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Chapter 16

Managing costs and quality



Learning objectives

- 16.1 Define *cost management* and explain how it differs from traditional approaches to cost control.
- 16.2 Use the four steps of activity-based management to determine the real cause of costs, eliminate costs and manage cost, time and other sources of customer value.
- 16.3 Describe how business process re-engineering can be used to manage costs and other sources of value.
- 16.4 Analyse life cycle costs and revenues and understand how to use life cycle management to reduce costs.
- 16.5 Estimate target costs and describe the processes of target costing that lead to cost reduction and enhanced customer value.
- 16.6 Undertake analyses, using the theory of constraints, to manage costs and time.
- 16.7 Explain the meaning of 'quality' and describe the different approaches that can be used to manage quality.
- 16.8 Describe the four types of quality costs, and prepare and interpret cost of quality reports.
- 16.9 Describe how quality can be managed through total quality management (TQM), Six Sigma methodologies and quality accreditation.

Introduction

In earlier chapters we described the changes that have occurred in the business world over the past few decades. With the evolution of global markets, the rapid rate of technological innovation, the greater use of electronic commerce and the increasing importance of customer satisfaction, businesses need to offer a wider range of high-quality goods and services, developed to meet or exceed customers' requirements for functionality, quality, delivery time and price. Some businesses have been able to meet this challenge and have prospered.

As well as developing new approaches to performance measurement, management accounting has responded to the changing business environment by paying increased attention to managing relationships with suppliers and customers, and managing resources and quality within the business. In this chapter, we consider various approaches to managing costs and quality. We revisit the Mason & Cox case, from Chapter 8, to illustrate activity-based management, a model that provides information to managers to help reduce costs and improve other sources of customer value. We describe other approaches to controlling and reducing costs, namely business process re-engineering, life cycle management and the related concept of target costing. We explore the role that quality plays in driving customer value, and various approaches to managing quality.

COST MANAGEMENT

Traditional management accounting systems include a range of financial performance reports and measures to provide managers with information for cost control. Modern management accounting systems include various tools and techniques that provide information for cost management. What is 'cost management', and how does it differ from traditional approaches to cost control? **Cost management** is the improvement of an organisation's cost effectiveness through understanding and managing the real causes of costs. Although the predominant focus is on costs, most modern approaches to cost management also focus on improving other aspects of performance, such as quality and delivery, that may drive customer value.

The major differences between traditional approaches to cost control and modern cost management are:

- *Drivers of costs.* Under the traditional approach, managers control costs by bringing them into line with some predetermined goal, such as budgeted or standard costs. The focus is on cost outcomes. Cost management reduces costs by identifying wasted resources and eliminating this waste through identifying the factors that really drive costs.
- *Strategic perspective.* The primary focus of traditional approaches is on controlling costs within the organisation—an internal perspective. Modern cost management is also concerned with achieving value for the customer—a strategic perspective.



cost management
the improvement
of cost effectiveness
through
understanding and
managing the real
causes of costs

- *Process perspective.* Traditional systems tend to control costs by reporting results for responsibility centres based on functional areas of the business, such as production, marketing and administration. Modern cost management recognises that customers' needs are met by processes, which flow across the business and may cross functional areas.

A number of separate approaches have evolved to managing costs, including:

- 1 activity-based management
- 2 business process re-engineering
- 3 life cycle management
- 4 target costing
- 5 approaches based on the theory of constraints.

As described below, each of these techniques can be used independently to reduce costs, although in some instances they may also be complementary. For example, activities, which are the foundation for activity-based management, can also provide a useful framework for business process re-engineering, life cycle management and target costing. Moreover, target costing reduces costs by applying life cycle management principles.



ACTIVITY-BASED MANAGEMENT

In Chapter 8 we described how Mason & Cox implemented an activity-based product costing (ABC) system, and found that its traditional product costing system had distorted product costs and undermined strategic decision making. The distorted product costs appeared to have eroded the ability of the company to compete successfully; activity-based product costing helped to solve the problem. However, this is only half of the story. We now return to Mason & Cox to examine the role that activity-based costing and activity-based management can play in managing costs and improving business performance.

RETURNING TO MASON & COX

You will recall that Mason & Cox was Australia's largest independent foundry, producing metal castings for a wide range of local industries and export customers. Production began with drawing and issuing patterns, which were used to build up moulds. Molten metal was poured into the moulds, and when the metal was set, the castings were knocked out. The castings were 'finished' by grinding, welding and heat treating. Mason & Cox had been in business for a long time, but by the 1990s its profits had declined. The cause of the problem was not clear from the company's existing management accounting system. As accounting manager at Mason & Cox, Olivia Shannon, knew that an improved product costing system would help with strategic decision making. However, ultimately the company needed to reduce its costs and improve performance in other key areas in order to survive.

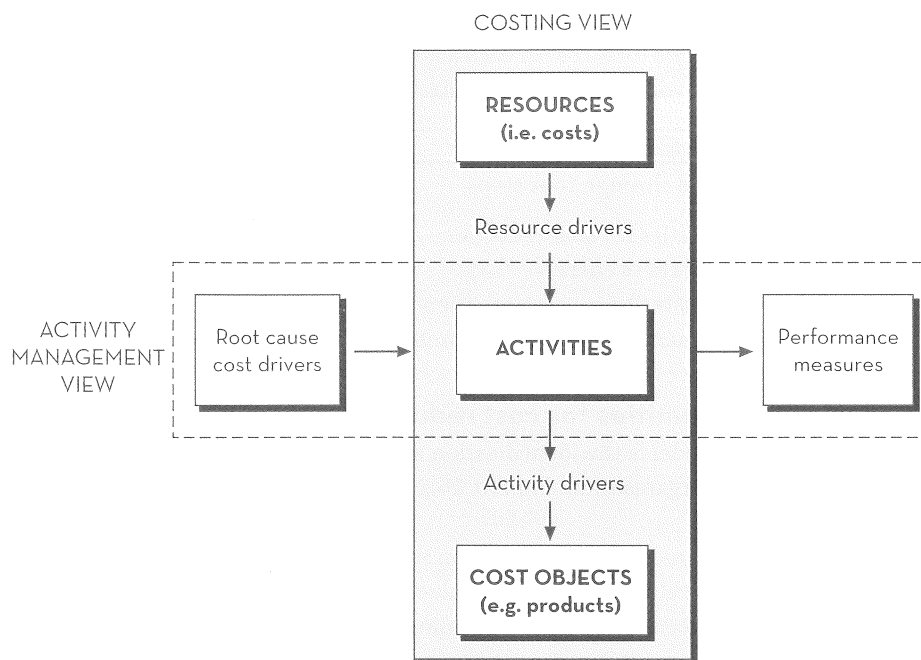
Mason & Cox had a planning and control system based on standard costing and budgeting. Managers investigated variances between actual and budgeted results and instigated corrective action. This approach to planning and control is similar to that found in many businesses today, and these types of performance reports and measures have changed little since they were first developed in the 1920s. While Shannon provided managers at Mason & Cox with regular variance reports to help them control their costs, she was concerned about the usefulness of this information. She decided to explore the possibility of using activity-based management to improve Mason & Cox's performance.

ACTIVITY-BASED MANAGEMENT AT MASON & COX

Exhibit 16.1 shows that activity-based costing can have two dimensions: costing and activity management.¹ Costing is used to calculate the cost of cost objects, such as products. The activity management dimension is a dynamic view that reports what is happening in the business.

¹ The terminology used in this section is based on a glossary of terms about activity-based management prepared for CAM-I and published in Raffish and Turney (1991).

An activity-based costing model

Exhibit
16.1

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

When Shannon first encountered the term 'activity-based management' she was not sure how it differed from activity-based costing. Soon she understood that **two-dimensional activity-based costing** provides information about activities, cost drivers and performance, as well as about the costs of cost objects such as products. **Activity-based management (ABM)** refers to the process of using information from activity-based costing to analyse activities, cost drivers and performance so that customer value and profitability are improved. You will remember from Chapter 1 that **customer value** is the value that a customer places on particular features of a product. Activity-based management enabled Shannon to reduce costs and manage other important aspects of performance.

REDEFINING ACTIVITIES FOR ABM

Before we commence using ABM to reduce costs, we need to reconsider the way that Mason & Cox have identified and costed their activities under ABC.

In Chapter 8, you will recall that Shannon allocated manufacturing overhead cost to activities and this was then used for product costing (see Exhibit 8.5). However, this simple activity analysis is not very useful when it comes to cost management. To use ABM we need a more comprehensive analysis that includes the following:

- *Activities need to be identified at a greater level of detail* to reflect individual tasks or steps in a process. The six activities identified in Chapter 8 for ABC—machine-related, inspection, setup, material handling, engineering and facility sustaining—need to be disaggregated into smaller activities.
- *The total cost of each activity* will include not only manufacturing overhead cost but also the cost of the direct labour used to undertake activities.
- *The cost of non-manufacturing activities* will be included. The analysis of activities in Chapter 8 stopped at the factory door. Under ABM, activities are built into processes that often extend into non-manufacturing areas.

two-dimensional activity-based costing a costing system that provides information about activities, cost drivers and performance, as well as the costs of cost objects

activity-based management (ABM) the process of using information from activity-based costing to analyse activities, cost drivers and performance so that customer value and profitability are improved

customer value the value that a customer places on particular features of a product

Exhibit 16.2 provides a list of manufacturing and non-manufacturing activities for Mason & Cox's and their costs. The non-manufacturing activities have been classified into Corporate management, Administration, and Sales and Dispatch. The six activities used for ABC in Chapter 8 have been replaced by 16 manufacturing activities. The total cost of each activity now also includes the cost of direct labour.² It is this list of activities that we will use to demonstrate ABM.

USING ABM TO REDUCE COSTS

To reduce costs, Shannon worked through four steps:

- 1 Identify the major opportunities for cost reduction
- 2 Determine the real causes of these costs
- 3 Develop a program to eliminate the causes and, therefore, the costs
- 4 Introduce some new performance measures to monitor the effectiveness of cost reduction efforts.

Identify the major opportunities for cost reduction

The pivotal point of the ABC model is the identification and costing of activities. **Activities** are the units of work performed within the organisation. Exhibit 16.2 reproduces Mason & Cox's activities and their costs.

To identify opportunities to reduce costs, Shannon undertook a **value analysis** (or **activity analysis**), where she classified activities as value-added or non-value-added. **Value-added activities** provide essential value to the customer, or are essential to the functioning of the business. Exhibit 16.2 shows that the value-added activities included:

- basic production activities that contribute to the final product, such as making moulds and pouring metal
- essential administrative activities, such as managing the business and preparing financial statements.

Non-value-added activities do not add value to a product from the customers' perspective or for the business and, therefore, can be eliminated without detriment to either. In many businesses, major sources of non-value-added activity include waiting, inspection, rework, and the unnecessary movement and storage of inventories. Activity analysis is part of the 'lean thinking' approach to cost management, as explained in the 'Real life' on page 710. Its origins are in Toyota's production system and the focus is on reducing waste. Exhibit 16.2 shows the non-value-added activities at Mason & Cox, which accounted for 19 per cent of the total activity costs.

The analysis and elimination of non-value-added activities can require considerable resources. Like many businesses, Mason & Cox decided to target their major non-value-added activities. The major non-value-added activities were 'Grind castings', 'Move material' and 'Weld defects'. These three activities accounted for almost two-thirds of the cost of all non-value-added activity at Mason & Cox.

Determine the real causes of non-value-added costs

To eliminate non-value-added costs, Shannon began by building activities into processes. Then she analysed those processes to find the causes of the non-value-added activities.

Building activities into processes

Eliminating non-value-added activities requires a clear understanding of the way work is done in an organisation. One way of developing this understanding is to identify, for each activity, the preceding activities that supply its inputs (that is, its suppliers) and the subsequent activities that consume its outputs (its customers). This information can be used to link activities together into processes. A **process** (or **business process**) is a series of activities that are linked together to achieve a specific objective.

activity a unit of work performed within the organisation

value (or **activity**) **analysis** a method that classifies activities as value-added or non-value-added

value-added activity an activity that provides essential value to the customer, or is essential to the functioning of the business

non-value-added activity an activity that does not add value to a product from the customers' perspective or for the business and, therefore, can be eliminated

process (or **business process**) a series of activities that are linked together to achieve a specific objective

² In Exhibit 16.2 total activity costs are \$11.13M, and in Chapter 8 only \$4.88M of manufacturing overhead is allocated to activities. The difference between the two totals is due to total direct labour of \$4.53M and total non-manufacturing costs of \$1.72M. Note also that in the Appendix of Chapter 8, where the comprehensive ABC system is demonstrated, the total cost of activities in Exhibit 8.13 is \$11.13M.

**Exhibit
16.2**
Activity costs and value status, Mason & Cox

Activity centres and activities	Value-added	Non-value-added
Corporate management		
Manage business (CEO and Board)	\$ 471 000	
Prepare financial statements	92 000	
Administration		
Process receivables	200 000	
Process payables	275 000	
Operate IT system	300 000	
Prepare payroll	132 000	
Sales & dispatch		
Process sales order	250 000	
Factory management		
Program production	262 000	
Expedite orders		\$ 220 000
Manage plant	200 000	
Pattern design		
Design method	357 000	
Issue pattern	125 000	
Moulding		
Make CT moulds	810 000	
Make job moulds	480 000	
Move material		420 000
Melting		
Pour metal	3 115 000	
Finishing		
Grind castings		560 000
Weld defects		377 000
Set up heat treat furnace	332 000	
Operate heat treat furnace	1 080 000	
Quality control		
Inspect moulds		300 000
Inspect castings		220 000
Preventative maintenance	552 000	
Total costs	<u>\$9 033 000</u>	<u>\$2 097 000</u>

Processes cut across responsibility centres such as functional departments. Exhibit 16.3 illustrates the process of filling a customer order for a custom-made casting at Mason & Cox. Notice:

- horizontal flow of activities across the business, which crosses functional areas such as product design, manufacturing, sales and administration
- interdependence between activities, where a preceding activity is the supplier of a subsequent activity (or the subsequent activity is the customer for the preceding activity).

REALLIFE

LEAN THINKING AT THE CITY OF MELBOURNE

The term *lean thinking* was coined by James Womack in the 1980s, following his research into the automotive industry. In the bestselling book, *The Machine That Changed the World* (Roos, Womack & Jones, 1991), he contrasted the mass production methods pioneered at General Motors with Toyota's lean production approach. Lean thinking was first adopted by other manufacturing companies, but has also been adopted by the service sector.

In 2009, the Melbourne City Council became the first local government in Australia to adopt an organisation-wide lean thinking program. Lean thinking means *delivering the right service, in the right place, at the right time, provided by the right person and done right the first time*. This is a process of continuous improvement, involving the identification and elimination of non-value-added activities, to benefit the organisation and the customer.

To embed lean thinking throughout the Melbourne City Council, staff are trained in the its principles when they first join the council. This enables them to integrate this approach into their daily work and improve work processes in their own areas. In 2011–12, more than 1100 staff members attended lean thinking workshops.

In the first four years of the program, nearly \$4 million of costs were saved and improved processes led to a reduction of more than 1200 days of staff time. Process improvements also led to benefits for customers. For example, the introduction of a centralised booking system allowed mothers to book maternal health appointments with just one phone call, and the need to leave messages on voicemail was largely eliminated. This reduced the need for wasteful return phone calls and maximised available time to service customers. A redesign of aged care service processes led to an increase in the number of aged care assessments undertaken for clients, using the same number of staff. By freeing up staff time the program has allowed staff to undertake more value-adding activities with clients. For example, an additional 50 minutes per day was made available through improvements to the referral and scheduling process, allowing maternal and child health nurses to spend more time with clients. Also, the introduction of a centralised waiting list for childcare led to increased utilisation of childcare facilities, and childcare places were, on average, filled five days faster.

Sources: City of Melbourne (2012); Roos, Womack & Jones (1991)

The process perspective helps to identify cost drivers and establish relevant performance measures. Also, using processes can simplify activity management as, in many cases, it may be possible to manage fewer aggregated processes rather than many detailed activities. Activities in a process may share common cost drivers and performance measures.

Cost driver analysis

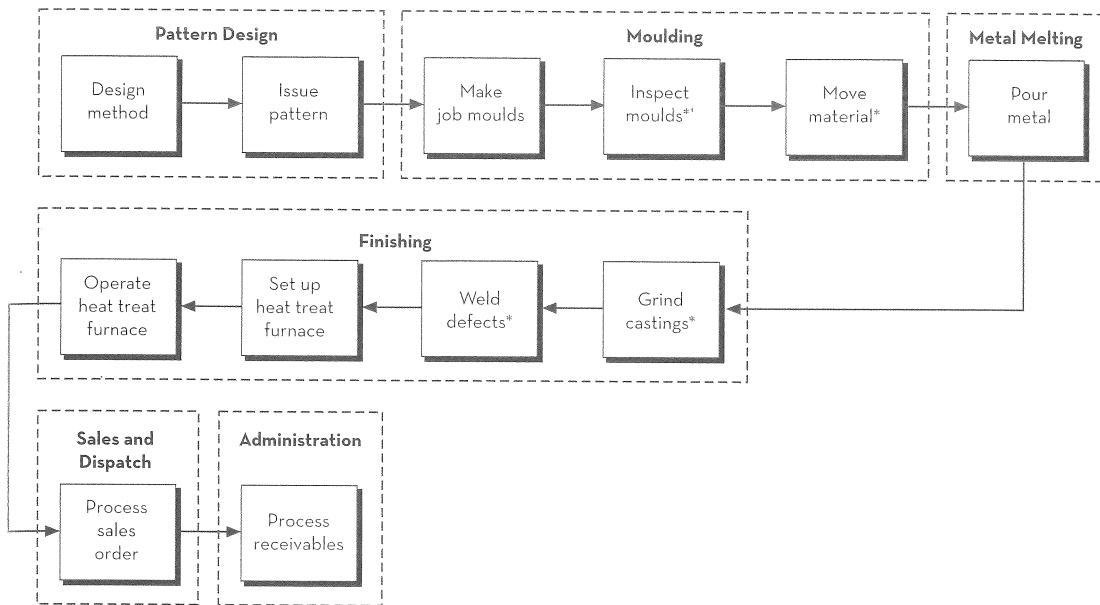
Once the processes had been identified, Shannon attempted to identify the root cause cost drivers of the three major non-value-added activities at Mason & Cox. **Root cause cost drivers** are the underlying factors that cause activities to be performed and their costs to be incurred. For example, the quality of the moulds built up in the Moulding Centre appeared to be a root cause cost driver for the non-value-added activities 'Grind castings' and 'Weld defects' in the Finishing Centre. The poorer the quality of the moulds, the higher was the number of defects in the castings, and the more grinding and welding was required to rectify them.

Shannon used **cost driver analysis** to identify root cause cost drivers for the major non-value-added activities. The number of defects that resulted from pouring the hot metal into the moulds also *appeared* to drive the activities 'Grind castings' and 'Weld defects'. Each defect must be ground and welded, but is this a root cause cost driver? What causes these defects: is it impurities in the metal? or is it the poor quality of moulds used to make the casting? If metal impurities are a major problem, what causes these impurities? Does Mason & Cox need to seek new metal suppliers or negotiate more stringent quality requirements with its existing suppliers? The search for root cause cost drivers inevitably involves continually asking why. Exhibit 16.4 lists possible root cause cost drivers for the three major non-value-added activities at Mason & Cox.

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

cost driver analysis a method that identifies root cause cost drivers of activities

Process of filling a customer order at Mason & Cox



* Denotes a non-value-added activity.

* The inspection of moulds is undertaken by the Quality Control Department, but this inspection occurs in the Moulding Department.

Note: This exhibit is based on Exhibit 16.2 (see page 739).

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

Root cause cost drivers, Mason & Cox

Activity	Possible root cause cost drivers
■ Grind castings	■ Complexity of the casting
	■ Defects in moulds
	■ Metal impurities
■ Weld defects	■ Complexity of the casting
	■ Defects in moulds
	■ Metal impurities
■ Move material	■ Plant layout
	■ Supplier delivery arrangements

Develop a program for reducing costs

The next step for Shannon was to develop a program to eliminate the root causes of the major non-value-added activities. This was a complex task and involved managers from across the organisation. For example, Shannon identified metal impurities as a primary cause of defects in castings and, therefore, as a major cause of the non-value-added activities 'Grind castings' and 'Weld defects'. She worked with the purchasing manager to improve the quality of metal used in castings.

Eliminating root cause cost drivers may involve tackling individual activities. Alternatively it may require a fundamental restructure of processes, called business process re-engineering, which is described later in this chapter.

**Exhibit
16.3**

**Exhibit
16.4**

Measure performance

Activity-based performance measures can be used to monitor the effectiveness of cost reduction efforts, as well as other key sources of customer value. Mason & Cox's management identified three aspects of performance that it believed were critical to the achievement of strategies and, therefore, to the success of the business: quality, delivery time and cost. (These are critical success factors for many businesses.)

Shannon identified performance measures that reflected both costs and cost drivers. She also introduced activity-based performance measures to monitor quality and delivery. In some cases these measures were interrelated. For example, a number of the quality and delivery measures, such as defects and cycle time, were also cost drivers. To illustrate this concept, Exhibit 16.5 lists some performance measures for cost, quality and delivery for each of the activities in the Finishing Centre.

By monitoring the measures over time, managers could obtain feedback on their performance. Targets could be set and corrective actions could be instigated where required. You will notice that by focusing on performance across key sources of customer value, ABM can be used in conjunction with the modern approaches to performance measurement described in Chapter 14.

THE IMPACT OF ACTIVITY-BASED MANAGEMENT AT MASON & COX

The activity-based costing system was expensive to implement at Mason & Cox. It was more complex than the traditional management accounting system and more expensive to maintain. Nevertheless, even though the new system had not been in place for long, ABC and ABM seemed to improve profitability at Mason & Cox. Part of the improvement was due to the more accurate product costs, which provided a reliable basis for strategic decision making, as described in Chapter 8 and part was due to the company's improved cost management. Cost savings had been achieved by targeting the most significant non-value-added activities. Their real cost drivers had been identified, and managers from across the business worked to eliminate them.

Moreover, part of the improvement was due to increased customer satisfaction. In addition to tracking cost drivers, activity-based performance measures enabled the company to monitor and improve quality and delivery, key sources of customer value. Instead of aggregated, outdated, financial measures of their performance, the new approach provided timely information about factors that were important to customers and factors that employees could control.

Exhibit 16.5

Performance measures in the Finishing Centre, Mason & Cox

Finishing Centre activities	Cost/cost drivers	Quality	Delivery
■ Grind castings	■ \$35 per hour*	■ No. of spots reground	■ Cycle time: 5.3 min. per casting
	■ No. of defects in moulds	■ No. of defects during grinding	
	■ No. of defects during metal pouring		
■ Weld defects	■ \$29 per hour*	■ No. of cavities rewelded	■ Cycle time: 11.2 min. per casting
	■ No. of defects in moulds	■ No. of defects during welding	
	■ No. of defects during metal pouring		
■ Set up heat treat furnace	■ \$332 per setup*	■ No. of faulty setups	■ Cycle time: 214 min. per setup
	■ Cycle time		
■ Operate heat treat furnace	■ \$2 per kilogram-hour*	■ No. of defects due to heat treatment	■ Cycle time: 110 min. per casting
	■ Cycle time		

* These costs were explained in Chapter 8, see Exhibit 8.13 in the Appendix to Chapter 8.

The 'Real life' on page 710 explains how the City of Melbourne introduced a lean thinking program to identify and eliminate non-value-added activities, improve processes, reduce costs and add value for customers.

MANAGING SPARE CAPACITY TO ACHIEVE COST REDUCTION

A likely outcome of undertaking ABM is the creation of spare capacity, and cost reductions will not be achieved unless this capacity is reduced. At Mason & Cox plant layout was a root cause cost driver of the activity 'Move material'. Eliminating the root causes of 'Move material' involves reorganising the positions of machines to shorten the time it takes employees to move material from one machine to the other. This reorganisation will lead to spare capacity, that is, it will lead to idle time for the shop floor employees who move the materials, and free up space on the factory floor. Employees are paid wages and those costs will only be reduced if the employees are able to use their time on other value-adding activities or if some of the employees leave the company. The costs associated with the freed up factory floor, such as factory lease, insurance, and cleaning, will be ongoing, whether or not the factory floor can be used for other profitable activities.

In summary, cost management programs such as ABM will only lead to cost reduction if the spare capacity that is created through reduction in root cause cost drivers is either eliminated or used for other value-adding activities. This principle applies to other cost management techniques outlined in this chapter such as BPM and target costing.

USING THE COSTING DIMENSION OF ABC TO HELP MANAGE COSTS

Most of the information for managing costs and improving customer value at Mason & Cox was obtained from the activity management dimension of the ABC model. However, some businesses use information from the costing dimension to reduce costs; for example, they may use ABC to obtain information about customer and supplier costs, as discussed in Chapter 15. Alternatively, they may use budgeted activity costs as a framework for control.³

BUSINESS PROCESS RE-ENGINEERING

Business process re-engineering is another approach to managing costs and improving customer value that has become popular since the early 1990s. **Business process re-engineering (BPR)** or **process re-engineering** is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvement in critical areas of performance such as cost, quality and delivery. The ground-breaking book *Reengineering the Corporation* (Hammer & Champy, 1993) presents the principles that can be used to re-engineer core business processes successfully.

Business process re-engineering should focus on the processes that are essential to achieving the company's business objectives and strategies; that is, its **strategic processes**. Common processes include developing new products, manufacturing products, acquiring customer orders, fulfilling orders and developing human resources, although processes may differ from one organisation to the next. These processes cut across functional or departmental boundaries of the business. (For example, the process of filling a customer order at Mason & Cox, described in Exhibit 16.3, cuts across manufacturing departments, sales and administration.) The aim of BPR is to totally reorganise the way in which work is done by identifying and enhancing the value-added activities and eliminating all the non-value-added activities for a process. For example, re-engineering Mason & Cox's process of filling a customer order would aim to eliminate the non-value-added activities 'Inspect moulds', 'Move material', 'Grind castings' and 'Weld defects'. The value-added activities in the process would also be enhanced.

Once a process has been identified for re-engineering, BPR involves four major steps:

- 1 *Prepare a business process map.* A flowchart of the activities that make up the business process, called a **business process map**, is prepared. Exhibit 16.3 is an example of a business process map.⁴



business process re-engineering (BPR, or process re-engineering) the radical redesign of business processes to achieve dramatic improvement in critical areas of performance such as cost, quality and delivery

strategic processes those processes that focus on achieving the company's business objectives and strategies

business process map a flowchart of the activities that make up the business process

³ Activity-based budgeting is discussed in Chapter 11.

⁴ A more complete process map would include inputs, outputs and key aspects of performance.

- 2 *Establish goals.* Clear goals for the re-engineered process are established, based on the sources of customer value. These may include quality and delivery performance, as well as cost. Depending on the strategies of the business, they may also include innovation, flexibility and so on.
- 3 *Reorganise work flow.* The flow of work is reorganised to enable the goals to be achieved. For example, in re-engineering the process of filling a customer order at Mason & Cox, it may have been possible to develop new, highly reliable moulding techniques that eliminated the need to inspect moulds, or to develop metal pouring techniques that eliminated the need for subsequent grinding and welding of defects in castings. It may have been possible to house custom-cast production and dispatch in one area where material movement was minimised, and staff were so highly trained that the need to inspect moulds, grind castings and weld defects was significantly reduced. (Reconfiguring the business around processes rather than functional departments is a common outcome for business process re-engineering.) These changes can lead to spare capacity which needs to be reduced in order to achieve cost reductions. This issue was discussed in an earlier section of this chapter.
- 4 *Implementation.* The final step is implementation of the changed workflows. Business process re-engineering involves substantial change and, like any change, may meet resistance from employees. Such resistance may be managed through forming re-engineering project teams that involve employees from all functional areas affected by the proposed change. In such situations, employees may feel a stronger sense of ownership of the changes.

The 'Real life' on page 715 outlines the difficulty of implementing cost management techniques, such as BPR in the wine industry.

IS BUSINESS PROCESS RE-ENGINEERING THE SAME AS ABM?

Activity-based management includes some steps similar to those of business process re-engineering. These steps are the identification of business processes and activities. However, the focus of ABM is on **process improvement**, which is the *incremental continuous improvement of processes*, and the use of cost driver analysis to manage costs. BPR tends to focus on major business processes and to implement *fundamental changes to the structure of processes*. The goal of BPR that directs the re-engineering effort can be cost efficiency, but can also be to maximise quality, innovation, delivery or whatever is of strategic importance to the organisation.

process improvement the incremental continuous improvement of processes



LIFE CYCLE COSTING

Life cycle costing is an alternative approach to cost management which accumulates and manages costs over a product's life cycle. There are two important aspects to life cycle costing: the focus on the product cost and the inclusion of all upstream and downstream costs. A **product life cycle** is the time from the conception of a product through to its abandonment—that is, 'from cradle to grave'. From a production perspective, product life cycles usually cover four stages:

- 1 product planning and initial concept design
- 2 product design and development
- 3 production
- 4 distribution and customer (or logistical) support.

The length of a product's life cycle varies from one product to the next. For example, clothing and fashion goods tend to have a life cycle of one year or less. General Motors Holden plans on a life cycle of four to five years, from the time a new model is conceived to the time its production is discontinued. They allow another 10 years for the production of spare parts for discontinued models.

A **life cycle budget** can be developed to compare planned costs with predicted revenue over each year of the product's life. To complete the planning and control cycle, life cycle costing should be linked to the annual budgeting and performance reporting process to monitor the actual costs and revenues each year over the product's life cycle and compare them with the planned outcomes.

life cycle costing a cost management approach where costs are accumulated and managed over a product's life cycle

product life cycle the time from the conception of a product through to its abandonment

life cycle budget a budget that compares planned costs with predicted revenue over each year of the product's entire life

REALLIFE

COST MANAGEMENT IN THE AUSTRALIAN WINE INDUSTRY

Australia is a major producer and exporter of wine, so the wine industry is of major importance to the Australian economy. In 2008, it was the market leader in the UK and ranked second in the US. Australia has over 2000 wine companies of which about half export wine, and the wine industry employs about 31 000 people. Many wine companies are classified as SMEs (small and medium enterprises). The wine industry is very competitive and the smaller companies often struggle to compete with the large dominant industry players, and the long periods of drought and floods that Australia has seen in recent years creates financial pressures on the small wine companies. This would seem to be a good argument for the adoption of cost management programs such as business process re-engineering and total quality management. These techniques would not only assist wine companies to operate more efficiently, but could also help enhance quality which is a major focus of the industry.

A study of Western Australian small and medium wine companies (Chong, 2007) investigated the factors that inhibited small- and medium-sized wine companies from implementing modern cost management techniques. The research was based around 10 case studies of wineries and, in all but one company, attempts had been made to implement cost management techniques. However, very limited progress had been made. The factors that constrained development, in order of importance, were as follows:

- Lack of financial resources
- Lack of time
- Lack of support from senior management
- Lack of information technology expertise
- Poor knowledge of process-oriented approaches.

The lack of financial resources and time were the most highly cited constraints. The companies were unable to generate or access sufficient resources to accommodate a potentially large outlay for IT-driven tools or consultants to undertake cost management. The wine industry is very capital-intensive and smaller companies are limited by the finance that they can access. The alternative of using their own staff to implement the programs was also not possible due to staff having insufficient skills and insufficient time. This was also reflected in the last two constraints. The lack of support from senior management is a much cited factor that constrains the implementation of many organisational systems. However, in this study, some of the reasons explaining this lack of support were the traditional mindsets of senior management and the family-orientation of many of the smaller wine companies.

The research also uncovered an interesting paradox: whereas some companies choose to implement cost management programs to reduce costs, other companies choose to *not implement* cost management programs to save costs!

Source: Based on Chong (2007)

Life cycle budgeting enables a comprehensive assessment of the profitability of a product over its entire life, which can help managers decide which products to produce.⁵ Traditional costing systems enable product cost and profitability to be assessed each year, but this approach ignores upstream and downstream costs and the effects of life cycle stages.⁶ In cost-plus pricing, cost should be based on the product's cost over its entire life cycle. This is especially important where products have short life cycles and high upstream and downstream costs. In this situation, prices must be set to recover all costs plus make a profit in a relatively short time.

We will illustrate these concepts with Australian CD Players.

LIFE CYCLE BUDGETING: AUSTRALIAN CD PLAYERS PTY LTD

Australian CD Players Pty Ltd (ACDP) manufactures portable CD players. Let's suppose that ACDP began the development of a revolutionary compact disc system, CD Super, in Year 1. The system was introduced into the market at the beginning of Year 2, with an expected life of four more years. Exhibit 16.6 shows

⁵ The introduction of new products should be treated like any other capital investment decision. As described in Chapter 21, in evaluating these decisions, the expected cash inflows and outflows are identified year by year over the life of the planned project and discounted for the time value of money. For a new product introduction, the cash flows can be used to develop a life cycle budget for the product.

⁶ As discussed in Chapter 4, some businesses include upstream and downstream costs in their product costing system, but many confine product costs to manufacturing costs to comply with external reporting requirements.

the life cycle budget for CD Super. Over its life cycle, CD Super is expected to make a profit of \$4.85 million, although it will be unprofitable during design and in the first year of production. If product profitability were assessed year-by-year, management may have decided to drop CD Super after one year of production! The company uses cost-plus pricing, and the life cycle budget helps management to set a price that covers all the costs that are expected to be associated with CD Super over its life.

Exhibit 16.6

Life cycle budget, Australian CD Players Pty Ltd

	A	B	C	D	E	F	G
1	Year						
2		1	2	3	4	5	Total
3	Revenue	\$0	\$600 000	\$4 500 000	\$6 750 000	\$3 000 000	\$14 850 000
4	Costs:						
5	Product planning and concept design	300 000					300 000
6	Design and development	100 000	600 000				700 000
7	Production		300 000	2 000 000	2 700 000	1 200 000	6 200 000
8	Distribution and customer support		50 000	750 000	1 000 000	1 000 000	2 800 000
9	Profit (Loss)*	-\$400 000	-\$350 000	\$1 750 000	\$3 050 000	\$800 000	\$4 850 000
10							
11							

* This analysis ignores the time value of money. (See chapter 21)

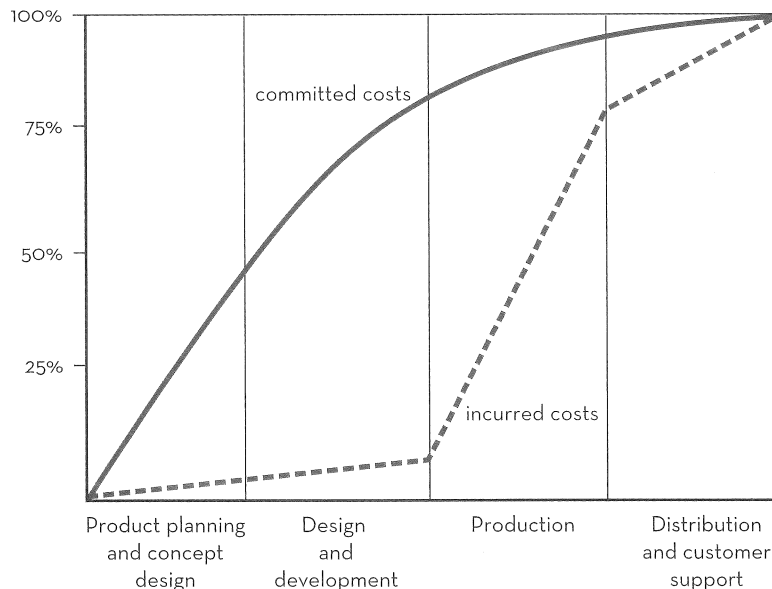
MANAGING COSTS THROUGH A LIFE CYCLE PERSPECTIVE

The life cycle budget provides useful information for managing and reducing costs. For example, it can be used to carefully plan capacity requirements. More importantly, major cost savings can be achieved by recognising the trade-off between costs incurred prior to production and costs incurred once production begins. Exhibit 16.7 shows that nearly all of a product's costs are actually committed during the pre-production stages of its life cycle when the product and its production processes are designed. The design

Exhibit 16.7

Life cycle costs and cost commitment for a typical product

Product life
cycle costs



Product
life cycle
phases

Source: Adapted from Burstein (1988, p. 261)

of the product, and of the processes that will be used to produce it, is a major determinant of subsequent production costs (and customer support costs). Spending more on the design phase can lead to significant savings during the production phase. Target costing, described below, is based on this principle and evaluates alternative product and process designs to identify the most cost-effective design.

Traditional cost control systems, such as standard costing, focus on controlling production costs when they are incurred. However, far greater cost reductions can be achieved by designing efficient and effective production processes than by trying to control the costs of the processes after the processes are in place. Cost controls applied once production has begun can be expected to have only a relatively minor impact. Moreover, most conventional costing systems tend to treat pre-production (upstream) and post-production (downstream) costs as period costs, rather than recognising and managing them as product-related costs.

Impediments to life cycle costing

Although the concepts of life cycle costing make sound management sense, they are not always used in practice for the costing of products. This may reflect lack of awareness, or uncertainty about how to calculate life cycle costs (Booth, 1994). Life cycle budgeting is not easy, particularly for products with longer lives. It is very difficult to predict the effects of changing consumer tastes and the impact of competitors. The effects of inflation must also be considered. There is limited information in traditional budgeting systems for constructing life cycle budgets, because traditional systems have a short-term (usually annual) cycle and focus on responsibility centres rather than on products, although the capital budgeting process may support the development of life cycle budgets. Activity-based costs can also play a useful role in estimating budgeted and actual life cycle costs, based on the activities performed in each year of the life cycle.

TARGET COSTING

Target costing is a system of profit planning and cost management. The required features and performance of the proposed product are established. Then target costing determines the life cycle cost at which the product must be produced, to generate the firm's desired level of profit, given the product's anticipated selling price. Note that target costing is not a method for *product costing*, it is a technique for *cost management*. It was devised in Japan, where it is used widely, particularly in the automobile, electrical and equipment-manufacturing industries (Lorino, 1995). With the effects of globalisation, it spread to the Western world.

Remember the revolutionary compact disc system, CD Super, developed by Australian CD Players Pty Ltd (ACDP)? We can extend this example to illustrate target costing. In developing the life cycle budget, shown in Exhibit 16.6, ACDP's management accountant identified the planned selling price for CD Super and the planned number of units to be sold. Let's assume that the budgeted life profit of \$4 850 000 assumed sales of 50 000 units at a planned selling price of \$297 and a planned cost, including upstream and downstream costs, of \$200 per unit. The selling price was based on the planned cost per unit plus a planned profit markup of 48.5 per cent on cost (or 32.66 per cent of selling price). The planned costs were derived from the management accountant's understanding of the current production technology and facilities available to the company.

If the company had used target costing, the preparation of the life cycle budget and the planned level of profit might have been very different. Let's say that market research indicated to ACDP that to sell 50 000 units the CD Super would have to be priced at \$190. Given this information we can estimate the target cost for CD Super as:

$$\begin{aligned}\text{Target cost} &= \text{target selling price} - (\text{target profit margin}) \\ &= \$190 - (0.3266 \times \$190) \\ &= \$127.95\end{aligned}$$

Notice that this cost is well below the planned cost of \$200 per unit. (Indeed, the target selling price is below the planned cost!) Substantial cost reduction would be required before the CD Super would earn a return of 32.66% on selling price.



target costing a system of profit planning and cost management that determines the life cycle cost at which a proposed product must be produced, to generate the firm's desired level of profit, given the product's anticipated selling price

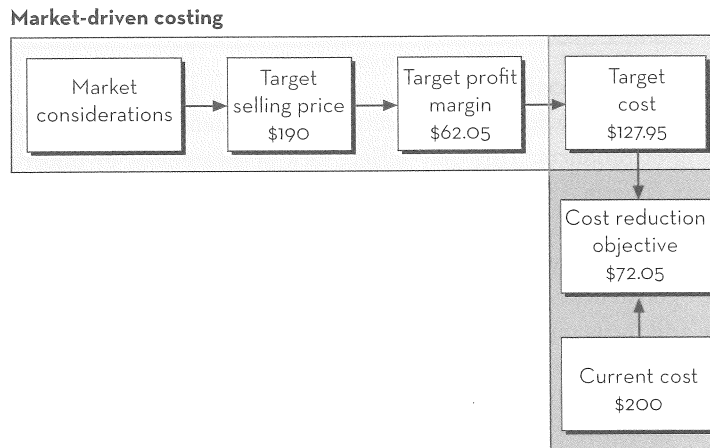
THE TARGET COSTING PROCESS

We have used the CD Super to illustrate the basic calculations involved in setting target costs, but it is important that you also understand the processes that would be used to drive the current cost down towards the target cost. Exhibit 16.8 describes the approach to reducing costs through the target costing process at ACDP.

We will continue with the CD Super to explain these steps.

Exhibit 16.8

The target costing process, CD Super



Setting the target cost

Early in the product planning stage, ACDP would have developed a clear picture of the product features required to meet customers' expectations, and the level of performance required for each feature. This would have involved identifying the size of the CD player, the quality of the sound, the batteries to be used, and so on. The CD Super's **target selling price** of \$190, is the anticipated market price for the product, based on market considerations, such as customers' needs and expectations and competitors' behaviour, as well as the business' strategic objectives for the product.

ACDP would then determine its **target profit margin**, based on an assessment of the return on sales required to make an acceptable profit on the CD Super. This would be influenced by the profit performance of similar products and the long-term profit objectives of the business. The target profit margin for ACDP is 32.66 per cent of sales, which is \$62.05. Based on this information, the CD Super's **target cost** is \$127.95, which is the cost at which the product must be produced if it is to be sold at the target selling price (\$190) and generate the rate of return required by the business (\$62.05).

ACHIEVING THE TARGET COST

You will notice that the target cost is driven primarily by market considerations. Companies need to actively seek answers to questions that include: Who are our customers? What features do customers want in our product? What price are they willing to pay? What are the competitors' products and prices? It does not take into account whether or not ACDP has the capabilities to achieve this cost for the CD Super through its product designers, production capabilities, and material and component suppliers. The degree of cost reduction required to achieve the target cost is called the *cost reduction objective*. To calculate this objective, ACDP would need to estimate the cost, including upstream and downstream costs, for which the CD Super could be manufactured, given the current design and resources but prior to any cost reduction activities. This is called the **current cost**, which was estimated (in the life cycle budget) at \$200. Thus, as indicated in Exhibit 16.8, the **cost reduction objective** is the difference between the target cost and the current cost. At ACDP the cost reduction objective for the CD Super would be \$72.05 (the current cost, \$200, minus the target cost, \$127.95).

target selling price the anticipated selling price for the product, based on market considerations and the strategic objectives for the product

target profit margin the return on sales that the business requires to make an acceptable profit on the product

target cost the cost at which the product must be produced if it is to be sold at the target selling price and generate the target profit margin

current cost the cost that the new product could be manufactured for, including upstream and downstream costs, given the current design and resources but prior to any cost reduction activities

cost reduction objective the difference between the target cost and the current cost

Having established the cost reduction objective, the challenge is to find ways to remove cost from the product. This task is often undertaken by a cross-functional team, which is set up to manage the target costing process. This team may consist of members representing key activities across the value chain, such as production engineering, product design, purchasing, marketing and accounting. There may be extensive negotiations between team members to locate where in the value chain the cost savings can be found. How much cost reduction can be achieved in product design? How much in the manufacturing process? How much in reduced material and component costs? Individual targets would be set for various functional departments, product components and materials, and value engineering would provide a way of reducing costs while enhancing the functionality of the new product (this is described below). Under target costing, all areas of the business must make a firm commitment to designing, producing and distributing the product with total life cycle costs equal to the target cost.

Techniques such as value engineering can be used to find creative ways of achieving some of these targets. **Value engineering (VE)** involves analysing the design of the product and the production process to eliminate any non-value-added elements, in order to achieve the target cost while maintaining or increasing customer value. Value engineering may involve design engineers modifying the design of some components to make them easier to manufacture and maintain, substituting more cost-effective material which does not reduce customer value, and improving the efficiency of the production processes. Thus, in undertaking VE, it is critical that engineers and product designers have a clear understanding of customer value. Value engineering will also involve working with suppliers to provide components or raw materials that meet target costs.

value engineering (VE) a systematic approach to analysing the product and process design to eliminate any non-value-added elements to achieve the target cost, while maintaining or increasing customer value

Most businesses rely on outsourced components, to some degree, and the product designers may work with suppliers to reduce the costs of those components, which may then create a cycle of target costing within supplier organisations. At ACDP this would involve setting target costs for the speakers and battery packs, which are sourced from external suppliers. Given that suppliers will seek to maximise the price they receive and the business will seek to minimise the cost it pays, negotiations between the business and its suppliers are likely to be very intense. The relationship with suppliers needs to be managed carefully throughout this process. Often the business' and the suppliers' design teams work together to achieve the component-level target cost.

Notice that the setting of target costs may have behavioural implications. Target costs need to be demanding but achievable, otherwise the target costing process would lose credibility and targets would not be taken seriously.⁷

PURSuing CONTINUOUS IMPROVEMENT ONCE PRODUCTION BEGINS

If production of the CD Super began before the gap between the current cost and the target cost had been eliminated completely, actual costs would be monitored against the target, and the various approaches to cost management described in this chapter, such as value analysis and cost driver analysis, would be used to drive the actual cost closer to the target cost. During this stage, the emphasis would be on continuous, incremental improvements to production processes. ACDP would not achieve its target profit margin until the actual cost is reduced to the target cost.

TARGET COSTING FOR COST MANAGEMENT

The key features of target costing are that it:

- is price led (it begins with the expected market price and works backwards to set the target cost)
- focuses on the customer (the product features and quality required to meet customers' expectations are established and taken as given when setting the target cost and then working to achieve the target cost)
- is based on the principles of life cycle management, placing primary emphasis on managing production and downstream costs by focusing on the design and development phase
- is cross-functional, involving managers from across the value chain.

⁷ The behavioural issues associated with setting target costs are similar to those involved in setting budget targets, as described in Chapter 9.

In its initial life cycle budget, ACDP used a cost-plus approach to pricing. The target costing study indicates that the planned level of sales of 50 000 units would not be achievable at this price. Target costing would encourage ACDP first to set a market-driven selling price and determine the target cost, and then plan how to manage costs in order to achieve the target cost.

Like life cycle costing, target costing has a major role to play in developing and managing new products, although it can also be used to manage the costs of existing products, especially product upgrades.

LO 16.6

theory of constraints an approach to managing costs and improving quality and delivery performance, by focusing on identifying and removing bottlenecks

bottleneck a point in a process that blocks or slows progress

MANAGING THROUGHPUT

The effective management of bottlenecks is vital to managing time and costs. There is a school of thought that considers managing bottlenecks—or, more generally, managing throughput—to be the key to profitability. This is the theory of constraints.⁸

THE THEORY OF CONSTRAINTS

The **theory of constraints** is an approach to managing costs and improving quality and delivery performance, by focusing on identifying and removing bottlenecks. A **bottleneck** is a point in a process that blocks or slows progress. According to the theory of constraints, the rate of production is limited to the capacity of the constraints (or bottlenecks) that exist in the organisation. Production cannot flow through the plant faster than it can move through the bottlenecks. In the short term, therefore, the rate of production through all areas should be limited to the rate at which products can pass through the bottleneck. Any attempt to improve efficiency in non-bottleneck areas will not improve production flow; it will only cause inventory to build up at the bottleneck. While this inventory build-up ensures that activities at the bottleneck do not cease, it also implies increased holding and handling costs.⁹ In the longer term, management efforts should focus on removing bottlenecks. Inadequate labour or machinery can cause bottlenecks. Labour resources can be improved with overtime, hiring and training, but constraints involving plant and equipment are more difficult to rectify. Applying the theory of constraints enables a business to increase revenue, reduce costs and improve customer response time. Removing bottlenecks may also improve quality, as defective units, hidden in the inventory stockpile at the bottleneck, will now be detected more quickly during further processing.

We will continue with our example of the company ACDP to illustrate this concept.

Managing throughput at ACDP

Australian CD Players Pty Ltd (ACDP) manufactures portable CD players. Once again we will focus on ACDP's exciting new product, CD Super, which is now in production and has met with very high demand. Production facilities at ACDP are highly automated, with three separate departments:

- 1 *Moulding*, which uses sophisticated injection moulding machines to produce 600 plastic cases per hour.
- 2 *Assembly*, which uses robots to pick and place motors and other components into the plastic cases. The output from Assembly is 500 units per hour.
- 3 *Testing and Packaging*, which X-rays the completed CD players to identify any defects before packing them ready for sale. This department can process 800 units per hour.

Products are then shipped to customers, who consist of electronic goods distributors and retail chains. Aware of the potential market, the manager of the Moulding Department has just begun a productivity drive to increase the output of his department from 600 to 900 units per hour. As shown in Exhibit 16.9 (opposite), this proposal will have no effect on the rate at which CD players are shipped to customers, which is limited by the Assembly Department to 500 units per hour. The Assembly Department is the *bottleneck*. If the Moulding Department increases its output, the extra moulded cases will simply pile up in the Assembly Department, waiting to be assembled. Rather than improve profitability, work in process inventory and inventory-related costs will increase. Any attempts to improve the flow of production should focus on the Assembly Department.

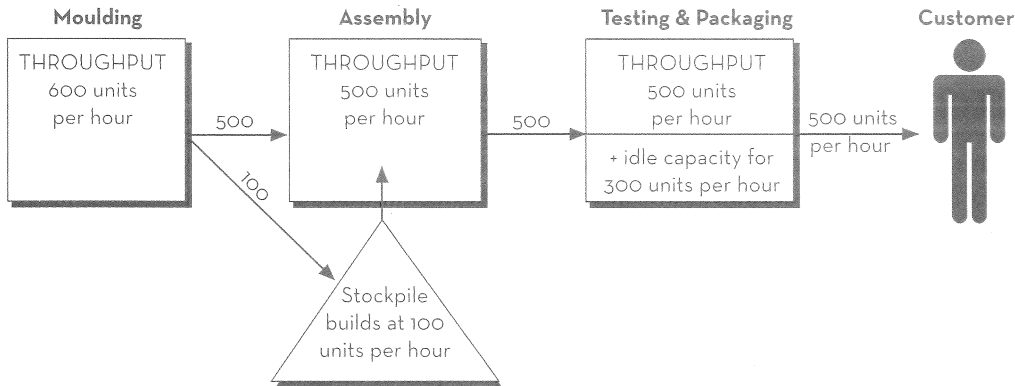
⁸ See, for example, Goldratt (1990) and Ruhl (1996).

⁹ The costs of inventory are described in Chapter 15.

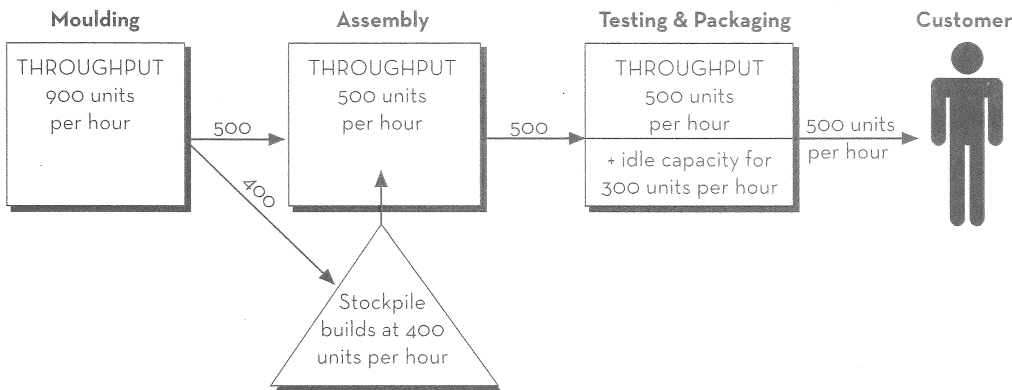
Managing throughput, Australian CD Players Pty Ltd

Exhibit
16.9

CURRENT SITUATION



AFTER EFFICIENCY DRIVE



THROUGHPUT ACCOUNTING

Throughput accounting is a measurement tool based on the theory of constraints. **Throughput accounting** is a method of measuring the effect of bottlenecks and operational decisions using financial measures of throughput, investment and operating expense. It recognises that the ultimate business goal is to make money, so the ultimate performance measure must be profit- or cash-based. Throughput accounting aims to measure the effects on profitability of bottlenecks and operational decisions using three *financial* measures:

- *throughput*, which is the rate at which a business generates profit through sales, calculated as sales revenue minus 'true' variable costs, such as direct material
- *investment*, which is the resources that the business has tied up in inventory, buildings, machinery and other assets and liabilities
- *operating expense*, which measures the cost of converting inventory into output, such as the cost of labour, machine maintenance and utilities.

A decision or action is evaluated by understanding its impact on any one of these three measures. When throughput is increased with no change in investment or operating expense, then profit, ROI and cash flow will increase. Likewise, when operating expense decreases with no change in throughput or investment, then profit, ROI and cash flow will increase. Decreases in investment will also increase profit, ROI and cash flow.

throughput accounting a method of measuring the effects of bottlenecks and operational decisions using financial measures of throughput, investment and operating expense

Throughput accounting has been criticised as it concentrates only on the short term. Constraints are often short-term problems and, once identified, they can be overcome. As explained in Chapter 14, to survive a business must identify strategic objectives, which should form the basis for identifying critical success factors and related performance measures. While throughput accounting may play a role in the identification and elimination of constraints, it has some limitations over the longer term.

MANAGING QUALITY

In this final part of the chapter, we will look at how businesses manage quality. Managing quality is important to managing costs and customer value. Organisations manage quality in many different ways. Some firms include quality measures as part of their performance measurement systems. Others implement total quality management systems to gain quality accreditation, and some firms regard total quality management as an end in itself. 'Six Sigma' approaches can also be used to manage quality.

The 'Real life' that follows describes the challenges of managing costs, throughput and quality in a massive process redesign project at a major Australian hospital.

REALLIFE

MANAGING COSTS, THROUGHPUT AND QUALITY FOR CUSTOMER VALUE: FLINDERS MEDICAL CENTRE

Many of the techniques described in this chapter to manage costs and quality more efficiently and effectively have been developed in manufacturing settings. However, modern cost management approaches are also used in the service sector. Lean thinking approaches are also used by hospitals, such as the Flinders Medical Centre.

Over the past decade there has been considerable publicity around the issue of public hospital budget deficits and quality of service problems in Australia, which are often attributed to insufficient funding. Two of the most significant problems have been excessive waiting times for patients requiring medical care, and cancellations of planned medical procedures (i.e. operations) due to insufficient resources. These problems have affected Flinders Medical Centre, a major public hospital in South Australia, which has one of Australia's busiest accident and emergency departments, treating more than 74 000 patients each year.

In the winter of 2003, Flinders Medical Centre cancelled dozens of planned medical procedures as the hospital diverted its resources to cope with the seasonal inflow of emergency services patients. Queues in the Accident and Emergency Department grew, and patients admitted for operations were left on trolleys lined up in the hospital's corridors, sometimes for many hours. In one month, more than 1000 people waited in the Accident and Emergency Department for more than eight hours, and in another month 230 operations were cancelled.

In response to this situation, in 2004 the hospital introduced a program entitled 'Redesigning Care', which focused on improving the flow of patients through the hospital, reducing duplication, error and rework and, in doing so, minimising risk. With this program, Flinders Medical Centre was able to reduce dramatically waiting times and cancellations of procedures, using a lean thinking approach to process redesign to ensure the smooth flow of patients through hospital services. For example, in the Accident and Emergency Department, one approach was to process separately patients who could be treated and discharged quickly. This has been likened to 'the supermarket eight-items-or-less checkout concept'. Throughout the hospital patients were tracked from the moment they arrived until they departed.

The program was expected to take three to five years to complete, although some improvements were experienced within the first six months. For example, in the first half of 2003, 86 medical procedures were cancelled, whereas in the same period in 2004 only 13 were cancelled. Flinders Medical Centre set a goal of seeing 90 per cent of Accident and Emergency patients within four hours. In the first six months of 2004 only 50 per cent of patients had been seen within four hours; however, this was an improvement of 10 per cent over the previous year, and average waiting time during this period was reduced by approximately 90 minutes.

In 2003, the Emergency Department was struggling to manage the 140 new patients each day, whereas by 2008, patient numbers were between 180 and 200 per day and these were able to be managed within the same physical space and with about the same staff-patient ratios. Since the start of the program the number and type of serious adverse events have decreased from 91 to 19 per year.

In addition, the Redesigning Care program sought to develop a culture which placed a much greater emphasis on customer value—in this case, patient care. The new culture urged staff to see things 'through the eyes of the patient'. To this end, hospital staff were subjected to simulated patient experiences, including leaving the doctors lying on hospital trolleys!

Sources: Based on Crouch (2004); Ben-Tovim et al. (2008); O'Connell et al. (2008)

RL

Questions See p. 732

THE MEANING OF QUALITY

What do we mean by 'quality'? **Quality** means different things to different people. However, in many organisations quality is defined in terms of products (including services) and meeting customers' expectations. There are two concepts that need to be considered in meeting those needs:

- 1 **Quality of design:** the degree to which the product's design specifications meet customers' expectations. For example, a coffee mug designed with a handle that is too small for the user's fingers would have poor quality of design.
- 2 **Quality of conformance:** the degree to which the product meets its design specifications. A coffee mug with an appropriately sized handle may be well designed, but if the handle breaks off due to shoddy manufacturing the mug will be useless. Such a mug has poor quality of conformance as it fails to conform to its design specifications.

How does quality relate to customer value? Companies need to design products to satisfy customer expectations—*quality of design*—and then put in place processes to ensure that the design specification are met—*quality of conformance*. Thus, a clear understanding of customer value is essential in order to provide customers with a high-quality product. Remember that customer value is the value that a customer places on particular aspects of a product.

MEASURING QUALITY

Once customers' needs and expectations are known, managers need to be able to *measure* quality in order to improve and maintain it. Measures such as defect rates, yield, warranty claims and customer complaints are examples of performance measures that focus on quality.

How do these quality measures fit into strategic performance measurement systems, such as the balanced scorecard? (See Chapter 14) There is no specific quality perspective in Kaplan and Norton's balanced scorecard. However, quality measures, such as customer complaints and delivery-on-time, may drive customer satisfaction, and are therefore lead indicators under the Customer Perspective. In addition, quality measures such as defect rates, yield, waste, scrap and rework rates would be lag indicators under the Internal Business Process Perspective of the balanced scorecard.

THE COSTS OF QUALITY

Quality costs focus on the costs of the quality of conformance. There are four types of quality costs:

- 1 **Internal failure costs:** the costs incurred when defective products are detected before leaving the business.
- 2 **External failure costs:** the costs incurred because defective products are provided to customers.
- 3 **Appraisal costs:** the costs of determining whether defects exist.
- 4 **Prevention costs:** the costs incurred in preventing defects and in minimising appraisal activities.

Exhibit 16.10 shows the types of costs included in each category. Notice that quality costs include costs not measured by the accounting system, such as the lost profit contribution due to internal and external failures.

Let's assume that ACDP has commenced production of CD players and set up a system to monitor quality costs. A sample **cost of quality report** for ACDP is shown in Exhibit 16.11. Note that the internal and external failure costs do not include the opportunity costs associated with scrapped products and lost sales. These costs are excluded because they are difficult to estimate, but they can be considered qualitatively when making decisions. It has been estimated that these 'hidden' costs of quality amount to 'at least three times and up to ten times the visible cost of quality' (Petty, 1996).

Using cost of quality information

How might the managers at ACDP use the monthly cost of quality report? These reports can help managers to reduce costs and improve quality. For example, managers can analyse the quality costs as a percentage of total sales and look at the trend over time. They can also classify the quality costs as fixed or variable with respect to the level of sales so that they can compare them with a flexible budget.



LO 16.7

quality the degree to which a product meets customers' needs and expectations

quality of design the degree to which a product's design specifications meet customers' expectations

quality of conformance the degree to which a product meets its formal design specifications



LO 16.8

internal failure costs the costs incurred when defective products are detected before leaving the business

external failure costs the costs incurred because defective products are provided to customers

appraisal costs the costs of determining whether defects exist

prevention costs the costs incurred in preventing defects and in minimising appraisal activities

cost of quality report a report of the costs incurred in ensuring that the firm maintains a high level of quality, and the costs arising from having poor-quality products

**Exhibit
16.10**
Quality costs
Internal failure costs

- Scrap
- Rework
- Downtime
- Material disposals
- Lost contribution margin from scrapped products

External failure costs

- Sales returns
- Warranty claims
- Processing customer complaints
- Legal fees
- Service callouts
- Lost contribution margin from current and future sales

Appraisal costs

- Monitoring
- Inspecting materials
- Inspecting work in process
- Inspecting finished goods
- Testing equipment

Prevention costs

- Quality engineering
- Quality planning
- Employee training
- Quality improvement plans
- Quality reporting

**Exhibit
16.11**
Costs of quality report, Australian CD Players Pty Ltd

	A	B	C
		Current month's costs	Percentage of total*
1			
2			
3	Internal failure costs		
4	Scrap in production	\$2 000	4.55%
5	Scrapped finished goods	3 000	6.82%
6	Rework	2 000	4.55%
7	Downtime	1 000	2.27%
8	Total internal failure costs	\$8 000	18.18%
9	External failure costs		
10	Warranty costs	7 000	15.91%
11	Out-of-warranty repairs and replacement	3 000	6.82%
12	Servicing customer complaints	1 000	2.27%
13	Transportation losses	2 000	4.55%
14	Total external failure costs	\$13 000	29.55%
15	Appraisal costs		
16	Materials inspection	3 000	6.82%
17	In-process inspection	2 000	4.55%
18	Finished goods inspection	2 000	4.55%
19	Laboratory testing	4 000	9.09%
20	Total appraisal costs	\$11 000	25.00%
21	Prevention costs		
22	Quality training	4 000	9.09%
23	Quality planning	1 000	2.27%
24	Quality reporting	2 000	4.55%
25	Quality systems development	5 000	11.36%
26	Total prevention costs	\$12 000	27.27%
27			
28	Total quality costs	\$44 000	100.00%
29			

*Rounded

Other aspects that can be considered include the possible *interactions* between the costs in the four categories. High levels of prevention costs should result in low internal and external failure costs, and may allow a low level of appraisal activity. High appraisal costs may cause high internal failure costs but should also result in low external failure costs.

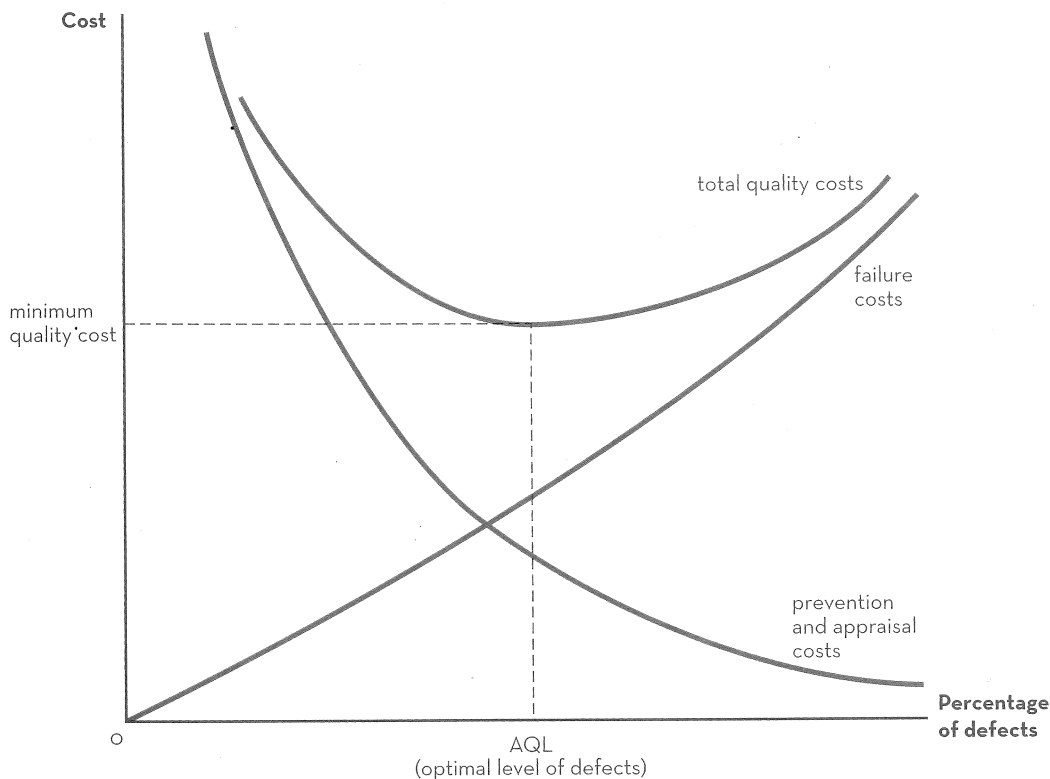
There are two views among quality experts about how these costs interact. The traditional view is that there is some *optimal level of quality* (as measured by the percentage of defects) beyond which any further improvement will cause the total costs of quality to increase. This view is illustrated in Exhibit 16.12. This is based on the assumed interaction of prevention and appraisal costs, on the one hand, with failure costs on the other hand. Initially, as more money is spent on prevention and appraisal, the level of defects decreases and the failure costs decline. The savings in failure costs more than offset the increases in prevention and appraisal costs. But, after a certain point, any further attempts to drive the defect rate down cause increases in prevention and appraisal costs that are greater than the savings in failure costs. Total quality costs are minimised by driving the defect rate down to this point, called the **acceptable quality level (AQL)**, and no further. This viewpoint is not driven by customer value; rather, it is concerned with optimising resources.

The alternative view is that a business should aim to push its level of quality (or defect rate) towards zero rather than accepting some *apparently* optimal level. Three arguments support this view:

- 1 Quality is recognised as a *source of customer value* in its own right. Thus, the level of defects should be pushed below that level that minimises costs. (This argument assumes that customers value zero defects.)
- 2 Many businesses underestimate the costs of failure, particularly the more nebulous costs of external failure such as lost future sales, which means that the optimal level of defects will be much lower than that estimated.

acceptable quality level (AQL) the defect rate at which total quality costs are minimised

Optimal level of quality performance



**Exhibit
16.12**

- 3 Experience has shown that, as businesses increase prevention and appraisal costs, failure costs reduce. As failure costs reduce, businesses discover that they can reduce prevention and appraisal costs. In fact, the traditional view of a trade-off between prevention and appraisal costs on the one hand, and failure costs on the other hand, does not hold. The costs in all four categories go down. Quality costs move towards zero as the level of defects is driven towards zero.

Finally, it should be pointed out that cost of quality reports are *not used by some companies*, as some managers believe that the emphasis on tracking costs is not an appropriate way to manage quality.



total quality management (TQM)
a comprehensive structured approach to achieving continuous improvement in processes to meet customers' expectations

internal customer
the next person or group in a process within an organisation

TOTAL QUALITY MANAGEMENT (TQM) AND A QUALITY CULTURE

With the realisation that quality underlies the competitive strengths of many businesses, total quality management became increasingly popular during the late 1980s and 1990s. **Total quality management (TQM)** is a comprehensive structured approach to achieving continuous improvement in processes to meet customers' expectations. While TQM has been eclipsed by other quality management approaches such as Six Sigma, the quality culture associated with TQM has permeated many businesses and has provided the framework for managing costs and other sources of customer value.

The six key features of TQM are as follows:

- 1 *Total quality management is organisation-wide.* Total quality management needs to infiltrate all aspects of a business, and involve all employees—it is not the exclusive concern of manufacturing. A quality management program should encompass the *entire value chain*, from research and development through production to customer services. In addition, TQM can focus on relationships with external suppliers. Only suppliers with a commitment to quality, and accredited suppliers, are engaged.
- 2 *Total quality management is customer-driven.* Quality is defined by the needs and expectations of customers. Employees need to understand the requirements of their **internal customer**, who is the next person or group in the process.
- 3 *Total quality management involves empowerment.* In order for shopfloor employees to manage their own quality inspection and to correct problems, extensive training is required.
- 4 *Total quality management has a process perspective.* A process perspective focuses on the smooth flow of activity across the organisation rather than within functional departments.
- 5 *Total quality management is supported by a quality management system.* Although TQM is more a philosophy than a set of techniques, it should be supported by documented quality procedures and practices to keep the entire TQM process under control.
- 6 *Total quality management involves continuous improvement.* Given the goal of meeting customers' requirements, and because customers' requirements are constantly changing, continuous improvement is an essential part of TQM.

The development of total quality management is attributed to 'quality pioneers' such as Deming, Juran, Crosby and Ishikawa. Although their models differ, the six features listed above are recognised as key elements of TQM by each of these quality experts (Dotchin & Oakland, 1992; Shank & Govindarajan, 1994). In reviewing the characteristics of TQM you will notice that a TQM culture is essential for effective supply chain management (SCM). (Supply chain management was discussed in Chapter 15.)

Quality in service organisations

Total quality management has evolved from concepts such as inspection, quality control and quality assurance that have been developed and used largely in manufacturing organisations. However, a quality culture is just as important in a service environment, including professional service firms, such as law and accounting firms, architects and the organisations in the health sector. The 'Real life' on page 722 explains the changes that took place in the Flinders Medical Centre to reduce cost and to improve quality.

USING SIX SIGMA TO IMPROVE QUALITY

Total quality management has become an integral part of the culture in many organisations. Some businesses, however, have adopted a more tightly structured approach to managing quality known as

Six Sigma, which focuses on improving business processes, in particular by identifying and eliminating defects.¹⁰ It is based on the idea that business processes have certain characteristics that can be measured, analysed, improved and controlled. Six Sigma was developed by Motorola in the mid-1980s to reduce the level of defects in manufacturing processes. Over time, however, it has evolved into an effective method for improving any business process.

Six Sigma uses two different process improvement methodologies, one for *existing processes* and the other for *new products or processes*. Both methodologies begin by identifying customer expectations and then analyse the processes needed to meet these expectations. The collection and analysis of data is fundamental to both methodologies. The selection of Six Sigma projects is prioritised according to detailed estimates of their financial outcomes. In improving *existing processes*, data is collected to measure critical aspects of the process and analysed rigorously to identify underlying causes of defects. In addition, data is used in controlling the process once problems have been resolved. Data collection and analysis are also central to the design of *new products or processes*. Part of the design process involves identifying and measuring the characteristics that are critical to quality, as well as product and process capabilities, and risks. This information is analysed systematically to select the best design. Further data collection and analysis occur during the design and testing stages, before the new product or process moves into production.

Not unlike ABM, BPR and TQM, Six Sigma works by seeking to understand what customers want and aligning the organisation's key business processes to meet these expectations. The methods used to collect and analyse data, such as variance analysis, process mapping, cause and effect diagrams, and statistical process control are not exclusive to Six Sigma. Six Sigma differs from other modern approaches to managing costs and quality because of its structured and disciplined approach, involving rigorous data analysis. Also, the team-based structure used to implement Six Sigma is unique. Highly trained staff are designated as 'Executive Leaders', 'Champions', 'Master Black Belts', 'Black Belts', 'Green Belts', and 'Yellow Belts', each with their own specific role to play in leading and implementing process improvement.

While key adopters, such as Motorola and GE, have achieved very substantial cost savings from their implementation of Six Sigma, there have been some suggestions that its structured approach may stifle creativity and innovation.

QUALITY ACCREDITATION

One of the driving forces behind the growth in quality management in Australia has been the quality accreditation process. **Quality accreditation** is obtained by meeting a series of quality standards set out in the international ISO 9000 series. The standards cover the systems, documentation, process controls and delivery methods that an organisation must have in place to deliver quality products (including services). The certifications are issued by approved quality auditors.

The take-up of the ISO 9000 series was high in the 1980s and 1990s. During this period of staggering growth in quality accreditation, certification was seen as necessary or useful in gaining access to local and overseas customers. For example, ISO 9000 was mandatory for all suppliers to the Queensland and Western Australian state governments. In other states and federally, ISO 9000 was not mandatory but was often used as a guide to awarding tenders.

Quality accreditation versus total quality management and Six Sigma

Does a quality-accredited organisation practise *total quality management*? Probably, but not necessarily. Total quality management is a philosophy or body of ideas. It is much broader than quality accreditation, which is a documentation process—it may encourage employees to think about ways to improve quality but it has no broad, underlying philosophy to guide management or employees. One consultant referred to the 'hill that represents improvement in the business' and used the following analogy to distinguish between TQM and quality accreditation: 'TQM is pushing the ball up that hill . . . Certification is a way of ensuring the ball does not roll back down the hill' (James, 1993).

Similarly an organisation can be quality accredited but not use the Six Sigma methodology.

Six Sigma a business improvement methodology that uses a structured approach involving rigorous data analysis and a unique team based structure

quality accreditation formal recognition that a series of quality standards set out in the international ISO 9000 series have been met

¹⁰ Six Sigma is a registered trademark of Motorola, Inc. The name 'Six Sigma' was derived from a statistical process measure which implies defects of less than 3.4 per million. For more information about Six Sigma, see Pyzdek et al. (2010).

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Summary

In this chapter we have considered modern approaches to managing costs and quality in order to enable effective resource management and also to drive customer value.

- Many organisations have moved from controlling costs to managing costs. Cost management improves an organisation's cost effectiveness through understanding and managing the real causes of costs.
- Activity-based management (ABM) can be used to manage costs, to improve profitability and customer value. This involves four steps:
 - 1 Identify the major opportunities for cost reduction, using value analysis to determine non-value-added activities.
 - 2 Find the real causes of these costs, using cost driver analysis.
 - 3 Develop a program to eliminate the causes of non-value-added activities and, therefore, costs.
 - 4 Measure performance of cost reduction efforts and key sources of value.
- Business process re-engineering (BPR) can also be used to reduce costs and improve other sources of customer value. Unlike ABM, which emphasises continuous improvement of processes, BPR involves radical changes to business processes.
- Life cycle costing and budgeting involve accumulating the revenues and costs associated with a product over its life cycle. The life cycle perspective helps management minimise total product cost by recognising the trade-offs between costs incurred prior to production, in the course of design and development, and during production and post-production.
- Another approach to cost management, target costing, is based on this trade-off. A product's target cost is based on the difference between its expected selling price and the firm's target profit margin. The design phase of a product's life cycle is driven towards meeting the target cost, as well meeting customers' expectations for product functionality and quality.
- The theory of constraints is a framework for identifying and managing bottlenecks. Throughput accounting focuses on measures of throughput, investment and operating expenses.
- The management of quality contributes to improved customer value. Quality can be defined in terms of quality of design and quality of conformance.
- An organisation can assess its performance in achieving quality using quality-based performance measures, as well as cost of quality reports. Cost of quality reports recognise four quality costs: internal failure costs, external quality costs, appraisal costs and prevention costs.
- Total quality management (TQM) is a comprehensive, structured approach to achieving continuous improvement in processes to meet customer expectations. It requires the development of a quality culture, from 'top floor to shop floor', across the entire value chain. Six Sigma is a business improvement methodology that uses a structured approach to improving quality (and other sources of customer value), based on rigorous data analysis and a unique leadership model.

KEY TERMS

acceptable quality level (AQL)	725	bottleneck	720	cost driver analysis	710
activity	708	business process map	713	cost management	705
activity-based management (ABM)	707	business process re-engineering (BPR, or process re-engineering)	713	cost of quality report	723
appraisal costs	723			cost reduction objective	718
				current cost	718

customer value	707	quality	723	theory of constraints	720
external failure costs	723	quality accreditation	727	throughput accounting	721
internal customer	726	quality of design	723	total quality management	
internal failure costs	723	quality of conformance	723	(TQM)	726
life cycle budget	714	root cause cost drivers	710	two-dimensional activity-based	
life cycle costing	714	Six Sigma	727	costing	707
non-value-added activity	708	strategic processes	713	value-added activity	708
prevention costs	728	target cost	718	value (or activity) analysis	708
process (or business process)	708	target costing	717	value engineering (VE)	719
process improvement	714	target profit margin	718		
product life cycle	714	target selling price	718		

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