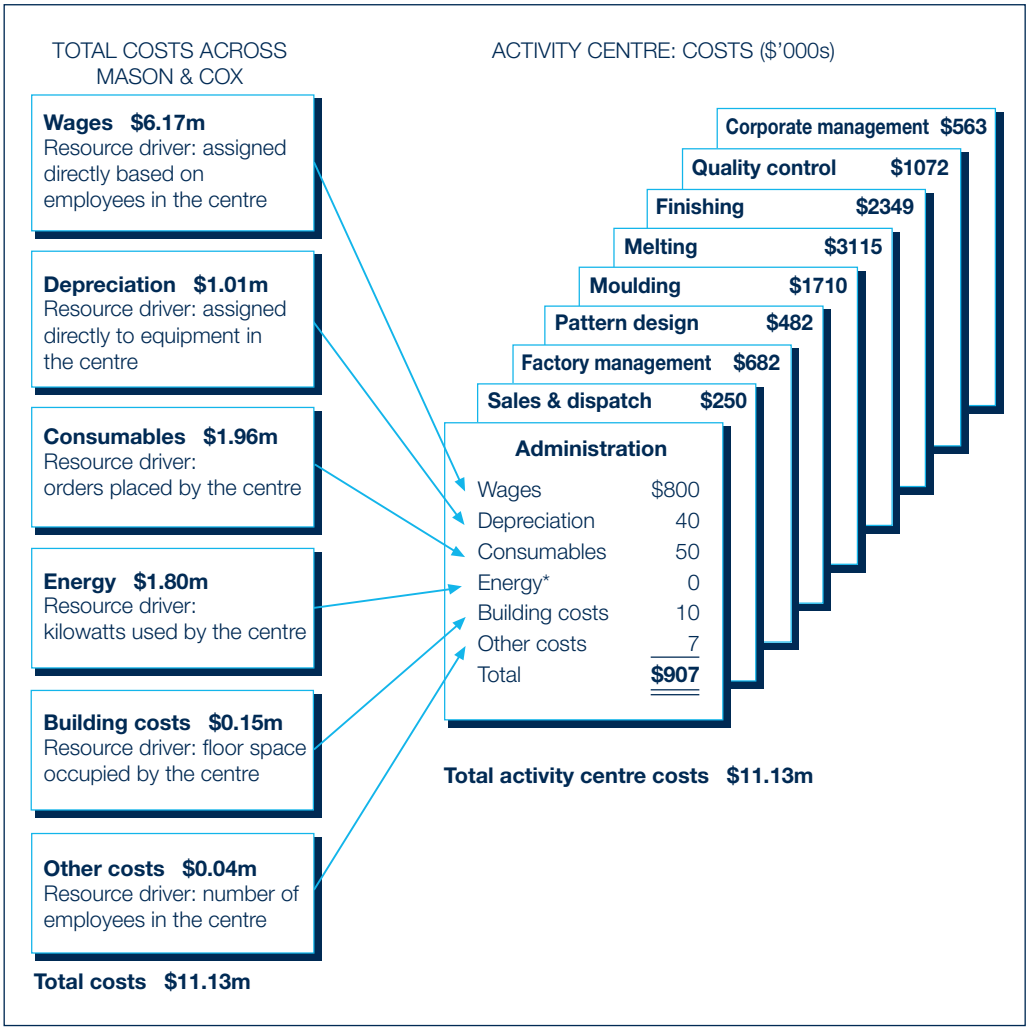


Exhibit 8.8 shows the costs of only one activity, 'Process receivables', in one activity centre, Administration. However, the same procedures were used to cost the other activities in the Administration Centre and in the eight other centres.

Once the interviews were complete, Shannon was able to compile a list of all the activities performed at Mason & Cox and their estimated cost. The costed activities became the basic building blocks for the product costing system.

While the activities of a foundry may seem quite foreign to you, the 'Real life' (overleaf) deals with more familiar territory, describing the resources and activities used by an Australian university to estimate the costs of its courses and programs.

STEP TWO: ASSIGNING ACTIVITY COSTS TO PRODUCTS

According to the model shown in Exhibit 8.5 (see page 373), the second step of activity-based product costing is to assign activity costs to products. This involves estimating the cost per unit of activity driver for each activity, and then preparing a bill of activities for each product.

Calculating the cost per unit of activity driver

When interviewees identified activities in the previous step, they also identified activity drivers for each activity. You will remember that an *activity driver* is a cost driver used to estimate

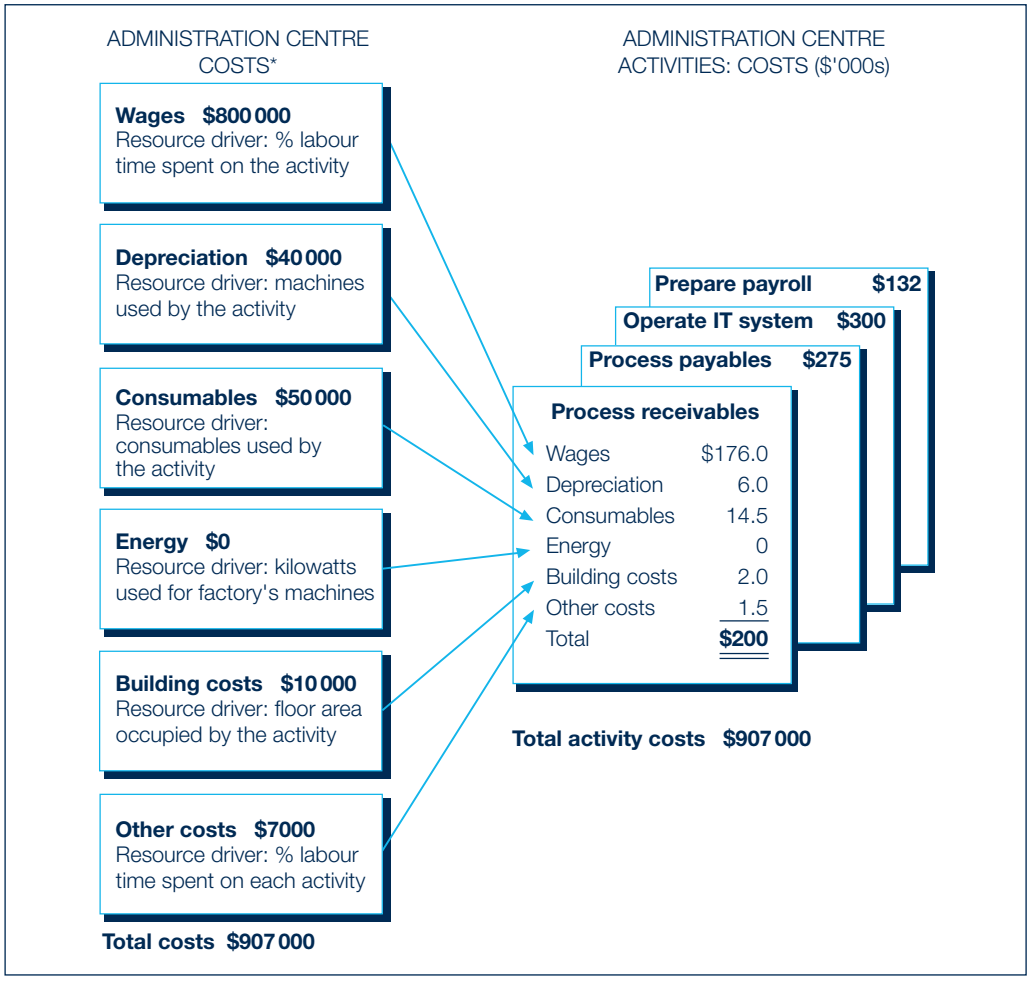


Exhibit 8.8

Assigning activity centre costs to activities at Mason & Cox

* See Exhibit 8.7.

the cost of an activity consumed by the cost object—in this case, products. For example, the 'number of invoices processed' is an activity driver for the activity 'Process receivables'. It can be used to assign the cost of the activity 'Process receivables' to all the products that involve receivables. In selecting an activity driver, there must be a linear relationship between the activity costs and the activity driver, otherwise the cost of the cost object will be distorted. For example, when we select the number of invoices as the activity driver, we are saying that twice as many resources are used to process two invoices as are used to process one invoice.

Shannon obtained estimates of the quantity of activity driver for each activity for the year so that she could calculate the **cost per unit of activity driver**. Some businesses use the term *cost pool rate* to describe the cost per unit of activity driver, reflecting the fact that an activity is a cost pool.[6] The activities, costs and activity drivers are shown in Exhibit 8.9 (overleaf).

cost per unit of activity driver the total cost of an activity divided by the quantity of its activity driver

A careful examination of Exhibit 8.9 shows that there are three main types of activity driver:

6 Because each product may consume a large number of activities, some ABC systems include an intermediate step where individual activities are combined into larger homogeneous 'activity cost pools'. The aim is to reduce the complexity of the costing system by reducing the number of 'activities' and therefore the number of activity drivers. To be aggregated into a larger cost pool, activities must share a common activity driver. Shannon chose not to use these larger 'activity cost pools'.

Exhibit 8.9

Activities and activity costs per unit of activity driver, Mason & Cox

Activity centres and activities	Activity cost ('000s)	Activity driver	Quantity of activity driver	Cost per unit of activity driver
Corporate management				
Manage business (CEO and Board)	$471	None available	Facility activity	
Prepare annual accounts	92	None available	Facility activity	
	563			
Administration*				
Process receivables	200	No. of invoices	5000	$40
Process payables	275	No. of purchase orders	2500	110
Operate IT system	300	No. of minutes CPU time	100000	3
Prepare payroll	132	No. of payslips	3385	39‡
	907			
Sales & Dispatch				
Process sales order	**250**	No. of sales orders	2500	100
Factory management				
Program production	262	No. of production runs	1000	262
Expedite orders	220	No. of expedited batches	500	440
Manage plant	200	No. of production man-hours	100000	2
	682			
Pattern design				
Design method	357	Direct assignment†		
Issue pattern	125	No. of patterns issued	1000	125
	482			
Moulding				
Make CT moulds	810	No. of man-hours	40500	20
Make job moulds	480	No. of man-hours	24000	20
Move material	420	No. of moves	10000	42
	1710			
Melting				
Pour metal	**3115**	No. of kilograms	778750	4
Finishing				
Grind castings	560	No. of man-hours	16000	35
Weld defects	377	No. of man-hours	13000	29
Set up heat treat furnace	332	No. of setups	1000	332
Operate heat treat furnace	1080	No. of kilogram-hours	540000	2
	2349			
Quality control				
Inspect moulds	300	No. of moulds inspected	60000	5
Inspect castings	220	No. of castings inspected	20000	11
Preventative maintenance	552	No. of machine-hours	14525	38
	1072			
Total costs	**$11130**			

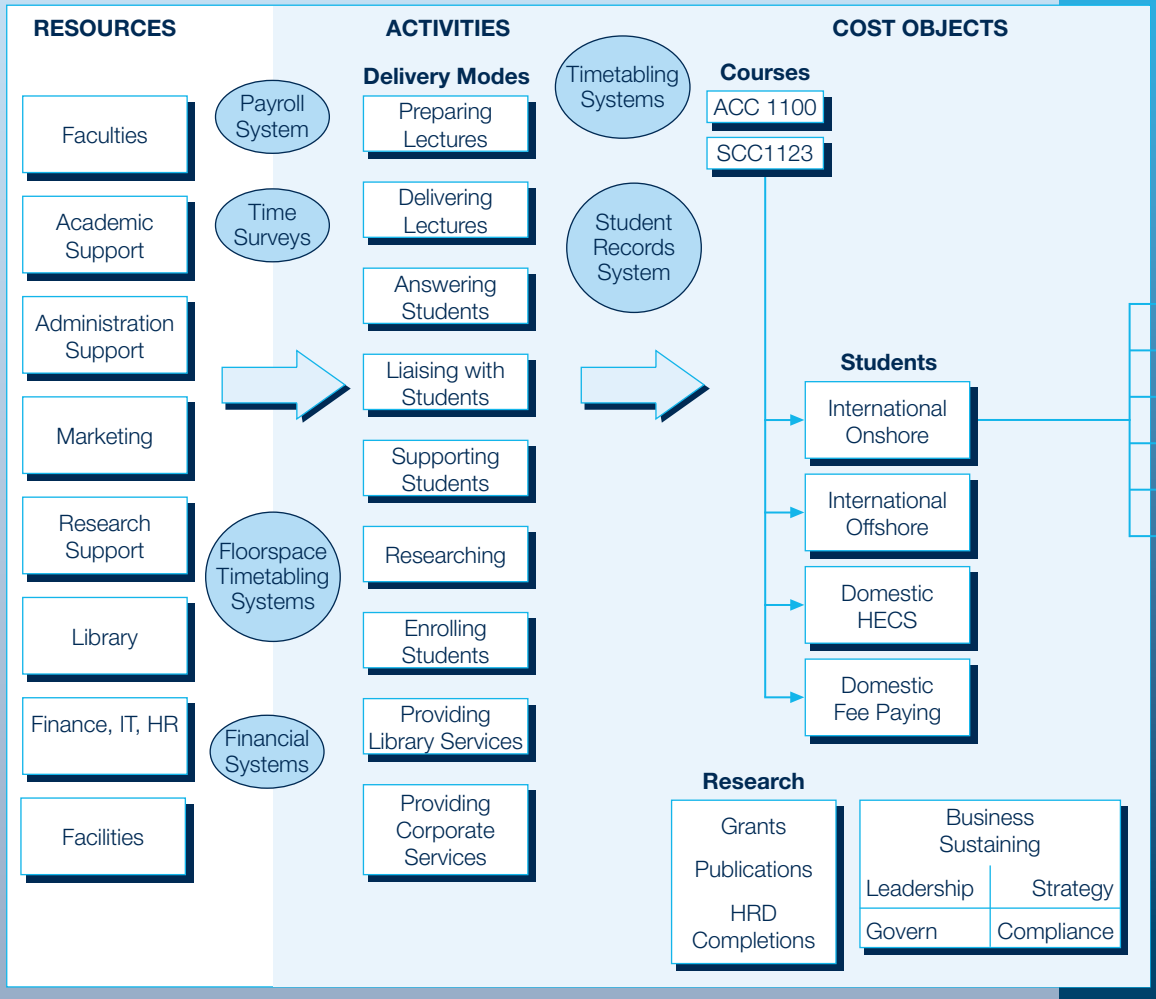
* See Exhibit 8.8 on page 379.
† The costs of 'Design method' was assigned directly to individual products based on their consumption of these activities.
‡ Rounded

ABC IN AUSTRALIAN UNIVERSITIES

REAL LIFE

In 1998, the Department of Education, Training and Youth Affairs (DETYA) commissioned the multinational accounting firm, Ernst & Young, to develop an ABC methodology for Australian higher education institutions. In 2000, the University of Newcastle conducted a pilot study, focusing on library costs. Since then, other universities that have used ABC include RMIT, University of Technology Sydney, University of Wollongong, University of Queensland, University of Western Australia, Edith Cowan University, University of South Queensland (USQ) and Northern Territory University.

What would an ABC system look like for a university? The diagram below describes USQ's ABC system. University of South Queensland wanted to estimate the costs and contribution of each delivery mode (e.g. class room, online and distance education), course, program, department and faculty.



Sources: Ernst & Young (1998); Ernst & Young (2000); Department of Education, Training & Youth Affairs (DETYA) (2001); Jackson (2001); Ellis-Newman (2003); Agility Consulting (2002 & 2005)

1 *Physical volume*, such as the number of kilograms for the activity 'Pour metal'.
2 The *number of transactions*, such as the number of setups for the activity 'Set up heat treat furnace'.
3 *Time duration*, such as the number of man-hours for the activity 'Make CT moulds'.

In addition, the costs of some activities, such as 'Design method', relate to specific products and can be assigned directly to those products.

Preparing a bill of activities for each product

bill of activities a report identifying the activities, the cost per unit of activity driver, the quantity of activity drivers consumed and, therefore, the cost of the activities consumed by a product

Next, Shannon prepared a **bill of activities** for each major product, which identified the activities, the cost per unit of activity driver, the quantity of activity drivers consumed and, therefore, the cost of the activities consumed by the product. The bills of activities for the Hensley Tooth and the Custom Cast Tooth are shown in Exhibit 8.10 (overleaf).

The activity-based product costs

The activity-based product costs for the Hensley Tooth and the Custom Cast Tooth are shown in Exhibit 8.10. The Hensley Tooth now has an estimated cost of **$29.01** per unit. The direct material cost, which was drawn from the conventional costing system, remains at $12.00 per unit. The remaining $17.01 reflects the estimated cost of all the activities consumed in designing, producing and selling one Hensley Tooth. The Custom Cast Tooth now has an estimated cost of **$76.78** per unit, of which $12.00 is the direct material cost and $64.78 is the cost of activities.

Where did Shannon get these numbers from, and what did they mean? Let's focus on the cost of the Hensley Tooth. Over the year, the Hensley Tooth was produced in 100 batches of 250 units to meet the required annual volume of 25 000 units. Exhibit 8.10 (overleaf) shows the cost of producing the annual volume of 25 000 units. For each activity, the annual cost is the cost per unit of activity driver, multiplied by the quantity of activity drivers consumed in producing and selling the Hensley Tooth over the year.[7] The unit cost is the annual cost divided by the number of units, 25 000, produced over the year.

As you examine Exhibit 8.10 (overleaf) you may notice that the quantity of activity drivers consumed by a product depends on whether the activity is performed for each unit, batch, or entire product line. (You may remember that we introduced the concept of unit, batch, product and facility level activities in Chapter 3, when discussing cost drivers.) For example, the activities 'Program production' and 'Set up heat treat furnace' are **batch level activities**, as they were performed for each batch of castings. In contrast, activities such as 'Inspect moulds', 'Inspect castings' and 'Pour metal' are **unit level activities**, as they were performed for each casting (production unit) produced. The third type of activity identified in Exhibit 8.10 (overleaf) is a **product level** (or **product-sustaining**) **activity**, which is an activity performed to enable the design, production and sale of an entire product line. At Mason & Cox, the activity 'Design method', which referred to designing a product and its production processes, is a product level activity. The costs of some product level activities vary with the number of products produced, but others may be assigned directly to individual products. There is a fourth type of activity, a **facility level** (or **facility-sustaining**) **activity**, which is an activity required to run the business. Facility level activities reflect the costs of providing the overall environment for producing and selling products. Since facility level activities are not caused by any particular product and can only be allocated to products in some arbitrary manner, it can be argued that they should not be included in the product cost. However, it seems that the allocation of facility level costs to products does occur in practice (Cooper, 1990). In Exhibit 8.9 (see page 382) all the

batch level activities activities performed for each batch of product

unit level activities activities performed for each unit of product

product level (or **product-sustaining**) **activities** activities performed for specific products or product families

facility level (or **facility-sustaining**) **activities** activities required to support the business as a whole; not caused by any particular product

7 The only exception is the activity 'Design method'. The cost of this activity is assigned directly to products and then spread over the expected life of the product.

Exhibit 8.10

Activity-based product costs, Mason & Cox

Activity level	Activity	Cost per unit of activity driver	Annual quantity of cost driver consumed	Annual cost	Cost per unit of product
	7.5 kg Hensley Tooth: Bill of activities				
Unit	Make CT moulds	$20	1 650	$33 000	
Unit	Pour metal	4	18 750	75 000	
Unit	Operate heat treat furnace	2	75 000	150 000	
Batch	Process payables*	110	200	22 000	
Batch	Process sales order*	100	200	20 000	
Batch	Program production	262	100	26 200	
Batch	Issue pattern*	125	100	12 500	
Batch	Move material	42	1 000	42 000	
Batch	Set up heat treat furnace	332	100	33 200	
Product	Design method*†			1 250	
Facility	Manage plant	2	5 000	10 000	
Total activity cost (annual and per unit)#				**$425 150**	**$17.01**
Direct material cost					12.00
Total product cost per unit					**$29.01**
	7.5 kg Custom Cast Tooth: Bill of activities				
Unit	Make job moulds	$20	20	$400	
Unit	Inspect moulds	5	500	2 500	
Unit	Pour metal	4	375	1 500	
Unit	Operate heat treat furnace	2	1 500	3 000	
Unit	Inspect castings	11	500	5 500	
Batch	Process payables*	110	20	2 200	
Batch	Process sales order*	100	10	1 000	
Batch	Program production	262	10	2 620	
Batch	Issue pattern*	125	10	1 250	
Batch	Move material	42	100	4 200	
Batch	Set up heat treat furnace	332	10	3 320	
Batch	Expedite orders	440	5	2 200	
Product	Design method*†			2 500	
Facility	Manage plant	2	100	200	
Total activity cost (annual and per unit)§				**$32 390**	**$64.78**
Direct material cost					12.00
Total product cost per unit					**$76.78**

* Non-manufacturing activity.
† Design costs are assigned directly to products.
# Annual cost is based on 100 batches of 250 units; unit cost is based on the annual cost divided by the annual volume of 25 000 units.
§ Annual cost is based on 10 batches of 50 units; unit cost is based on the annual cost divided by the annual volume of 500 units.

activities in the Corporate Management Centre, were facility level activities. Hence no activity drivers were identified. The activity 'Manage plant' was also a facility level cost, but Shannon decided to allocate the costs of this activity to products. She wished to include all manufacturing activities in product costs, and, in her view, the man-hours worked in the production plant provided a reasonable basis for allocating this cost.

ACTIVITY-BASED VERSUS CONVENTIONAL PRODUCT COSTS

To demonstrate the impact of the new activity-based system, Shannon chose to compare the activity-based costs of the 7.5 kilogram Hensley Tooth and the 7.5 kilogram Custom Cast Tooth to their cost under the existing, conventional product costing system. As mentioned earlier, under the current conventional costing system these products had identical product costs of $36.32 per unit (see Exhibit 8.3 on page 369), but this had not seemed to make sense to the managers.

When comparing activity-based product costs with conventional product costs, we must be careful to compare 'like with like'. For example, the conventional product costs calculated earlier in this chapter included manufacturing costs only, but at Mason & Cox, the activity-based product costs included both the manufacturing and non-manufacturing costs that were related to the product. The non-manufacturing costs are denoted by an asterisk in Exhibit 8.10 (see page 383).

Exhibit 8.11 identifies the manufacturing and non-manufacturing costs for the Hensley Tooth and the Custom Cast Tooth. The total product cost per unit of the Hensley Tooth of $29.01 included manufacturing costs of $26.78 and non-manufacturing costs of $2.23 per unit, whereas the $76.78 per unit for the Custom Cast Tooth, included manufacturing costs of $62.88 and non-manufacturing costs of $13.90.

Remember that Costello was sure that the existing system overstated the manufacturing cost of the high-volume product line, the Hensley Tooth, and understated the cost of the low-volume product line, the Custom Cast Tooth. Exhibit 8.11 shows that he was right. The conventional cost for the Hensley Tooth is 36 per cent higher than its activity-based cost, and the conventional cost of the Custom Cast Tooth is 42 per cent lower than its activity-based cost. What caused these differences? How do we know that the activity-based cost is more accurate?

CAUSES OF DIFFERENCES BETWEEN ABC AND CONVENTIONAL PRODUCT COSTS

The existing system assumed that each unit of the two products had the same manufacturing overhead cost because they consumed the same amount of direct labour. In fact, the Hensley Tooth had a *much lower manufacturing overhead cost*, for two reasons. First, the conventional system assumed that all manufacturing overhead costs were driven by the volume of production—that is, that they were unit level costs. But, as shown in Exhibit 8.10 on page 383, a number of the overhead costs were batch level costs rather than unit level costs. Hensley Tooth batches were large, which meant there was a relatively low level of consumption of batch activities *per unit* produced. Second, the Hensley Tooth was a simple product to make. It did not require a large amount of overhead support. The level of overhead support was lower than the average level of support assumed in the average plantwide overhead rate. The Custom Cast Tooth had a *much higher manufacturing cost* than that estimated by the conventional system. As shown in Exhibit 8.10 on page 383, it had a number of batch activities and batch sizes were small. This meant a relatively high consumption of batch level costs *per unit*. In addition, the Custom Cast Tooth was complex to make and required a higher than average level of overhead support activities.

Exhibit 8.11

Activity-based manufacturing product costs, Mason & Cox

Activity Level	Activity	Cost per unit of activity driver	Annual quantity of cost driver consumed	Annual cost	Cost per unit of product
7.5 kg Hensley Tooth: Bill of activities					
Make CT moulds	$20	1 650	$33 000		
Pour metal	4	18 750	75 000		
Operate heat treat furnace	2	75 000	150 000		
Program production	262	100	26 200		
Move material	42	1 000	42 000		
Set up heat treat furnace	332	100	33 200		
Manage plant	2	5 000	10 000		
Total manufacturing activity cost#				$369 400	$14.78*
Direct material cost					12.00
Total manufacturing product cost per unit					**26.78**
Process payables	110	200	22 000		
Process sales order	100	200	20 000		
Issue pattern	125	100	12 500		
Design method			1 250		
Total non-manufacturing activity cost				**55 750**	**2.23**
Total product cost per unit					**$29.01**
7.5 kg Custom Cast Tooth: Bill of activities					
Make job moulds	$20	20	$400		
Inspect moulds	5	500	2 500		
Pour metal	4	375	1 500		
Operate heat treat furnace	2	1 500	3 000		
Inspect castings	11	500	5 500		
Program production	262	10	2 620		
Move material	42	100	4 200		
Set up heat treat furnace	332	10	3 320		
Expedite orders	440	5	2 200		
Manage plant	2	100	200		
Total manufacturing activity cost§				$25 440	$50.88
Direct material cost					12.00
Total manufacturing product cost per unit					**62.88**
Process payables	110	20	2 200		
Process sales order	100	10	1 000		
Issue pattern	125	10	1 250		
Design method			2 500		
Total non-manufacturing activity cost				**6 950**	**13.90**
Total product cost per unit					**$76.78**

* Rounded to the nearest cent.

\# Annual cost is based on 100 batches of 250 units; unit cost is the annual cost divided by the annual volume of 25 000 units.

§ Annual cost is based on 10 batches of 50 units; unit cost is the annual cost divided by the annual volume of 500 units.

In the activity-based system, the inclusion of non-manufacturing costs increased the cost of the Hensley Tooth by $2.23 and the cost of the Custom Cast Tooth by $13.90. Both products used the same types of non-manufacturing support activities, but the non-manufacturing costs had a more dramatic effect on the Custom Cast Tooth. This is because a number of these activities were batch level activities, and the small batch size resulted in a relatively high cost per unit. Mason & Cox's management could have used this total cost information to assess product profitability and review product prices (or to consider how activities and costs could have been managed more effectively, as we will see in Chapter 16).

The Mason & Cox case demonstrates that moving from a conventional costing system to ABC can significantly improve the accuracy of product costs. As shown in the 'Real life' below, a recent survey of practitioners supports this view.

ABC AT MASON & COX: TRIAL OR TRIUMPH?

Once the activity-based system had been established, Kidman and Shannon decided to review its costs and benefits. Implementing activity-based costing had consumed a lot of Shannon's time and a lot of management and interviewee time. The activity-based system was more complex than the existing costing system and would require a considerable amount of ongoing effort and costs to maintain the accuracy of the information used within the system.

The new system had not been in place for long, before Kidman saw some benefits. Product costs reflected more accurately the cost of the resources used in producing and selling the product. They made sense to both the production and marketing people. Under ABC, the company's 'cost-plus' pricing seemed to be in line with competitors' prices and customer expectations. Also, it was possible to make more reliable estimates of product profitability, which provided a sound basis for decisions about product mix and product promotion.

Under the conventional costing system, many product costs had been distorted and the 'cost-plus' prices were not accepted by customers. It was frightening to think that management may have used this unreliable costing information to decide which products to produce and promote. They may have discontinued some high-volume products because they appeared

REAL LIFE

ABC DOES MAKE A DIFFERENCE TO PRODUCT COSTS

In 2004, the Chartered Institute of Management Accountants (CIMA) and the consulting firm, ABM Systems, surveyed CIMA members in Australia as well as a random sample of prior attendees at training courses facilitated by ABM Systems, about their activity-based costing (ABC) experiences. Respondents covered 96 companies, ranging from small (less than 100 employees) to very large (more than 10 000 employees).

Sixty-five per cent of respondents indicated that they used ABC to estimate product costs. Many of the respondents were members of CIMA (which promotes ABC amongst its members) or had attended an ABM Systems training session, it could be expected that their involvement or interest in ABC was higher than many other accountants. So it is risky to generalise about the extent of activity-based costing in Australia. However, it is interesting to note that 87 per cent of these respondents found that their product costs differed substantially from those based on their conventional costing system. While the majority reported average cost differences of 5 to 10 per cent, 11 per cent reported cost differences of more than 100 per cent. Around 50 per cent of these respondents had repriced their products as a result!

Source: Chartered Institute of Management Accountants (CIMA)–ABM Systems (2004).

unprofitable when, in fact, they were not. Or perhaps they had promoted some low-volume products that appeared profitable, when they were losers rather than winners!

The important point is that these problems were not confined to Mason & Cox. They are likely to occur in many businesses. A number of progressive Australian businesses, including Holden's Engine Company, Parke Davis, BHP Billiton, Nestlé, Orica, Hamersley Iron and Argyle Diamonds have implemented activity-based costing in some of their business units. Now he understood why!

THE ABC DECISION

In many businesses, product diversity has increased and cost structures have become more overhead-intensive and less volume-driven. Under these circumstances, conventional costing systems are likely to overstate the costs of high-volume simple products produced in large batches, and understate the costs of low-volume customised products produced in small batches. Where product costs are an essential part of the strategic decision making, planning and control processes, these businesses are likely to experience considerable difficulty because of the inadequate information from their conventional costing systems, and to reap substantial benefits from implementing activity-based costing. Given the emerging business environment and its implications for product and cost structures, we might have expected a strong trend towards the adoption of ABC since its introduction in the late 1980s. However, as the 'Real life' (overleaf) shows, many businesses do not use ABC. The decision of whether or not to implement ABC should be based on a careful assessment of the costs and benefits.

WHEN TO USE ABC

The benefits from ABC will be greatest where:

- overhead costs are a significant portion of total costs, and a large part of overhead is not directly related to production volume;
- the business has a diverse product range, and individual products' use of support resources differs from their use of volume-based cost drivers;
- production activity involves diverse batch sizes and product complexity;
- the proportion of product-related costs incurred outside of manufacturing is increasing relative to manufacturing costs;
- there are likely to be high 'costs' associated with making inappropriate decisions based on inaccurate product costs (this is most likely in a highly competitive environment where product cost is a key input to strategic decision making and where competitors have accurate product cost information);
- the cost of designing, implementing and maintaining the ABC system is likely to be relatively low due to sophisticated IT support.

IMPEDIMENTS TO INTRODUCING ABC

While the benefits from ABC can be significant, the take-up rate has been relatively slow. Some firms believe that their existing costing is adequate—and it may be, if they have low overheads and limited product diversity. In other firms ABC would significantly improve the accuracy of product costing, but it has not been adopted. Why not? Perhaps these firms:

- remain unaware of ABC;
- are uncertain about the potential benefits from ABC;
- understand the need for change but are concerned about the extensive resource requirements to implement ABC; or

REAL LIFE

THE ADOPTION OF ABC IN AUSTRALIA AND NEW ZEALAND

Below you will find the results of some surveys of ABC adoption in Australia and New Zealand. However, this evidence is difficult to interpret, with reported adoption rates between 1995 and 2007 ranging from 12 to 57 per cent. The apparent inconsistencies amongst the results may reflect differences in industry (manufacturing, manufacturing and service, or public sector), firm size, time period and survey instruments used to measure ABC. For example, some studies focused on *whether or not* an organisation had implemented ABC whereas, following the ideas of Gosselin (1997), Baird *et al.* (2004) and Baird (2007) identified three different levels of activity-based analysis, *activity analysis (AA)* (which identifies activities and procedures), *activity cost analysis (ACA)* (which identifies the costs of activities and their cost drivers), and *activity-based costing (ABC)* (which traces overhead costs to products using activity cost pools and activity drivers). The extent of adoption reported in these two studies is significantly higher than in other studies but they do alert us to the fact that there is no single ABC model, rather different firms use different approaches.

Industry/firm size		ABC adoption rate	Publication date	Author
Largest manufacturers in Australia		13%	1995	Clarke & Mia
Manufacturers in Australia		12%	1997	Booth & Giacobbe
Very large manufacturers in Australia		56%	1998	Chenhall & Langfield-Smith
Australia's largest manufacturers		23%	2000	Wijewardena & De Zoysa
Manufacturing and service entities, both public and private, as well as not-for-profit in New Zealand, with more than 100 employees		20%	2003	Cotton *et al.*
Australian manufacturing and service business units, with at least 50 employees	AA ACA ABC	57% 50% 42%	2004	Baird *et al.*
Australian public sector organisations	AA ACA ABC	48% 43% 34%	2007	Baird

While the evidence is murky, the surveys of practice in Australia and New Zealand indicate that many businesses have not adopted ABC. What is happening here? Within the accounting profession ABC is viewed as a rational response to the contemporary business environment and associated cost structures. Recent studies have found that rather than technical factors (such as the level product diversity and extent of overhead costs), organisational factors (such as the level of top management support for ABC and the existence of an internal champion to drive the acceptance and implementation of ABC) influence the adoption and success of ABC (Brown *et al.*, 2004; Baird *et al.*, 2007). Clearly the decision to implement ABC is complex, and involves consideration of behavioural issues as well as assessing the more technical costs and benefits of ABC.

Sources: Clarke & Mia (1995); Booth & Giacobbe (1997); Chenhall & Langfield-Smith (1998); Wijewardena & De Zoysa (2000); Cotton et al. *(2003); Baird* et al. *(2004); Brown* et al. *(2004); Baird (2007); Baird* et al. *(2007).*

- are constrained by powerful behavioural factors that cause resistance to change. (This issue is explored later in the chapter.)

We should not view the decision to stick with an existing costing system as irrational. In many cases it is likely to reflect an assessment, formal or informal, of the perceived costs and benefits of ABC.

OTHER ACTIVITY-BASED COSTING ISSUES

The Mason & Cox case provides a comprehensive description of ABC, but there are a number of additional issues that must be considered, including the variations in the types of ABC systems, the implications of spare capacity, behavioural issues and limitations of ABC.

VARIATIONS IN TYPES OF ABC

There is not one ABC system but many. ABC can be used for product costing, activity management, or both. Product costing systems may be confined to the analysis of manufacturing overhead, or they may include product-related non-manufacturing costs and direct labour costs too. But there are other sources of variation, such as whether:

- actual (past) or budgeted costs are analysed;
- implementation is a one-off project or an ongoing system;
- cost objects other than products are included.

Budgeted or actual costs

The ABC implementation at Mason & Cox analysed the prior year's costs. However, it's not 'What did this product cost?' but 'What will this product cost?' that is relevant to making strategic decisions such as deciding which products to produce and what prices to charge. Budgeted costs provide more timely and relevant information for such decisions. In a *stable* environment, past costs can be reliable indicators of future costs. In a *rapidly changing* environment, past costs are less relevant, but it may be very difficult to predict future costs and activities accurately. (You may remember that Hot Exhausts Ltd, in Chapter 7, developed budgeted activity costs to estimate the costs of its two exhaust systems.) Some businesses analyse past costs as a starting point for their ABC system, and later move to budgeted costs. Others simply analyse past costs as a one-off exercise.

ABC project or ABC system?

Not all businesses implement ABC as an ongoing costing system; some adopt a project approach instead. However, the choice is not whether ABC is either a project or an ongoing system: these choices can be viewed as ends of a continuum. For example, a survey of Australian manufacturers found that only 56 per cent of ABC adopters had implemented ABC as an ongoing system, 20 per cent had developed ABC as an *ad hoc* system to be updated and consulted when necessary, 12 per cent had implemented ABC as a one-off cost analysis exercise, and the remaining 12 per cent used ABC for some other purpose (Booth & Giacobbe, 1997). Where strategic plans are developed or reviewed relatively infrequently, a business may not require accurate estimates of product costs on a day-by-day basis. They may simply determine activity-based product costs as an occasional special project to better understand the relative costs of their products. The 'Real life' overleaf describes an ABC project undertaken for CardLink Services Ltd. Although the activity-based information was invaluable to CardLink's CEO, it was not required on a regular basis.

Other cost objects

In the Mason & Cox case study, we have focused on using activity-based costing to estimate product costs. However, the cost assignment dimension of ABC can be used to assign costs

to any chosen cost object. For example, some businesses use ABC to estimate the costs of using particular suppliers, and some businesses identify the costs of producing products *and* servicing particular customers. These ABC models include product-related cost drivers (i.e. unit, batch and product level cost drivers) and customer-related cost drivers. We describe customer-related activities and cost drivers as well as supplier-related activities and drivers in Chapter 15.

IMPLICATIONS OF SPARE CAPACITY

10 LEARNING OBJECTIVE

committed resources resources, such as plant, equipment and supervision, supplied in advance of being used in production

Activity-based costing estimates the cost of resources *used* to perform activities to produce and sell products. Conventional financial statements, such as the income statement, focus on the cost of the resources *supplied*. Some resources, such as direct material, energy sources and some forms of labour, are supplied as they are used. However, other resources, such as plant, equipment and supervision, are supplied in advance. These resources are called **committed resources**. Where activity costs are based on budgeted costs, *the committed resources supplied will not necessarily equal the resources used* because of spare capacity (i.e. *underutilised* activities). In estimating and reporting profit under an ABC system, therefore, it is necessary to include the cost of unused capacity, when budgeted costs have been used (Cooper & Kaplan, 1992). At Mason & Cox, the ABC system was used to assign actual costs, including committed costs, to products at year-end, so this issue did not arise. The 'Real life' about art.com (opposite) describes an ABC system that included the identification of costs of unused capacity.

REAL LIFE

ABC: A PROJECT OR A SYSTEM?

CardLink Service Ltd was established in 1988 by a consortium of leading financial institutions, including Australia's major banks, to provide a range of back office services. Operating in an environment of rapid technological change, CardLink's major services now include credit card authorisation, credit card transactions processing and the popular consumer to business bill paying service, BPay (including the related online billing service BPay View).

Courtesy of Shutterstock®

Although initially established as a 'necessary processing service' with little emphasis on commercial viability, in 2000, CardLink's management decided only to offer services that were profitable. An activity-based costing (ABC) project was implemented to estimate the costs of services and to help set fair prices.

Prices had not been reviewed for years and the ABC team quickly discovered that a number of services were unprofitable, particularly those that involved manual processing, such as the paper processing and scanning of credit card transactions. Armed with these results, management decided to cease some aspects of the business, by either selling them or closing them down. Others would be tackled through differential pricing and technology.

Although the CEO of CardLink described the results of the ABC analysis as invaluable, the company opted not to implement an ongoing activity-based costing system, instead using ABC 'as a management tool on a periodic basis'. As is the case with any management accounting innovation, it is important to weigh up the costs and benefits of the new approach. It seems that CardLink was able to derive the benefits it really needed from the improved cost information by undertaking only occasional ABC projects.

Source: Agility Consulting (2002)

BEHAVIOURAL ISSUES IN IMPLEMENTING ACTIVITY-BASED COSTING

11 LEARNING OBJECTIVE

Activity-based costing involves major changes in the ways in which data are collected and analysed and the business is managed. In many organisations, any change is perceived as threatening and is therefore likely to be resisted. To succeed, the introduction of activity-based costing must be accompanied by a change management plan that is carefully constructed to take account of the extent of change required and the personalities involved. The design and implementation of ABC requires far more involvement of *non-accounting* staff than that of a conventional costing system. Consider the amount of involvement of operational employees from across the business in the development of the ABC system at Mason & Cox. Developing an effective ABC system requires the cooperation and expertise of many people—not just accountants!

There is no single formula for managing change, although there is some evidence to suggest that the process will be most effective where a 'bottom up' approach rather than a 'top down' approach is used. With a 'bottom up' approach, instead of viewing the activity-based system as a financial system imposed by top management, employees would be encouraged to consider ABC as a tool that *they* own, to help *them* manage *their* work. Developing a sense of ownership requires a high degree of participation in the development and implementation of the new system across all levels of the organisational hierarchy. Management must be seen to be totally committed to the activity-based project, but also willing to let employees play a major role in developing and using the system. Evidence from the US indicates that organisational and behavioural issues can have a major effect on the success of activity-based costing (Shields, 1995). Similarly the 'Real life' on page 388 reminds us that Australian studies have found that top management support and the influence of an ABC champion within the organisation can be more important to the successful adoption of ABC than technological factors such as cost and product structures.

LIMITATIONS OF ACTIVITY-BASED COSTING

12 LEARNING OBJECTIVE

While ABC has the potential to improve the accuracy of product costs, it is important to understand its limitations:

- *Facility level costs*. Some proponents of ABC recommend that virtually all costs, including facility costs, be assigned to products. However, facility level activities may bear no obvious relationship to products. (In the Mason & Cox case, the costs of

THE COST OF SPARE CAPACITY AT ART.COM

REAL LIFE

The e-retailer art.com sells prints and framed print art. Timely and accurate cost information is particularly important for e-businesses because their competitive environment tends to be very fluid. Activities for art.com include 'service customers', 'web site optimisation', 'merchandise inventory selection and management', 'purchasing and receiving', 'customer acquisition and retention—revenue share marketing', 'customer acquisition and retention—paid for marketing', 'sustain information system', 'sustain business—administration', 'sustain business—production', 'sustain business—executive', 'maintain facility—administration' and 'maintain facility—production'. A major problem facing dot.com companies is the difficulty in predicting demand and, therefore, in matching resources supplied with resources used. At art.com, in addition to estimating the cost of each order, the activity-based costing (ABC) system was used to estimate the dollar value of unused resources in total, by activity and by product line. According to art.com, 'unless a dollar value is attached to used and unused capacity, it won't gain management's attention'.

Source: Zeller, Kublank & Makris (2001)

'Manage plant' were the only facility level costs assigned to products.) If these facility level costs are assigned to products, the allocation basis must be arbitrary. The higher the proportion of allocated facility costs, the greater the arbitrary element of the product costs. Of course a business must cover its facility level costs to make a profit but, in the income statement, it is better to deduct them after estimating the product-related profit margin rather than including them in the product costs.

- *Use of average costs*. Activity-based estimates of the cost per unit of product, such as the costs of the Hensley Tooth and the Custom Cast Tooth in Exhibit 8.10 (see page 383), are *average costs*. Unit level costs *are* incurred for each unit of product, but batch level, product level and any allocated facility level costs must be divided by the number of units produced to estimate the cost per unit of product. It is important that managers understand this. Many product-related decisions are better based on either unit level costs in the short term or *total* product costs in the longer term, rather than looking at the average cost *per unit* of product.
- *Complexity*. When ABC is set up as an ongoing costing system, it involves more detailed recording and analysis than for conventional costing systems. If the company is changing rapidly, the data in the activity-based system must be updated frequently to avoid the production of outdated, irrelevant information. This can be expensive. The level of complexity increases dramatically when the system is used for activity management as well as for product costing, because activity management requires a more extensive and detailed analysis of costs and activities. This issue is dealt with further in Chapter 16.

Despite these limitations, there are many examples of businesses, both in Australia and abroad, that have implemented some form of ABC.

ACTIVITY-BASED COSTING IN SERVICE ORGANISATIONS

Activity-based costing can help to overcome the problems of inaccurate conventional costing in service businesses, although three factors make it more difficult to implement than in manufacturing:

1. Service businesses often have a higher level of facility costs than do most manufacturers, so fewer costs may be included in the ABC system.
2. It is often difficult to identify individual activities, because they are non-repetitive. An activity may be repeated, but in a different way for each client.
3. The non-repetitive production environment may also make it difficult to identify service outputs.

Consider the services provided by your local doctor. Two patients may be booked in for the removal of skin lesions. One skin lesion is a small sunspot that can be removed by burning it with dry ice. The second lesion is much larger and deeper and has to be cut out. Is there one product, 'The removal of a skin lesion', or are there two products, 'Burning off skin lesions' and 'Cutting out skin lesions'? To cut out the skin lesion, the doctor has to administer a local anaesthetic. Is this part of the product 'Cutting out skin lesions', or a separate product, 'Administering local anaesthetic'? What appears to be a basic product may actually disguise a whole range of different products.

Now what if both patients had sunspots which required the same basic activities of drawing up the dry ice, burning the lesion and dressing the wound, but the burning of one lesion turned out to be much more difficult and time consuming than burning the other? Both services require the same basic activities, but they have very different costs. Is 'Burning the lesion' one activity, or should there be one activity for 'Burning simple lesions' and another for 'Burning more difficult lesions'?

ACTIVITY-BASED COSTING IN LOCAL GOVERNMENT

REAL LIFE

In 1995, the National Competition Policy was introduced and local governments were required to commit to the principles of competitive neutrality. These principles required local councils to open significant business activities to competitive tendering and ensure that full costs were estimated in submitting in-house tenders for the provision of goods and services. The National Competition Policy program ended in 2005–06, but by then a number of local councils had moved to activity-based costing (ABC) systems because of their effectiveness in estimating the full cost of their services.

Courtesy of Shutterstock®

For example, Bayside City Council, located on the eastern shore of Port Phillip Bay, Victoria, used ABC to develop an accurate set of costs for corporate overheads. Activity-based cost recovery chargeout rates were estimated for major support services including 'invoices paid and invoices raised', 'cash receipting and payroll', 'management reporting and accounting services', 'information services (including PC workstations and peripheral equipment)', 'office rental' and 'utilities'. The council also found that activity-based data provided useful information for reducing costs and improving efficiency, by identifying and eliminating wasteful activities. And in north-west Tasmania, Devonport City Council used activity-based costing to identify the key activities required to provide the full range of its programs, including city management, city development, community health, leisure, the roads network, waste management and water supplies. In addition to providing a very detailed allocation system for estimating the costs of goods and services, the ABC system helped to establish and monitor responsibility for activities and service level agreements. The Council set revenue and expenditure budgets and reviewed performance for each major activity. The financial outcomes for activities were aggregated to program level for internal and external reporting. According to the Council's General Manager

> *The use of activity-based costing has proved to be appropriate to a local government entity, has enabled the development a fully integrated information and reporting system . . . and has enabled compliance with externally imposed National Competition policy requirements.*

Sources: Hoban (1995); Lewis (1999); Devonport City Council (2004)

Despite these problems, activity-based costing has been used in a number of major Australian service businesses including the National Roads and Motorists' Association (NRMA), Telstra, Australia Post, and the Electricity Trust of South Australia, and a number of universities and local councils, as described in the 'Real life' above.

SUMMARY 8

Product costs are needed to help managers make decisions that create value and manage resources as well as for reporting to various outside organisations. In Chapters 4, 5 and 6 we described conventional approaches to estimating the costs of goods and services. In this chapter we identified the problems that may occur with conventional product costing systems and described activity-based product costing, which has been developed to overcome these problems. Key points include:

- Conventional product costing systems allocate overhead costs to products using one (or sometimes several) broad volume-based overhead rates. They also tend to ignore non-manufacturing costs. Yet, in many businesses overheads are a significant cost (and a large part of this cost is now caused by such factors as product diversity and production complexity, rather than by production volume), and non-manufacturing costs are becoming more substantial. In these situations, the conventional approach to product costing is likely to distort product costs.
- There are a number of common indicators of an outdated costing system, as described in Exhibit 8.2 on page 367.
- Activity-based costing (ABC) has been the major response to the problems encountered with conventional costing systems. The ABC model has two dimensions. The costing view assigns resources to the activities that consume them and then to products on the basis of the activities that the products consume. The activity management view provides information about the root causes of activities and their value to customers, and various measures of their performance.
- The range of costs assigned by the activity-based system depends on the purpose of the system. An ABC system can be used to assign manufacturing overhead costs to products, or manufacturing overhead and product-related non-manufacturing costs, or direct labour costs, in addition to manufacturing overhead and non-manufacturing costs. This third approach to activity-based costing was illustrated in this chapter, using the Mason & Cox case, and is discussed further in Chapter 16.
- Activity-based product costing involves two main steps:
  - measuring the costs of activities; and
  - assigning activity costs to products.

  Each of these steps is described in the chapter using the Mason & Cox example.
- A comparison of activity-based and conventional product costs indicates that, in businesses that are overhead intensive and have a diverse product range, conventional product costing systems tend to overstate the cost of simple products that are made in large quantities and understate the costs of complex products made in small quantities.
- Activity-based costing is likely to benefit businesses with significant levels of non-volume driven overhead costs, a diverse product range (involving diverse batch sizes and differing degrees of production complexity) and substantial non-manufacturing costs, and where product cost information is important and IT resources are good.
- Organisations may not use ABC because of a lack of awareness or concerns about the potential benefits, finding appropriate cost drivers and the level of resources required.
- There are a range of design issues to be considered in implementing activity-based costing, including whether to use budgeted or actual costs, whether to develop an ongoing costing system or a project approach, and which cost objects should be included.
- In estimating and reporting profit under an activity-based system, where activity costs are based on budgeted costs, the cost of unused capacity should be recognised,

because of the difference between the costs of resources used (identified under ABC) and the cost of resources supplied.

- Activity-based costing, particularly as an ongoing system, can involve significant organisational change and the ABC implementation should consider and actively manage resistance to change.
- Although more accurate than conventional product costing, ABC also has some limitations. Facility level costs should not be assigned to products, as they have no obvious cost drivers; average batch, product and facility level costs per unit can undermine product-related decisions; and ABC is more complex than conventional product costing.
- Activity-based costing can be useful in service organisations but can be more difficult to implement because of high facility-level costs, non-repetitive activities and difficulties in identifying and measuring service outputs.
- As discussed in the appendix, where activity-based costing is used solely to assign manufacturing overheads to products, it is possible to develop a simple system with relatively few major overhead activities and cost drivers.

We will return to activity-based costing in Chapters 15 and 16, where we examine its role in supply chain and cost management.

KEY TERMS

activity 371
activity-based costing (ABC) 371
activity centre 377
activity driver 373
batch level activities 380
bill of activities 380
committed resources 390
conventional product costing system 364
cost driver 373
cost object 373
cost per unit of activity driver 379
facility level (or facility-sustaining) activities 381
product diversity 366
product level (or product-sustaining) activities 381
resource driver 371
root cause cost drivers 374
unit level activities 381

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SELFSTUDY 8

SELF-STUDY PROBLEM: ACTIVITY-BASED COSTING

Barbara Higgins is the manager of Inhouse Training, a company that provides in-house management development training courses. The company offers two basic training packages: two-day short courses covering topics such as leadership skills, managing change and learning organisations, and five-day courses in areas such as strategic management, supply chain management and developing performance measurement systems.

At the end of the year, Higgins reviewed the company's total costs with a view to setting prices for the coming year. Over the past 12 months, the company ran 40 two-day courses, with an average of 50 participants, and 60 five-day courses, with an average of 30 participants. Total costs amounted to $696 000. Higgins decided to base prices for the coming year on the cost per day for last year plus a 20 per cent profit margin.

Before setting these prices, Higgins bumped into a friend who was a management consultant. He suggested that activity-based costing would provide a more accurate estimate of the cost of the two types of courses. With his help, Higgins identified the following activities and costs for last year:

Activity	Activity cost	Activity driver	Quantity of activity driver
Advertise courses	$50 000	Number of courses	100
Enrol participants	19 000	Number of participants	3 800
Hire presenters	570 000	Number of days	380
Hire premises	38 000	Number of days	380
Hire audiovisual equipment	95 000	Number of days	380
Produce handouts	38 000	Number of participants	3 800
Provide lunches	195 000	Number of person-days	13 000
Total costs	$960 000		

Required:

1 Estimate the costs of a two-day course and a five-day course, using the 'average cost per day' approach.
2 Estimate the cost of a two-day course and a five-day course, using activity-based costing.
3 Which cost out of those estimated in requirements 1 and 2 do you think would provide a more reliable basis for cost-plus pricing? Explain your answer.

Solution to Self-study problem

1 Cost per course based on average cost per day:

Total number of days on which courses were run = $(40 \times 2) + (60 \times 5)$
= 380 days

Total cost = $960 000

$$\text{Cost per day} = \frac{\$960\,000}{380 \text{ days}}$$

= $2526 per day

Cost of two-day course = $2526 × 2 = $5052
Cost of five-day course = $2526 × 5 = $12 630

2 Cost per course based on activity-based costing:

Two-day course			
Activity driver	Cost per unit of activity driver	Quantity of activity driver	Activity cost
Advertise courses	$500 per course	1 course	$500
Enrol participants	$5 per participant	50 participants	250
Hire presenters	$1500 per day	2 days	3 000
Hire premises	$100 per day	2 days	200
Hire audiovisual equipment	$250 per day	2 days	500
Produce handouts	$10 per participant	50 participants	500
Provide lunches	$15 per person per day	100 person-days	1 500
Total cost			$6 450

	Five-day course		
Activity driver	**Cost per unit of activity driver**	**Quantity of activity driver**	**Activity cost**
Advertise courses	$500 per course	1 course	$500
Enrol participants	$5 per participant	30 participants	150
Hire presenters	$1500 per day	5 days	7 500
Hire premises	$100 per day	5 days	500
Hire audiovisual equipment	$250 per day	5 days	1 250
Produce handouts	$10 per participant	30 participants	300
Provide lunches	$15 per person per day	150 person-days	2 250
Total cost			$12 450

You will notice that we have omitted the step shown in Exhibit 8.10 (see page 383), in which annual activity costs were calculated for products and these costs were divided by the number of units produced over the year. For Inhouse Training, we have sufficient information to identify directly the consumption of activities for each unit of product (i.e. each course).

3 The activity-based costing system provides a more accurate estimate of cost. The average cost assumes that the cost of courses varies proportionately with the number of days. While this is true for some costs (such as the costs of presenters, premises and equipment hire), other costs are incurred for each course (such as advertising costs), or for each participant (such as the costs of enrolling participants and providing them with handouts).

CYBERSEARCH 8

1 Look for web sites of consulting firms that offer activity-based costing services or software packages.
   (a) Are the concepts of activity-based product costing consistent with those described in the chapter? If not, describe any differences.
   (b) What benefits do the software consultants suggest may be expected from activity-based product costing? Do you consider the proposed benefits to be realistic? Explain your answer.
   (c) Do the software consultants suggest that activity-based product costing is appropriate for allorganisations? If so, do you agree? Explain your answer.
2 Find a web site with an example of an organisation that uses activity-based product costing.
   (a) Compare their approach with that described in the chapter.
   (b) Outline the advantages that activity-based product costing has provided for the organisation.
3 Locate web sites with examples of universities that have implemented activity-based costing.
   (a) Describe the benefits from ABC that universities have experienced in estimating the costs of their courses and programs.
   (b) Can you find any evidence of resistance to the move to ABC in these universities?

For a list of useful web sites to help you with these exercises, visit the Online Learning Centre at www.mhhe.com/au/langfield5e.

APPENDIX TO CHAPTER 8

ACTIVITY-BASED COSTING: AN ALTERNATIVE APPROACH

From the discussion in this chapter, you will be aware that there are many variations of activity-based costing. Management assesses the problems that their business is facing, and an ABC system is designed to tackle those problems. The approach used at Mason & Cox is useful for businesses that need more accurate product costs and better information for activity management. However, the inclusion of the activity management view, in addition to the product costing view, makes the ABC system more complex. Some businesses choose a simpler version of ABC to meet their product costing needs. This type of ABC assigns only indirect costs (often only manufacturing overhead costs) to products. We introduced this approach to activity-based costing in the Hot Exhausts case in Chapter 7. Now we will look at it in more detail and consider how it differs from the activity-based costing system described in this chapter.

SIMPLIFYING ACTIVITY-BASED PRODUCT COSTING

Let's assume that the only serious problem facing Mason & Cox was distorted product costs. The distortions were caused by the inappropriate allocation of manufacturing overhead. Remember, Mason & Cox used a plantwide overhead rate based on direct labour hours. There were no major difficulties with the conventional approach to tracing direct material and direct labour costs to products. The solution to this problem would have been to develop an ABC system to assign the manufacturing overhead costs to activities and then to products. This is the simple activity-based product costing system that was described in the chapter (see Exhibit 8.6 on page 375).

The activity-based costing model in Exhibit 8.5 (see page 373) can be used to describe this simple activity-based product costing system. However, this ABC system is confined to the vertical costing view and analyses only manufacturing overhead costs and manufacturing overhead activities. Thus, the two steps for the costing view become:

- *Step one:* Measure the costs of the *manufacturing overhead* activities.
- *Step two:* Assign the costs of the manufacturing overhead activities to the products.

The ABC system at Mason & Cox, which we described in the chapter, assigned $11.13 million to activities. These costs included direct labour costs ($4.53m), manufacturing

overhead ($4.88m) and non-manufacturing costs ($1.72m).[8] Direct material costs were not included as they were traced to products using the conventional approach. What would happen to these costs in the simple activity-based product costing model? The direct material costs would still be traced using the conventional approach and so would the the $4.53 million direct labour costs. With direct costs, the conventional tracing should be reasonably accurate. The direct labour costs were included in the ABC system described in the chapter to enhance the activity management view, not to improve the product costing. The $1.72 million of non-manufacturing costs would have been expensed as they were incurred. These were included previously for activity management and also to provide a more complete measure of product cost. (The simple ABC system could have been expanded to include these costs if management had believed that their omission seriously distorted the product costs.)[9] Thus, at Mason & Cox, the simple ABC system would have assigned the $4.88 million manufacturing overhead costs, first to activities and then to products. Let's look at these two steps.

STEP ONE: MEASURING THE COST OF OVERHEAD ACTIVITIES

As in the more complex system, the first step in simple activity-based product costing is to identify the activities and measure their costs. Let's suppose that there were six manufacturing overhead activities at Mason & Cox: a machine-related activity, an inspection activity, a setup activity, a material-handling activity, an engineering activity and a facility activity.

Exhibit 8.12 shows the allocation of the $4.88 million of manufacturing overhead costs to the six major activities. Note that the activities are classified as unit level, batch level, product level and facility level, just as the detailed activities were in the chapter. The machine-related activity is a unit level activity since every product unit (casting) required machine time. Likewise the inspection activity is a unit level activity as individual moulds and castings were inspected. (If batches of moulds and castings rather than individual units had been inspected the inspection activity would have been a batch level activity.) The setup and material-handling activities are classified as batch level activities because these activities were performed for batches of castings. The engineering activity is classified as a product level activity because it was needed to support an entire product line, but was not always performed every time a new casting or batch of castings was produced. The facility level activity covers the costs that support the entire production process—plant management salaries, and some plant maintenance and insurance costs.

The procedure for assigning the manufacturing overhead costs to the activities is similar to the procedure for measuring activity costs described earlier in this chapter. The accounts that made up the $4.88 million would have been reviewed and, where they were of a similar nature and driven by the same resource driver, they would have been combined into cost categories. Resource drivers would have been used to assign the costs in each category to activities. For example, the machine-related costs would have included machinery depreciation costs, consumables used by machines and the energy costs of operating the machinery. The setup costs would have included wages of employees involved in setting up machinery, consumables used during setups, and the costs of other resources used during setups. In the chapter, activity centres were used as an intermediate step to accumulate costs before assigning them to activities. Activity centres can also be used in this way in a simple product costing system.

In reality, there were more than six manufacturing overhead activities at Mason & Cox. The six major activities identified in Exhibit 8.12 were made up of a number of smaller activities that have been aggregated into larger activity cost pools. Activities can be aggregated in

8 These costs have been classified by 'cost category' (see Exhibit 8.7 on page 378) and activity (see Exhibit 8.8 on page 380), but it is not possible to identify direct labour, manufacturing overhead and non-manufacturing costs from these exhibits. Instead, a separate exercise was required to identify these costs.

9 In this chapter we described this approach as the activity-based product costing system for indirect costs (see Exhibit 8.6 on page 375). It is not illustrated here, but the procedures for costing the non-manufacturing activities are similar to the procedures for costing the manufacturing overhead activities.

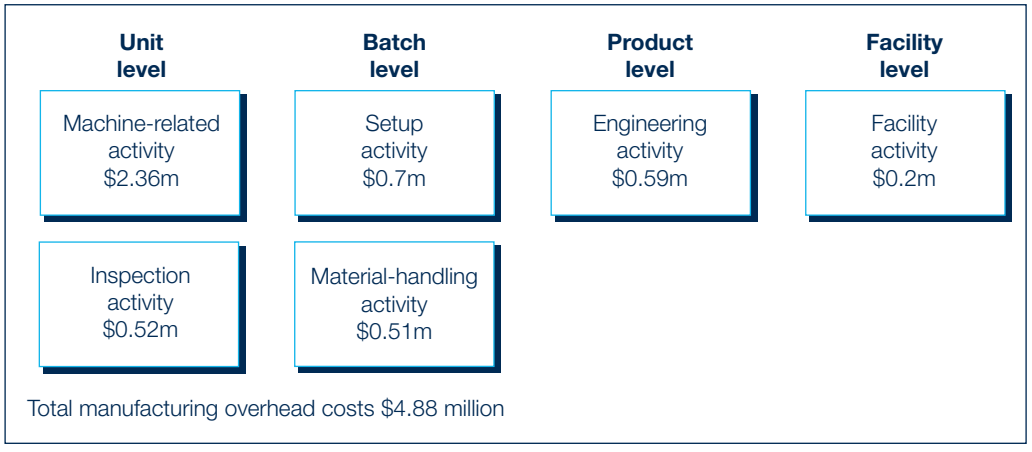

Exhibit 8.12

Measuring the cost of overhead activities at Mason & Cox

this way if they are at the same level (i.e. unit, batch or product) and use the same activity driver. As discussed in the chapter, reducing the number of activities helped to keep down the complexity and cost of the system. Detailed activities were not required because the system was to be used only for product costing, not for activity management.

STEP TWO: ASSIGNING THE ACTIVITY COSTS TO PRODUCTS

The second step is to assign the costs of the overhead activities to the products that consume them, based on the costs per unit of activity driver, sometimes called **cost pool rates**. You will notice that the costing procedures are very similar to those described in this chapter. Once the activity cost pools have been estimated, the costs are divided by the annual quantity of activity driver to obtain the cost per unit of activity driver for each activity. Let's assume that, in the Mason & Cox case, activity drivers could have been measured for machine-related costs (machine hours), inspection costs (number of units inspected), setup costs (number of production runs), material handling (metres of material moved) and engineering (the number of engineering hours). This is shown in Exhibit 8.13. You will notice that we have not calculated a cost per unit of activity driver for facility level costs, and they have not been apportioned to product lines. As discussed in the chapter, most facility costs are not attributable to any particular product lines and it would be misleading to assign them to products.

cost pool rate an alternative term for cost per unit of activity driver

To estimate the overhead cost of a product, it is necessary to estimate the amount of each overhead activity consumed by the product. This is illustrated in Exhibit 8.14 (overleaf), which shows the cost of the manufacturing overhead activities consumed by our old favourites, the 7.5 kilogram Hensley Tooth and the 7.5 kilogram Custom Cast Tooth. The costs of the activities are calculated by multiplying the cost per unit of activity driver by the quantity of activity driver consumed by each product. Exhibit 8.14 (overleaf) also includes the cost of direct material and direct labour (as shown in Exhibit 8.3 on page 369) to give the manufacturing cost of each product. The costs of the Hensley Tooth and the Custom Cast Tooth are $29.78 and $67.18, respectively.

Activity	Activity cost ($m)	Quantity of activity drivers*	Cost per unit of activity driver
Machine-related	$2.36	100 000	$23.60
Inspection	0.52	80 000	$6.50
Setup	0.70	4 000	$175.00
Material handling	0.51	17 000	$30.00
Engineering	0.59	59 000	$10.00

Exhibit 8.13

Calculating the activity cost rates at Mason & Cox

* Activity drivers were:
- machine-related: number of machine hours
- inspection: number of units inspected
- setup: number of production runs
- material handling: number of metres moved
- engineering: number of engineering hours

Exhibit 8.14

Product costs based on the simple ABC system at Mason & Cox

		7.5 kg Hensley Tooth		Custom Cast Tooth	
Activity	**Cost per unit of activity driver**	**Quantity of activity driver**	**Cost**	**Quantity of activity driver**	**Cost**
Machine-related	$23.60 per machine hour	2500	$59000	50	$1180
Inspection	$6.50 per unit inspected	–	–	1000	6500
Setup	$175.00 per setup	100	17500	10	1750
Material handling	$30.00 per metre	1000	30000	100	3000
Engineering	$10.00 per engineering hour	8000	80000	1000	10000
			$186500		$22430
Number of units produced:					
7.5 kg Hensley Tooth			25000		
Custom Cast Tooth					500
Overhead cost per unit			$7.46		$44.86
Direct material*			12.00		12.00
Direct labour*			10.32		10.32
Product cost per unit			**$29.78**		**$67.18**

* From Exhibit 8.3 on page 369.

The cost of the Hensley Tooth at $29.78 and the Custom Cast Tooth at $67.18 are quite different to the ABC manufacturing product costs shown in Exhibit 8.11 on page 385 ($26.78 and $62.88 respectively).[10]

EVALUATING THE SIMPLE ACTIVITY-BASED PRODUCT COSTING SYSTEM

The simple ABC approach can be compared to the conventional approaches to product costing and to the more comprehensive approaches to activity-based costing described in this chapter.

SIMPLE ABC COMPARED TO CONVENTIONAL PRODUCT COSTING

Simple activity-based product costing can be viewed as a refinement to the conventional approaches to estimating product costs, which were described in Chapter 7. Exhibit 8.15 shows that it differs from the conventional approaches only in its treatment of manufacturing overhead. As we move from a plantwide rate to departmental rates and then to the simple ABC manufacturing overhead rates, the level of disaggregation of manufacturing overhead increases, enabling better identification of cost drivers; and, as a result, the accuracy of the allocation of the manufacturing overhead costs to products also increases.

10 Strictly speaking to compare these costs we should remove the facility level costs ('manage plant') included in Exhibit 8.10 on page 383. However this would have a relatively minor impact, reducing the costs per unit shown in Exhibit 8.10 by $0.40.

Product costing approach	Costs traced directly to products	Costs allocated to products	Overhead cost driver(s) (activity driver(s))	Overhead allocation basis (cost per unit of activity driver)
■ Conventional approach: Plantwide rate	■ Direct material ■ Direct labour	■ Manufacturing overhead	■ One volume-based cost driver for the entire plant	■ One rate for the whole plant
■ Conventional approach: Departmental rates	■ Direct material ■ Direct labour	■ Manufacturing overhead	■ One volume-based cost driver for each production department	■ One rate for each production department
■ Simple ABC	■ Direct material ■ Direct labour	■ Manufacturing overhead	■ One cost driver, either volume-based or non-volume-based for each overhead activity	■ One rate for each manufacturing overhead activity

Exhibit 8.15

Comparing conventional and simple ABC approaches to estimating product costs

SIMPLE ABC COMPARED TO MORE COMPREHENSIVE ACTIVITY-BASED COSTING MODELS

Exhibit 8.6 (see page 375) evaluated the various approaches to activity-based costing and concluded that the more comprehensive activity-based costing systems result in more accurate product costs because they include a wider range of costs. In Mason & Cox's case, there was a significant difference in the *manufacturing* cost of the Hensley Tooth and the Custom Cast Tooth under the two approaches. Using an ABC system with a large number of detailed activities may or may not not greatly improve the accuracy of the product costing over the simple ABC system based on relatively few manufacturing overhead activities. However, the comprehensive ABC system described in the chapter does offer two advantages. First, it includes non-manufacturing costs in product costs, although the simple system could be expanded to accommodate non-manufacturing activities. Second, and much more importantly, the ABC system described in the chapter provides lots of useful information for activity management. The value of this information is explained in Chapter 16. The issue of which system is appropriate can be resolved only in the light of the needs of each business.

KEY TERM

cost pool rate 401

QUESTIONS

8.1 Identify some of the common causes of changes to cost and product structures that many businesses are experiencing.

8.2 Conventional costing systems apply manufacturing overhead costs to products using a volume-based cost driver such as direct labour hours. What do we mean by the term *volume-based cost driver*? What problems can arise with this approach to product costing when used in a modern manufacturing environment?

8.3 Describe the common indicators of an outdated product costing system.

8.4 Which types of businesses are most likely to experience product costing problems with conventional costing systems? (*Hint*: Think about the composition of costs, and product diversity.) Why?

8.5 How are non-manufacturing costs treated under conventional costing systems? Is this approach useful for management?

8.6 Describe the two dimensions of the activity-based costing model shown in Exhibit 8.5 on page 373. Using the terms *resources*, *activity* and *resource driver*, and the diagram in the 'Real life' on ABC in Australian universities (see page 381) explain how costs are assigned to activities.

8.7 Using the terms *activity costs*, *activity drivers* and *cost per unit of activity driver* and the diagram in the 'Real life' on ABC in Australian universities (see page 381) explain how the costs of the Hensley Tooth has been calculated in Exhibit 8.10 (see page 383).

8.8 Explain the three different ways in which the term *cost driver* is used in activity-based costing and give two examples of each type of cost driver for a bank. (*Hint*: First think about the activities performed in a bank and then think about their cost drivers.)

8.9 There is not just one approach to activity-based costing: there are many. Describe some of the major areas of difference between the various approaches to activity-based costing systems.

8.10 Outline the three major approaches to activity-based product costing discussed in the chapter and describe their costs and benefits. What are the major differences between each of these approaches and conventional product costing systems?

8.11 What factors would you consider in deciding whether a business needs to implement activity-based costing; and, if so, what is the most appropriate approach to adopt?

8.12 Explain why an activity-based costing system might include direct labour and non-manufacturing costs, as well as manufacturing overhead costs.

8.13 Describe the role of activity centres when assigning costs to activities.

8.14 Explain how cost categories can be used to simplify the assignment of costs to activities. Give three examples of cost categories that a manufacturing business might find useful and describe the costs that might be included in each category.

8.15 Activities may be classified as *unit level*, *batch level*, *product level* or *facility level*. Define each of these terms and give an example of each of these four types of activities for:
(a) Car manufacturer.
(b) Courier company.
How is the unit, batch, product and facility level classification relevant to product costing?

8.16 Should facility level costs be included when estimating product costs for:
(a) Reporting inventory balances?
(b) Evaluating product profitability?
Explain your answer.

8.17 Describe the three main types of activity driver found in activity-based costing and give two examples of each type of driver for Australia Post. (*Hint*: First think about the activities performed at Australia Post and then think about their activity drivers.)

8.18 What factors should be considered in deciding whether to aggregate individual activities into larger homogeneous 'activity cost pools' and in deciding how many cost pools to use?

8.19 What causes conventional product costing systems to report lower product costs than those reported by activity-based costing systems for low-volume, small-batch, speciality product lines?

8.20 Describe the circumstances in which the benefits from ABC will be greatest. Using the 'Real life' scenarios in this chapter give some examples of the benefits of activity-based costing.

8.21 What factors may impede the introduction of ABC?

8.22 What are the implications of spare capacity when activity-based costing is used to report on the profitability of a firm?

8.23 The success (or failure) of activity-based costing is determined by the reactions of the people who develop and use the system. Discuss.

8.24 Describe the limitations of activity-based costing.

8.25 Give three examples of service organisations that use activity-based costing drawing on the 'Real life' scenarios in this chapter. Are there any special problems that are likely to arise in using activity-based costing in service organisations?

8.26 (appendix) Compare the simple ABC system described in this chapter with the conventional approaches to product costing that use either a plantwide manufacturing overhead rate or departmental overhead rates.

EXERCISES

E8.27 **Assigning costs to activity centres: manufacturer**

Silverwater Ltd manufactures video recorders and has decided to develop an activity-based product costing system to assign labour and overhead costs to products. The table below lists Silverwater's costs during the current year and the resource drivers to be used to assign these costs to activity centres.

Silverwater Ltd
Labour and Overhead Costs

	Total cost	Resource driver	Total amount of resource driver
Wages	$600 000	Head count	100 employees
Building costs	200 000	Floor area	10 000 square metres
Energy	300 000	Kilowatt hours	250 000 kilowatt hours
Other	50 000	Head count	100 employees
Total labour and overhead costs	$1 150 000		

Required:

1 Calculate the costs assigned to the Assembly Centre given its usage of resource drivers during the year, as follows:

Number of employees	20
Floor area	1 000 square metres
Power used	10 000 kilowatt hours

2 The costs listed above are not individual costs but a series of costs grouped together into cost categories such as wages, building costs and so on. Explain why Silverwater combined the costs from its general ledger into cost categories. Under what conditions is it appropriate to combine costs into cost categories? Give three examples of the types of costs likely to be included in each category.
3 What is meant by the term *resource driver*? Can you suggest a better basis for assigning 'Wages' to activity centres?

E8.28 Assigning activity centre costs to activities: manufacturer

Acacia Paints Ltd manufactures paint and uses an activity-based product costing system. The table below lists the labour and overhead costs of the Mixing Centre for the current year, and their resource drivers.

Acacia Paints Ltd
Mixing Centre
Costs and Resource Drivers

	Total cost	Resource driver	Amount of resource driver consumed by the centre
Wages	$100 000	Head count	5 people
Energy	80 000	Kilowatt hours	10 000 kilowatt hours
Depreciation	20 000	Machine hours	5000 machine hours
Other	10 000	Head count	5 people
Total labour and overhead costs	$210 000		

Required:

1 Complete the following table to calculate the cost of the activity 'Load mixer' for the current year. This activity is performed in the Mixing Centre.

Acacia Paints Ltd
Activity: Load Mixer

Cost category	Mixing Centre cost	Amount of resource driver used to load mixer	Cost of activity 'Load mixer'
Wages	$100 000	5% of total labour time in Mixing Centre	?
Energy	80 000	500 kilowatt hours	?
Depreciation	20 000	100 machine hours	?
Other	10 000	5% of total labour time in Mixing Centre	?
Total cost	$210 000		

2 Why would Acacia Paints use an activity-based product costing system that assigns labour as well as overhead costs to activities?
3 How would the management accountant obtain details of the activities performed and the quantity of resource drivers used by the activities in the Mixing Centre?

E8.29 Calculating the cost per unit of activity driver: manufacturer

McPhail Ltd manufactures delicious shortbread biscuits in a variety of shapes and sizes. The following is a list of activities, costs, and quantities of activity drivers for the Mixing Centre for the current year:

McPhail Ltd
Mixing Centre
Activities and costs

Activity	Activity cost	Activity driver	Quantity of activity driver
Weigh ingredients	$6 000	No. of batches	400 batches
Load mixing machine	9 200	No. of batches	400 batches
Operate mixing machine	51 200	No. of machine hours	3 200 machine hours
Unload mixing machine	8 000	No. of batches	400 batches
Press biscuits onto trays	20 000	No. of biscuits	500 000 biscuits
Move trays to ovens	6 400	No. of loads	2000 loads
Total cost	$100 800		

Required:

1 Calculate the cost per unit of activity driver for each activity in the Mixing Centre.
2 Explain how these costs are used to calculate the cost of the range of shortbread products produced by McPhail Ltd.
3 Classify each activity in the Mixing Centre as facility, product, batch or unit level. Give your reasons for each classification.
4 Suggest alternative activity drivers for each of the activities.

E8.30 Assigning activity costs to products: manufacturer

Sonix Sounds Ltd manufactures high-fidelity compact disc players and uses an activity-based product costing system that assigns labour and overhead costs. Below is an incomplete bill of activities for the high-volume product, CD Standard.

Sonix Sounds Ltd
Bill of activities: CD Standard

Activity	Cost per unit of activity driver	Annual quantity of activity drivers used by the product
Process payables	$40 per purchase order	400 purchase orders
Program production	$150 per production schedule	100 schedules
Process sales order	$50 per sales order	300 sales orders
Issue materials	$80 per issue	100 issues
Set up solder machine	$105 per setup	100 setups
Solder circuit boards	$10 per solder joint	40 000 solder joints
Insert motor	$20 per player	5 000 players
Assemble player	$12 per player	5 000 players
Design player	Directly assigned cost of $8 000 for model CD Standard	

Required:

1 Complete the bill of activities and estimate the total activity cost of the CD Standard player, calculated on an annual and per unit basis, assuming the annual production is 5000 units. (You may find it useful to refer to Exhibit 8.10 on page 383.)

2 If the direct material cost of a CD Standard player is $45 per unit, what is the total unit cost of the product?
3 Explain the treatment of the costs of the activity 'Design player'.

E8.31 Activity-based costing and inventory valuation: manufacturer

Refer to the data in Exercise 8.30. Would the product cost calculated using the activity-based costing system be allowed as a basis for valuing inventory under Australian accounting standards? Explain your answer. (The inventory valuation requirements of the Australian accounting standards are described in the appendix to Chapter 4, see pages 171 and 172.)

E8.32 Classifying activities as unit, batch, product or facility level costs: manufacturer

Refer to the data in Exercise 8.30 on page 407. For each activity, indicate whether it represents a unit, batch, product or facility level activity. In each case, explain your answer.

E8.33 Classification of activities: winery

Seneca Falls Winery is a small, family-run operation in the Snowy Mountains. The winery produces two varieties of wine: riesling and chardonnay. Among the activities engaged in by the winery are the following:

(a) Pruning: At the end of a growing season, the vines are pruned, which helps prepare them for the next harvest.
(b) Tying: The vines are tied onto wires to help protect them from the cold. (This also occurs at the end of the season.)
(c) Hilling: Dirt is piled up around the roots to help protect them from frost.
(d) Conditioning: After the snow melts in the spring, dirt is levelled back from the roots.
(e) Untying: The vines are untied from the wires to allow them freedom to grow during the spring and summer months.
(f) Chemical spraying: The vines are sprayed in the spring to protect them from disease and insects.
(g) Harvesting: All of the grapes of both varieties are picked by hand to minimise damage.
(h) Stemming and crushing: Batches of grapes are hand-loaded into a machine, which gently removes the stems and mildly crushes them.
(i) Pressing: After removal from the stemmer/crusher, the juice runs freely from the grapes.
(j) Filtering: The grapes are crushed mechanically to render more juice from them.
(k) Fermentation: The riesling grape juice is placed in stainless steel tanks for fermentation. The chardonnay grape juice undergoes a two-stage fermentation process in oak barrels.
(l) Ageing: The riesling wines are aged in the stainless steel tanks for approximately a year. The chardonnays are aged in the oak barrels for about two years.
(m) Bottling: A machine bottles the wine and corks the bottles.
(n) Labelling: Each bottle in manually labelled with the name of the vintner, vintage and variety.
(o) Packing: The bottles are manually packed in 12 bottle cases.
(p) Case labelling: The cases are hand-stamped with the same information that the bottles received.
(q) Shipping: The wine is shipped to wine distributors and retailers, mainly in Sydney and Melbourne. Generally, about 100 cases are shipped at a time.
(r) Maintenance on buildings: This is done during the slow winter months.
(s) Maintenance on equipment: This is done when needed, and on a routine basis for preventative maintenance.

Required:
Classify each of the activities listed as a unit, batch, product-sustaining or facility level activity.

E8.34 Comparison of activity-based and conventional product costs: manufacturer

Fantastique Fashions Ltd has switched from a conventional product costing system to an activity-based product costing system to assign manufacturing overhead costs to products. The table below shows the cost per unit for two products under the two costing systems:

Costing system	Product A	Product B
Conventional	$36	$25
ABC	$30	$45

Required:

1 Describe the most likely features of products A and B by replacing the question marks (?) in the following table with 'Yes' or 'No'.

Product feature	Product A	Product B
High-volume product line	?	?
Low-volume product line	?	?
Produced in small batches	?	?
Produced in large batches	?	?
Simple to produce	?	?
Complex to produce	?	?

2 Explain your answers to requirement 1.

E8.35 Volume-based cost driver versus ABC: manufacturer

Optic Lens Company manufactures sophisticated lenses and mirrors used in large optical telescopes. The company is now preparing its annual profit plan. As part of its analysis of the profitability of individual products, the management accountant estimates the amount of overhead that should be allocated to the individual product lines from the following information:

	Lenses	Mirrors
Units produced	25	25
Material handling (number of moves) per product line	5	15
Direct labour hours per unit	200	200

The total budgeted material handling cost is $50 000.

Required:

1 Calculate the material handling costs allocated to one lens under a costing system that allocates overhead on the basis of direct labour hours.
2 Calculate the material handling costs allocated to one mirror under a costing system that allocates overhead on the basis of direct labour hours.
3 Calculate the material handling costs allocated to one lens under activity-based costing. The activity driver for the material handling activity is the number of material moves.
4 Calculate the material handling costs allocated to one mirror under activity-based costing.

(CMA, adapted)

E8.36 Distortion of product costs: manufacturer

Wheelco Pty Ltd manufactures car and truck wheels. The company produces four basic, high-volume wheels used by manufacturers of large cars and trucks. Wheelco also has two specialty wheel lines. These are fancy, complicated wheels used in expensive sports cars.

Lately, Wheelco's profits have been declining. Foreign competitors have been undercutting Wheelco's prices in three of its four major product lines, and Wheelco's sales volume and market share have declined. In contrast, Wheelco's speciality wheels have been selling steadily, although in relatively small numbers, in spite of three recent price increases. At a recent staff meeting, Wheelco's managing director made the following remarks:

> *Our profits are going down the tube. It costs us $29 to manufacture our A22 wheel. That's our best seller, with a volume last year of 17000 units, but our chief competitor is selling basically the same wheel for $27. I don't see how they can do it. I think it's just one more example of foreign dumping. I'm going to write to my local MP about it!*
>
> *Thank goodness for our speciality wheels. We must get our salespeople to push those wheels more and more. Take the D52 model, for example. It's a complicated thing to make and we don't sell many, but look at the profit margin. Those wheels cost us $49 to make, and we're selling them for $105 each.*

Required:

What do you think is behind the problems faced by Wheelco? Comment on the managing director's remarks. Do you think his strategy is a good one? What do you recommend, and why?

E8.37 Key features of activity-based costing: manufacturer

Refer to the description of Wheelco Ltd in Exercise 8.36. Suppose the firm's managing director has decided to implement an activity-based costing system.

Required:

1. List and briefly describe the key features that Wheelco's new product costing system should include.
2. What impact will the new system be likely to have on the company's situation?
3. What strategic options are likely to be considered once the results of the new costing system are examined?

E8.38 Activity-based costing: service firm

Rex Rogers, the manager of Outback Treks, uses activity-based costing to calculate the cost of the company's adventure walking trips. The company offers two basic trips: a two-day walk along the El Questro Gorge and a five-day trip to the Flinders Ranges. The activities and costs relevant to the walking trips are as follows:

Activity	Activity driver	Cost per unit of activity driver
Advertise trips	No. of trips	$50 per trip
Obtain National Park permit	Destination	$100 per group permit issued
Use equipment	No. of person-days	$20 per person per day
Insure participants	No. of people	$5 per person
Cook meals	No. of person-days	$25 per person per day
Guide walkers	Distance walked	$7 per kilometre

The El Questro Gorge trip caters for 8 people, does not enter National Parks and covers a walking distance of 50 kilometres. The Flinders Ranges trip

caters for 15 people, is based in the Mt Remarkable National Park, and covers 100 kilometres.

Required:

1 Calculate the total cost of each trip, the cost per person for each trip, and the cost per day for each trip, using the activity-based costing system.
2 Before introducing activity-based costing, Rex had estimated the average cost of all trips at $65 per person per day. (This was based on the previous year's costs, adjusted for any expected changes.) Explain how the activity-based system results in more accurate service cost estimates.

E8.39 Activity-based costing; identifying activities and activity drivers: university

Your university has decided to adopt an activity-based costing system to estimate the cost of the various courses taught at the university.

Required:

1 Identify the major activities performed by the staff in the department that teaches the accounting courses.
2 Suggest possible activity drivers for each activity.
3 Prepare a bill of activities that could be used to estimate the total cost of the management accounting subject that you are currently studying.
4 Do the terms unit level, batch level, product level or facility level activities have any relevance in this example? Explain.
5 In estimating the cost of the management accounting subject, how would you account for materials? Explain your answer.

E8.40 (appendix) Cost drivers and activity costs in a simple activity-based product costing system: manufacturer

Digitech Ltd manufactures various computer components in its Paramatta plant. The following costs are budgeted for the coming year:

Insurance, plant	$780 000
Electricity, machinery	156 000
Electricity, light	78 000
Engineering design	793 000
Depreciation, plant	910 000
Depreciation, machinery	1 820 000
Security staff wages, plant	52 000
Equipment maintenance, wages	195 000
Equipment maintenance, parts	39 000
Setup wages	52 000
Inspection	39 000
Property taxes	156 000
Natural gas, heating	39 000
Raw materials and components	3 835 000

Required:

1 Suggest possible activities for Digitech and identify which costs would be assigned to each activity.
2 For each activity, suggest an activity driver that could be used to assign activity costs to products.

E8.41 Categorising activity costs: manufacturer

Refer to the information given in Exercise 8.40. For each of the activity costs identified, indicate whether it represents a unit level, batch level, product sustaining level or facility level activity.

E8.42 Activity-based costing; quality control costs: manufacturer

Natural Cosmetics Ltd (NCL) has used a conventional cost accounting system to apply quality control costs uniformly to all products at a rate of 14.5 per cent of direct labour cost. Monthly direct labour cost for Satin Sheen make up is $27 500. In an attempt to distribute quality control costs more equitably, NCL is considering activity-based costing. The monthly data following relates to monthly quality control costs for Satin Sheen make up:

Activity	Activity driver	Cost per unit of activity driver	Quantity of activity driver for enamel paint
Incoming material inspection	Type of material	$11.50 per type	12 types
In-process inspection	Number of units	$0.14 per unit	17 500 units
Product certification	Per order	$77.00 per order	25 orders

Required:

1 Calculate the monthly quality control cost to be assigned to the Satin Sheen product line under each of the following approaches:
   (a) conventional system which assigns overhead on the basis of direct labour costs
   (b) activity-based costing
2 Does the conventional product costing system overcost or undercost the Satin Sheen product line with respect to quality-control costs? By what amount and why?

(CMA, adapted)

E8.43 Problems with conventional costing systems; activity-based costing principles: manufacturer

Marrabel Manufacturing has just completed a major change in its quality control (QC) process. Previously, products were reviewed by QC inspectors at the end of each major process, and the company's 10 QC inspectors were charged as direct labour to the operation or job. In an effort to improve efficiency and quality, a computerised video QC system was purchased for $250 000. The system consists of a computer, 15 video cameras, other peripheral hardware, and software. The new system uses cameras stationed by QC engineers at key points in the production process. Each time an operation changes or there is a new operation, the cameras are moved, and a new master picture is loaded into the computer by a QC engineer. The camera takes pictures of the units in process, and the computer compares them with a picture of a 'good' unit. Any differences are sent to a QC engineer who removes the bad units and discusses the flaws with the production supervisors. The new system has replaced the 10 QC inspectors with two QC engineers.

The operating costs of the new QC system, including the salaries of the QC engineers, have been included as factory overhead in calculating the company's plantwide manufacturing overhead rate, which is based on direct labour dollars. The company's managing director is confused. His production manager has told him how efficient the new system is, yet there is a large increase in the overhead rate. The calculation of the overhead rate before and after automation is as follows:

	Before	After
Budgeted manufacturing overhead	$1 900 000	$2 100 000
Budgeted direct labour cost	$1 000 000	$700 000
Budgeted overhead rate (as % of direct labour cost)	190%	300%

'Three hundred per cent', lamented the managing director. 'How can we compete with such a high overhead rate?'

Required:

1 Define 'manufacturing overhead' and cite three examples of typical costs that would be included in manufacturing overhead.
2 Explain why the increase in the overhead rate should not have a negative financial impact on Marrabel Manufacturing.
3 Discuss how an activity-based costing system might benefit Marrabel Manufacturing.

PROBLEMS

P8.44 Calculating activity-based product costs; identifying non-manufacturing costs: manufacturer

Kennelly and Sons manufactures components for the computer industry. The company uses an activity-based costing system to assign labour, manufacturing overhead and non-manufacturing costs to products. Below is a partially completed bill of activities for one of the company's major products, Switch 3901.

	Switch 3901	
Activity	**Cost per unit of activity driver**	**Annual quantity of activity driver**
Prepare purchase order	$43 per purchase order	50 purchase orders
Process payables	$27 per invoice received	50 invoices
Prepare payroll	$10 per payslip	300 payslips
Process sales orders	$33 per sales order	500 sales orders
Pack and dispatch	$17 per sales order	500 sales orders
Program solder robots	$153 per program	200 programs
Solder circuits	$2 per solder joint	72 000 solder joints
Assemble circuit boards	$5 per board	15 000 boards
Wire in switch	$14 per switch	5000 switches
Insert fuse	$10 per fuse	5000 fuses
Test switch	$4 per switch	5000 switches
Design switch	$5000 for model 3901	

These annual costs relate to an annual production level of 5000 switches. The direct material cost per switch is $20.

Required:

1 Calculate the total cost per unit for Switch 3901.
2 Calculate the manufacturing cost per unit for Switch 3901. (*Hint*: Include only those activities that relate to manufacturing.)
3 Discuss the role that product costs that include both manufacturing and non-manufacturing costs can play in management decision making.

P8.45 Calculating activity costs: winery

The management of Mutherglen Wines Pty Ltd is contemplating the introduction of an activity-based costing system and has just conducted an activity-based costing exercise in its bottling plant. The costs of the plant, summarised into cost categories for the year, are as follows:

Bottling Plant costs			
	Total cost	Resource driver	Total amount of resource driver
Wages	$2 000 000	No. of employees	40 employees
Building costs	200 000	Floor area	50 000 square metres
Machinery costs	900 000	Machine hours	90 000 machine hours
Energy costs	1 200 000	Kilowatt hours	600 000 kilowatt hours
Other	45 000	Machine hours	90 000 machine hours
	$4 345 000		

Four activity centres have been identified in the plant, with the following resource driver consumption patterns:

Bottling Plant activity centres Resource drivers				
Activity centre	No. of employees	Floor area (m^2)	Machine hours	Kilowatt hours
Filling	20	15 000	40 000	250 000
Corking	10	5 000	15 000	100 000
Labelling	4	10 000	10 000	50 000
Packing	6	20 000	25 000	200 000
Total	40	50 000	90 000	600 000

The work in the Labelling Centre has been broken down into the following five activities. Their use of resource drivers is also shown.

Labelling Centre activities Resource drivers				
Activity	No. of employees	Floor area (m^2)	Machine hours	Kilowatt hours
Set up front label machines	0.5	–	–	–
Operate front label machines	1.0	3 000	7 000	30 000
Set up back label machines	0.5	–	–	–
Operate back label machines	1.0	2 000	3 000	20 000
Inspect labelled bottles	1.0	5 000	–	–
Total	4.0	10 000	10 000	50 000

Required:

1 Calculate the cost of each activity centre.
2 Calculate the cost of the activities performed in the Labelling Centre.
3 Why would Mutherglen contemplate using an activity-based product costing system?
4 What are the limitations of activity-based product costing?

P8.46 Activity-based costing: service

Rabid Roberts is the manager of a firm, QuikTax, which specialises in the preparation of income tax returns. The firm offers two basic products: the preparation of income tax returns for wage and salary earners and the preparation of income tax returns for small businesses. Any clients requiring more complex

services are referred to Rabid's brother Roger, who is a partner in a large firm of chartered accountants.

The processing of wage and salary tax returns is quite straightforward, and the firm uses a software package to process data and print the return. A software package is also used to prepare returns for small businesses, although more information is required, particularly about business expenses.

Rabid has only recently joined QuikTax and he is concerned about the firm's pricing policy, which sets a flat fee of $40 per return for wage and salary clients and $200 for small businesses. He decides to use activity-based costing to estimate the costs of providing each of these services.

At the end of the year, Rabid reviewed the company's total costs and activities, resulting in the following list:

Activity	Activity cost	Activity driver	Quantity of activity driver
Interview salaried client	$40 000	No. of wage and salary clients	8 000
Interview business client	50 000	No. of business clients	2 000
Obtain missing data	400 000	No. of follow-up calls	8 000
Input data	80 000	No. of data entries	400 000
Print return	60 000	No. of returns	10 000
Verify return with client	120 000	No. of hours	6 000
Rectify errors	60 000	No. of errors	6 000
Submit return	20 000	No. of returns	10 000
Total costs	$830 000		

In identifying the activities required for each type of return, Rabid noted the following:

(a) Clients are interviewed only once per return.
(b) All follow-up calls to obtain missing data relate to business returns; on average, each business tax return requires four follow-up calls.
(c) Processing a wage and salary tax return requires 20 data entries, whereas a business return requires 120 data entries.
(d) On average, it takes 22.5 minutes to verify a wage and salary tax return, whereas it takes one and a half hours to verify a business return.
(e) All errors relate to business returns; on average, there are 3 errors per business return.

Required:

1 Use activity-based costing to estimate the cost of preparing:
   (a) Wage and salary tax return.
   (b) Business tax return.
2 In the light of your answers to requirement 1, evaluate the firm's pricing policy.

P8.47 Activity-based costing; analysis of operations: service firm

Clark and Shiffer perform consulting services related to e-commerce consulting and information systems in Perth. The firm, which bills $125 per hour for services performed, is in a very tight local labour market and is having difficulty finding quality staff. The labour cost per hour paid by Clark and Shiffer for professional staff time is $45. Selected information follows:

(a) Billable hours to clients for the year totalled 5000, consisting of: information systems services, 3100; e-commerce consulting, 1900.
(b) Administrative cost of $342 000 was (and continues to be) allocated to both consulting services based on billable hours. These costs consist of staff

support, $180 000; in-house computing, $136 400; and miscellaneous office charges, $25 600.

A recent analysis of staff support costs found a correlation with the number of clients served. In-house computing and miscellaneous office charges varied directly with the number of computer hours logged and number of client transactions, respectively. The following table shows the number of clients, computer hours and client transactions for the e-commerce and information systems consulting services:

	e-commerce consulting	Information systems consulting	Total
Number of clients	50	200	250
Number of computer hours	1 800	2 600	4 400
Number of client transactions	600	400	1 000

Required:

1 Activity-based costing (ABC) is said to result in improved costing accuracy when compared with conventional costing procedures. Briefly explain how this improved accuracy is attained.
2 Assume that the firm uses conventional costing procedures, allocating total costs on the basis of billable hours. Determine the profitability of the firm's e-commerce and information systems consulting services, expressing your answer both in dollars and as a percentage of activity revenue.
3 Repeat requirement 2, using activity-based costing.
4 Stephen Shiffer, one of the firm's partners, doesn't care where his professionals spend their time because, as he notes, 'Many clients have come to expect both services and we need both to stay in business. Also, information systems and e-commerce professionals are paid the same hourly rate'. Should Shiffer's attitude change? Explain.
5 Is an aggressive expansion of either consulting service desirable? Briefly discuss.

P8.48 Estimating activity-based product costs; problems with conventional costing systems: manufacturer

Sunsafe Optics Ltd manufactures lenses for sunglasses. Although the company manufactures a wide range of lenses that vary in size and shape, these products can be grouped into three basic product lines: coloured plastic lenses, lenses that absorb ultraviolet radiation, and lenses that provide both sun protection and the correction of optical defects.

All three products undergo the same injection moulding process where a plastic substance is injected between two glass dies. When the plastic is set, the lenses are removed from the dies, which, if possible, are re-used for subsequent batches. The coloured plastic lenses and the UV-absorbing lenses are high-volume lines produced in large batches. These two products are simple to make and are similar in many ways, except that the material used for the UV-absorbing lenses is much more expensive than the material used for the coloured plastic lenses. The optical lenses are a low-volume line, produced in small batches. These lenses are complex to make. They require specially ground optical dies and careful inspection at several points during production.

Currently, the company uses a conventional costing system and applies overhead on the basis of direct labour cost. This system was developed many years ago when the company's production processes were labour-intensive and overhead costs were relatively insignificant. However, over time, the production environment has become more automated, overhead costs have increased significantly and many of the overhead costs bear no direct relationship to the volume of production in general, or to the direct labour cost in particular.

The company's management accountant believes that the current costing system no longer fits Sunsafe's production environment and has set up a special costing study to analyse the labour and overhead costs for the year that has just finished. The study identified the activities and costs shown below:

Sunsafe Optics Ltd

Activity	Activity cost	Annual quantity of activity driver
Prepare purchase order	$25 000	2 000 purchase orders
Process payables	20 000	2 000 invoices
Prepare payroll	30 000	4 000 payslips
Process sales orders	90 000	15 000 sales orders
Move finished goods	600 000	15 000 sales orders
Pack and dispatch	240 000	15 000 sales orders
Produce basic dies	180 000	60 000 dies
Produce optical dies	200 000	20 000 dies
Inspect dies	60 000	20 000 dies
Clean injection moulders	600 000	1 000 batches
Program injection moulders	360 000	1 000 batches
Move material	800 000	1 000 batches
Operate injection moulders	2 800 000	40 000 machine hours
Remove dies	96 000	4 800 000 lenses
Inspect lens	90 000	50 000 lenses
Design lens	90 000	Assigned directly to products

These annual costs relate to an annual production level of 2.5 million coloured plastic lenses, 2.25 million UV-absorbing lenses and 50 000 optical lenses. The direct material costs for each product are as follows:

Coloured plastic	$2 per lens
UV-absorbing	$4 per lens
Optical	$4 per lens

The management accountant estimates that the activity consumption of the three product lines during the year was:

Sunsafe Optics Ltd
Quantity of activity driver used by each product line

Activity	Activity driver	Coloured plastic	UV-absorbing	Optical
Prepare purchase order	No. of purchase orders	1 000	900	100
Process payables	No. of invoices	1 000	900	100
Prepare payroll	No. of payslips	2 000	1 800	200
Process sales orders	No. of sales orders	6 950	8 000	50
Move finished goods	No. of sales orders	6 950	8 000	50
Pack and dispatch	No. of sales orders	6 950	8 000	50
Produce basic dies	No. of dies	30 000	30 000	–

continues

Sunsafe Optics Ltd
Quantity of activity driver used by each product line

Activity	Activity driver	Coloured plastic	UV-absorbing	Optical
Produce optical dies	No. of dies	–	–	20000
Inspect dies	No. of dies	–	–	20000
Clean injection moulders	No. of batches	500	450	50
Program injection moulders	No. of batches	500	450	50
Move material	No. of batches	500	450	50
Operate injection moulders	No. of machine hours	20000	18000	2000
Remove dies	No. of lenses	2500000	2 250000	50000
Inspect lens	No. of lenses	–	–	50000
Design lens	Assigned directly to products	$30000	$50000	$10000

Required:

1 Estimate the per unit cost of each of the three products (rounded to three decimal places).
2 Do you expect these costs to be higher than or lower than the product costs estimated under the existing conventional costing system? Explain your answer.

P8.49 Activity-based costing: service organisation

The Intellectually Disabled Council has the responsibility for distributing government grants to fund support services for intellectually disabled people. The director is concerned that grants be distributed on an equitable basis, and asks Sue Jolley, the Council's management accountant, to estimate the cost of providing institutional care to clients with intellectual disabilities. Jolley decides to use activity-based costing in one of the state's larger institutions, Greenfields, to obtain an initial estimate of the costs of the services provided.

Working with a project team at Greenfields, she identifies the following major activities and costs for next year.

Greenfields
Activities performed

Activity	Cost (in $'000s)	Annual volume of activity drivers
Cook meals	$500	100000 meals
Transport clients (internal)	200	4000 hours of assistance
Transport clients (external)	450	6000 hours of assistance
Clean rooms	100	20000 rooms cleaned
Bath clients	144	16000 baths given
Dress clients	30	10000 clients dressed
Administer medication	120	75000 doses administered
Provide occupational therapy	90	600 classes
Provide physiotherapy	250	5000 hours of physiotherapy
Run sheltered workshop	150	200 days of operation

Although the needs of the individual clients vary tremendously, the project team identifies three major service types: high-dependency support, low-dependency support and outpatient support. High-dependency and low-dependency clients live at Greenfields, while outpatients attend the centre on a daily basis. The average number of activities required to support each of the three types of clients each day is estimated as follows:

Greenfields
Activities consumed per client per day

Activity	High-dependency	Low-dependency	Outpatient
Cook meals	3	3	1
Internal transport	4	0	0
External transport	3	2	1
Clean room	2	1	0
Bath client	1	0	0
Dress client	1	0	0
Administer medication	4	1	1
Provide occupational therapy*	1	2	2
Provide physiotherapy	4	2	1
Run sheltered workshop†	0	1	1

* Occupational therapy classes are attended by an average of 10 clients.
† The sheltered workshop is used by an average of 20 clients per day.

Required:

1 Use an Excel® spreadsheet to:
   (a) Calculate the cost per unit of activity driver for each of the activities identified by the project team.
   (b) Calculate the daily cost of supporting:
   (i) High-dependency client. (ii) Low-dependency client. (iii) Outpatient client.
2 Review the list of activities and suggest some major activities that may have been overlooked by the project team.
3 Do you think activity-based costing is useful in this situation? Explain your answer.

P8.50 Activity-based costing; product decisions: manufacturer

Territory Electronics Company
Income Statement

	Zodiac	Novelle	Total
Sales	$4 560 000	$19 800 000	$24 360 000
Cost of goods sold	3 192 000	12 540 000	15 732 000
Gross margin	$1 368 000	$7 260 000	$8 628 000
Selling and administrative expenses	978 000	5 830 000	6 808 000
Net profit	$390 000	$1 430 000	$1 820 000
Units produced and sold	4 000	22 000	
Net profit per unit sold	$97.50	$65.00*	

* Rounded.

Territory Electronics Company (TEC) manufactures two large-screen television models, the Novelle which has been produced for 10 years and sells for $900, and the Zodiac, a new model which sells for $1140. Based on the income statement for the year just ended, presented on page 419, a decision has been made to concentrate TEC's marketing resources on the Zodiac model and to begin to phase out the Novelle model.

The unit costs for the Zodiac and Novelle models are as follows:

	Zodiac	Novelle
Direct material	$584	$208
Direct labour:		
Zodiac (3.5 hr × $14)	42	
Novelle (1.5 hr × $14)		18
Manufacturing overhead*	100	200
Cost per unit	$798	$570

* Manufacturing overhead was applied on the basis of machine hours at a predetermined rate of $26 per hour.

Territory Electronics Company's financial controller is advocating the use of activity-based costing, and has gathered the following information about the company's manufacturing overhead costs for the year just ended:

		Quantity of activity drivers consumed		
Activity (activity driver)	Activity costs	Zodiac	Novelle	Total
Soldering (number of solder joints)	$942 000	385 000	1 185 000	1 570 000
Shipments (number of shipments)	860 000	3 800	16 200	20 000
Quality control (number of inspections)	1 240 000	21 300	56 200	77 500
Purchase orders (number of orders)	950 400	109 980	80 100	190 080
Machine power (machine hours)	57 600	16 000	176 000	192 000
Machine setups (number of setups)	750 000	14 000	16 000	30 000
Total activity costs	$4 800 000			

Required:

1 Briefly explain how an activity-based costing system operates.
2 Using activity-based costing, determine if TEC should continue to emphasise the Zodiac model and phase out the Novelle model.

(CMA, adapted)

P8.51 (appendix) Activity-based costing for overhead versus conventional costing systems: manufacturer

Locket Storage Ltd manufactures two types of storage cabinets—Deluxe and Executive—and applies manufacturing overhead to all units at the rate of $80 per machine hour. Production information follows.

	Deluxe	Executive
Direct material cost	$35	$60
Direct labour cost	20	20
Budgeted volume (units)	8 000	15 000

The management accountant, who is studying activity-based costing, has determined that the firm's overhead can be identified with three activities: manufacturing setups, machine processing and product shipping. Data on the number of setups, machine hours and outgoing shipments, which are the activities' three respective cost drivers, follow:

	Deluxe	Executive	Total
Setups	50	30	80
Machine hours	16000	22500	38500
Outgoing shipments	100	75	175

The firm's total overhead of $3 080 000 is subdivided as follows: manufacturing setups, $672 000; machine processing, $1 848 000; and product shipping, $560000.

Required:

1 Calculate the unit manufacturing cost of Deluxe and Executive cabinets by using the company's current overhead costing procedures.
2 Calculate the unit manufacturing cost of Deluxe and Executive cabinets by using activity-based costing.
3 Is the cost of the Deluxe cabinet overstated or understated (i.e. distorted) by the use of machine hours to allocate total manufacturing overhead to production? By how much?
4 Calculate the aggregate amount by which the Deluxe cabinet line is undercosted by the company's current conventional overhead costing procedures. Then calculate the aggregate amount by which the conventional system overcosts the Executive cabinet line.
5 Assume that the current selling price of a Deluxe cabinet is $260 and the marketing manager is contemplating a $30 discount to stimulate sales. Is this discount advisable? Briefly discuss.

P8.52 (appendix) Activity cost pools; cost drivers: manufacturer

The accountant for Halifax Photographic Supply Ltd has estimated the following activity cost pools and activity drivers for the coming year:

Activity	Budgeted overhead cost	Activity driver	Budgeted level for activity driver	Cost per unit of activity driver
Machine setups	$200000	No. of setups	100	$2000 per setup
Material handling	100000	Weight of raw material	50000 kilograms	$2 per kilogram
Hazardous waste control	50000	Weight of hazardous chemicals used	10000 kilograms	$5 per kilogram
Quality control	75000	No. of inspections	1000	$75 per inspection
Other overhead costs	200000	Machine hours	20000	$10 per machine hou
Total	$625000			

An order for 1000 boxes of film development chemicals has the following production requirements:

Machine setups	4 setups
Raw material	10 000 kilograms
Hazardous materials	2000 kilograms
Inspections	10 inspections
Machine hours	500 machine hours

Required:

1 Calculate the total overhead that should be assigned to the order for development chemicals.
2 What is the overhead cost per box of chemicals?
3 If Halifax Photographic Supply Ltd were to use a plantwide predetermined overhead rate based on machine hours, calculate the rate per hour.
4 Under the approach in requirement 3, how much overhead would be assigned to the order for development chemicals:
   (a) In total?
   (b) Per box of chemicals?
5 Explain why these two product costing systems result in such widely differing costs. Which system do you recommend? Why?
6 Calculate the unit cost of a production order for 100 specially coated plates used in film development. In addition to direct material costing $120 per plate and direct labour costing $40 per plate, the order requires the following:

Machine setups	2 setups
Raw material	800 kilograms
Hazardous materials	300 kilograms
Inspections	3 inspections
Machine hours	50 machine hours

CASES

C8.53 Activity-based costing; forecasting; ethics: manufacturer

East Coast Marine Ltd (ECM) manufactures parts for small marine craft. Over the past decade, ECM's management has met its goal of reducing its reliance on government contract work to 50 per cent of total sales. ECM is now equally reliant on commercial sales and government contracts.

Traditionally, the costs of the Material Handling Department have been allocated to direct material as a percentage of direct material dollar value. This was adequate when the majority of the manufacturing was homogeneous and related to government contracts. Recently, however, government auditors have rejected some proposals, stating that 'the amount of Material Handling Department costs allocated to these proposals is disproportionate to the total effort involved'.

Eloise Smith, the newly hired cost accounting manager, was asked by the manager of ECM's Government Contracts Unit, Paul Jones, to find a more equitable method of allocating the Material Handling Department costs to the user departments. Her review has revealed the following information:

- The majority of the direct material purchases for government contracts are high-dollar, low-volume purchases, while commercial materials represent low-dollar, high-volume purchases.

- Administrative departments such as Marketing, Finance and Administration, Human Resources and Maintenance also use the services of the Material Handling Department on a limited basis but have never been charged in the past for material handling costs.
- One purchasing manager with a direct phone line is assigned exclusively to purchasing high-dollar, low-volume material for government contracts on an annual salary of $36 000. Employee on-costs are estimated to be 20 per cent of the annual salary. The annual costs of the dedicated phone line are $2800.
- The components of the Material Handling Department's budget for the coming year, as proposed by Lindley's predecessor, follow.

Payroll	$180 000
Employee on-costs	36 000
Telephone	38 000
Other utilities	22 000
Materials and supplies	6 000
Depreciation	6 000
Direct material budget:	
Government contracts	2 006 000
Commercial products	874 000

Smith has estimated the number of purchase orders to be processed in the coming year as follows:

Government contracts*	80 000
Commercial products	156 000
Marketing	1 800
Finance and Administration	2 700
Human Resources	500
Maintenance	1 000
Total	242 000

* Exclusive of high-dollar, low-volume materials.

Smith has recommended to Jones that material handling costs should be allocated on a per purchase order basis. Jones realises that the company has been allocating to government contracts more material handling costs than can be justified. However, the implication of Smith's analysis could be a decrease in his unit's earnings and, consequently, a cut in his annual bonus. Jones told Smith to 'adjust' her numbers and modify her recommendation so that the results will be more favourable to the Government Contracts Unit.

Being new in her position, Smith is not sure how to proceed. She feels ambivalent about Jones' instructions and suspects his motivation may not be in the best interest of ECM. To complicate matters for Smith, the company's new managing director has asked her to prepare a three-year forecast of the Government Contracts Unit's results, and she believes that the newly recommended allocation method would provide the most accurate data. However, this would put her in direct opposition to Jones' directives.

Smith has assembled the following data to project the material handling costs over the next three years:

- The number of purchase orders increases 5 per cent per year.
- The ratio of government purchase orders to total purchase orders remains at 33 per cent.

- Total direct material costs increase 2.5 per cent per year.
- Material handling costs remain the same percentage of direct material costs.
- Direct government costs (payroll, employee on-costs, and direct phone line) remain constant.
- In addition, she has assumed that the cost of government material in the future will be 70 per cent of total material.

Required:

1 Calculate the material handling rate that would have been used by Eloise Smith's predecessor at East Coast Marine.
2 (a) Calculate the revised material handling costs to be allocated on a per purchase order basis.
   (b) Discuss why purchase orders might be a more reliable cost driver than the dollar amount of direct material.
3 Calculate the difference due to the change to the new method of allocating material handling costs to government contracts.
4 Prepare a forecast of the cumulative dollar impact over a three-year period (based on the coming year plus 2 more years) of Eloise Smith's recommended change for allocating Material Handling Department costs to the Government Contracts Unit. Round all calculations to the nearest whole number.
5 Referring to the standards of ethical conduct for accountants described in Chapter 1:
   (a) Discuss why Eloise Smith has an ethical conflict.
   (b) Identify several steps that Smith could take to resolve the ethical conflict.

(CMA, adapted)

C8.54 Activity-based costing; conventional costing: manufacturer

Cravings for Cakes Pty Ltd manufactures a wide range of delicious cakes and pastries. At the annual Christmas party, the company's owner, I.M. Craving, treated his employees to a nostalgic review of the firm's history. He told them:

Twenty years ago we had only three product lines—pies, finger buns and lamingtons. We were flat out producing large volumes of each product, using very simple machinery and a lot of hard work.

My, how things have changed! We still make and sell a lot of pies and lamingtons, but we also produce a wide range of low-volume lines, such as danish pastries, donuts and vanilla slices. I hear you sighing, and no wonder; these low-volume products are a pain in the neck. They are complex to produce and their short production runs involve a lot of extra machinery setups and material handling. But the accountants tell me that these speciality lines have wonderful profit margins, so we must not complain.

Craving then outlined the dramatic changes that had occurred within the business over the past 20 years. In the factory he had seen the introduction of computer-controlled mixing machines and ovens that replaced a lot of the direct labour operations, and an increased emphasis on quality and delivery performance. Indeed, right across the business, more and more effort had been placed on keeping the customer happy.

However, his speech cast a gloomy shadow across the Christmas festivities when he warned:

Despite all this progress, the company seems to be struggling. Our profits are declining, and if things don't improve over the next few months, this may be our last Christmas together. To survive we must all work very hard. We must focus on increasing sales, particularly of our high-margin specialty products.

The company's management accountant, Ursula B. Bright, had become concerned about the conventional product costing system at Cravings for Cakes. The manufacturing people were also sure that the costing system was distorting product costs.

Required:

1 Describe the changes in cost structure that are likely to have occurred at Cravings for Cakes over the last 20 years, and explain their causes.
2 Do you think that the existing costing system understates or overstates the cost of:
   (a) Lamington?
   (b) Danish pastry?
   Explain your answers.
3 Explain how activity-based costing could overcome the deficiencies inherent in the existing costing system.
4 What factors should U.B. Bright consider when deciding whether to use:
   (a) Simple activity-based costing system to assign manufacturing overhead to products?
   (b) Activity-based system that includes both manufacturing overhead and non-manufacturing costs?
   (c) Comprehensive activity-based system that includes all product-related costs except direct material?

C8.55 Estimating activity costs; assigning costs to activity centres: manufacturer

Refer to Case 8.54. Assume that U.B. Bright decided to implement an activity-based costing system that included all costs except direct material. She identifies the following costs, by cost category, for the past year and selects the following resource drivers:

Cravings for Cakes
Costs and resource drivers

Cost category	Cost	Resource driver
Wages	$300 000	Number of employees
Building costs	80 000	Floor space
Depreciation	100 000	Machine hours
Consumables	50 000	Orders placed by centre
Energy	400 000	Kilowatt hours used
Other	20 000	Number of employees
Total	$950 000	

Next, Bright divides the company into the following activity centres:

Product Development	Baking
Sales and Dispatch	Packing and Warehousing
Mixing Pastries and Batters	Administration
Filling Pies and Danishes	Corporate Management

The resource driver usage by each activity centre, for the various cost categories, follow.

Cravings for Cakes
Resource drivers consumed by activity centres

	Cost categories (resource drivers)					
Activity centres	Wages (employees)	Building (m^2)	Depreciation (machine hours)	Consumables (orders)	Energy (kilowatt hours)	Other (employees)
Product development	5	200	–	10	–	5
Sales and dispatch	10	500	–	15	–	10
Mixing	15	500	1000	50	10000	15
Filling	20	1000	3000	100	10000	20
Baking	15	500	5000	100	200000	15
Packing	20	1000	500	150	30000	20
Administration	10	1000	500	50	–	10
Corporate management	5	300	–	25	–	5
Total quantity of resource drivers across all activity centres	100	5000	10000	500	250000	100

Required:

1 Assign the costs to the activity centres using the resource driver consumption patterns shown above.
2 Why did U.B. Bright use cost categories in her analysis?
3 Explain how she would have identified the cost categories, and give two examples of the costs likely to be included in each category.
4 U.B. Bright used the number of employees as the resource driver for wages. Can you suggest a more accurate basis for assigning wage costs to activity centres?
5 Can you suggest a more accurate basis than machine hours for assigning depreciation costs to activity centres?

C8.56 Estimating activity costs; assigning activity centre costs to activities: manufacturer

Refer to Cases 8.54 (see page 424) and 8.55 (see pages 425 and above). Notwithstanding your answers so far, assume the following costs and resource drivers for the Mixing Centre:

Cravings for Cakes
Mixing Centre: Costs and resource drivers

	Costs	Resource drivers
Wages	$45000	Percentage of labour time
Building costs	8000	Floor space occupied
Depreciation	10000	Machine hours
Consumables	5000	Percentage of labour time
Energy	16000	Kilowatt hours
Other	3000	Percentage of labour time
Total	$87000	

U.B. Bright has identified the following activities that take place in the Mixing Centre, and estimates that they use the following percentage of labour time and floor space:

Cravings for Cakes
Mixing Centre:
Activities and resource drivers used

Activity	Percentage of labour time	Percentage of floor space
Set up scales	20	5
Weigh ingredients	10	5
Load mixers	25	10
Operate mixers	30	50
Clean mixers	10	20
Move mixture to filling	5	10
Total	100%	100%

The only activity that makes significant use of machinery (and therefore depreciation and energy) is 'Operate mixers'.

Required:

1 Calculate the cost of each activity performed in the Mixing Centre.
2 Explain how U.B. Bright would have collected the information necessary to identify the activities and their resource driver consumption.
3 What steps can U.B. Bright take to ensure that this information is reliable?
4 Classify each activity as unit, batch, product or facility level.

C8.57 Assigning activity costs to products; benefits, costs and limitations of ABC: manufacturer

Refer to Cases 8.54 (see page 424) to 8.56 (above). After much hard work, U.B. Bright produces a list of the activities performed at Cravings for Cakes and their annual costs. In addition, Bright identifies an activity driver for each activity and the annual quantity of each activity driver. A partial list of activity costs and quantities of activity drivers is shown overleaf.

Cravings for Cakes
List of activities

Activity	Activity cost ($)	Activity driver	Annual quantity of activity driver
Prepare annual accounts	5000	None available	
Process receivables	15000	No. of invoices	5000 invoices
Process payables	25000	No. of purchase orders	2500 purchase orders
Program production	28000	No. of production schedules	1000 schedules
Process sales order	40000	No. of sales orders	4000 sales orders
Dispatch sales order	30000	No. of dispatches	2500 dispatches
Develop and test products	60000	Assigned directly to products	

continues

Cravings for Cakes
List of activities

Activity	Activity cost ($)	Activity driver	Annual quantity of activity driver
Load mixers	14050	No. of batches	1000 batches
Operate mixers	45900	No. of kilograms	200000 kilograms
Clean mixers	6900	No. of batches	1000 batches
Move mixture to filling	3450	No. of kilograms	200000 kilograms
Clean trays	20000	No. of trays	16000 trays
Fill trays	16000	No. of cakes/pastries	800000 cakes/ pastries
Move to baking	8000	No. of trays	16000 trays
Set up ovens	50000	No. of batches	1000 batches
Bake cakes/pastries	130000	No. of batches	1000 batches
Move to packing	40000	No. of trays	16000 trays
Pack cakes/pastries	80000	No. of cakes/pastries	800000 cakes/ pastries
Inspect pastries	2500	No. of pastries	50000 pastries

Required:

1 Construct an Excel® spreadsheet to:
   (a) Calculate the cost per unit of activity driver for the activities previously listed. (Work to four decimal places.)
   (b) Based on the information in the following table, prepare a bill of activities and determine the cost per unit for:
   (i) Lamington. (ii) Danish pastry.

Lamington (batch size 1000; annual volume 100000)

Activities consumed	Annual quantity of activity driver
Process receivables	500 invoices
Process payables	200 purchase orders
Program production	100 production schedules
Process sales order	400 sales orders
Load mixers	100 batches
Operate mixers	30000 kilograms
Clean mixers	100 batches
Move mixture to filling	30000 kilograms
Clean trays	2000 trays
Fill trays	100000 cakes
Move to baking	2000 trays
Set up ovens	100 batches
Bake cakes/pastries	100 batches
Move to packing	2000 trays
Pack cakes/pastries	100000 cakes
Dispatch sales order	500 sales orders
Develop and test product	$600 assigned directly to this product

Danish Pastry (batch size 200; annual volume 10 000)	
Activities consumed	**Annual quantity of activity driver**
Process receivables	150 invoices
Process payables	100 purchase orders
Program production	50 production schedules
Process sales order	100 sales orders
Load mixers	50 batches
Operate mixers	4 000 kilograms
Clean mixers	50 batches
Move mixture to filling	4 000 kilograms
Clean trays	400 trays
Fill trays	10 000 pastries
Move to baking	400 trays
Set up ovens	50 batches
Bake cakes/pastries	50 batches
Inspect pastries	10 000 pastries
Move to packing	400 trays
Pack cakes/pastries	10 000 pastries
Dispatch sales order	150 sales orders
Develop and test product	$2 400 assigned directly to this product

2 What other costs must be added to calculate the product cost for lamingtons and danish pastries?
3 Why is the cost per danish pastry much higher than the cost per lamington? Would this difference be reflected in the conventional costing system? Explain your answers.
4 U.B. Bright, as management accountant for Cravings for Cakes Pty Ltd, has recommended the introduction of an activity-based costing system to improve the accuracy of the company's product costs. Bright is filled with enthusiasm, but the company's owner, I.M. Craving, is more cautious:

> *All these new-fangled systems, with fancy names. Twenty years ago it was JIT, or was it ERP? Ten years ago, TQM, and now it's ABC or is it ABM? I'm not keen—ABC sounds complex and expensive. Your report outlines the benefits of ABC but it can't be all positive. I know every cloud has a silver lining, but I also know every silver lining has a cloud. Rewrite your report—but this time describe the costs of ABC and its limitations, as well as the benefits.*

Prepare a report for Craving that outlines the benefits, costs and limitations of activity-based costing. (To set your report in the appropriate business context, you should refer to the information given in Case 8.54 on pages 424 and 425.)

C8.58 (appendix) Conventional versus simple activity-based costing systems; strategic cost analysis: manufacturer

Gigabyte Ltd manufactures three products for the calculator industry:

- Gismos (product G): annual sales, 8000 units.
- Thingamajigs (product T): annual sales, 15 000 units.
- Whatchamacallits (product W): annual sales, 4000 units.

The company uses a conventional, volume-based product costing system with manufacturing overhead applied on the basis of direct labour dollars. The product costs have been calculated as follows:

	Product G		Product T		Product W	
Raw material	$105.00		$157.50		$52.50	
Direct labour	48.00	(2.4 hr × $20)	36.00	(1.8 hr × $20)	24.00	(1.2 hr × $20)
Manufacturing overhead*	420.00	($48 × 875%)	315.00	($36 × 875%)	210.00	($24 × 875%)
Total product cost	$573.00		$508.50		$286.50	

* Calculation of predetermined overhead rate:

Manufacturing overhead budget:

Machinery	$3 675 000
Machine setup	15 750
Inspection	1 575 000
Material handling	2 625 000
Engineering	1 034 250
Total	$8 925 000

Direct labour budget (based on budgeted annual sales):

Product G:	(8 000 × $48.00)	$384 000
Product T:	(15 000 × $36.00)	540 000
Product W:	(4 000 × $24.00)	96 000
Total		$1 020 000

$$\text{Predetermined overhead rate} = \frac{\text{Budgeted overhead}}{\text{Budgeted direct labour}} = 875\%$$

Gigabyte's pricing method has been to set a budgeted price equal to 150 per cent of full product cost. However, only the thingamajigs have been selling at their budgeted price. The budgeted and actual current prices for all three products are the following:

	Product G	Product T	Product W
Product cost	$573.00	$508.50	$286.50
Budgeted price	859.50	762.75	429.75
Actual current selling price	639.00	762.75	600.00

Gigabyte has been forced to lower the price of gismos in order to get orders. In contrast, Gigabyte has raised the price of whatchamacallits several times, but there has been no apparent loss of sales. Gigabyte has been under increasing pressure to reduce the price even further on gismos. In contrast, Gigabyte's competitors do not seem to be interested in the market for whatchamacallits. Gigabyte apparently has this market to itself.

Required:

1 Is product G the company's least profitable product?
2 Is product W a profitable product for Gigabyte Ltd?
3 Comment on the reactions of Gigabyte's competitors to the firm's pricing strategy. What dangers does Gigabyte face?
4 Gigabyte's financial controller, Nan O'Second, recently attended a conference at which activity-based costing systems were discussed. She became convinced that such a system would help Gigabyte's management to understand its product costs better. She obtained top management's approval to design an activity-based costing system, and an ABC project team was formed. In Stage one of the ABC project, each of the overhead items listed

in the overhead budget was placed into its own activity cost pool. Then an activity driver was identified for each activity cost pool. Finally, the ABC project team compiled data showing the percentage of each activity driver that was consumed by each of Gigabyte's product lines. These data are summarised as follows:

Activity cost pool	Activity driver	Product G	Product T	Product W
Machinery	Machine hours	24%	50%	26%
Machine setup	Number of setups	22%	30%	48%
Inspection	Number of inspections	16%	44%	40%
Material handling	Raw material costs	25%	69%	6%
Engineering	Number of change orders	35%	10%	55%

Show how the financial controller determined the percentages given above for raw material costs. (Round to the nearest whole per cent.)

5 Develop product costs for the three products on the basis of a simple activity-based costing system. (Round to the nearest cent.)

6 Calculate a budgeted price for each product, using Gigabyte's pricing formula. Compare the new budgeted prices with the current actual selling prices and previously reported product costs.

7 Refer to the new budgeted prices for Gigabyte's three products, based on the new activity-based costing system. Write a memo to the company managing director commenting on the situation Gigabyte has been facing regarding the market for its products and the actions of its competitors. Discuss the strategic options available to management. What do you recommend, and why?

8 Refer to the product costs developed in requirement 5. Prepare a table showing how Gigabyte's conventional, volume-based product costing system distorts the product costs of gismos, thingamajigs and whatchamacallits.