

PART TWO

# management accounting



# Management accounting, cost– volume–profit examined and applied

### Learning objectives

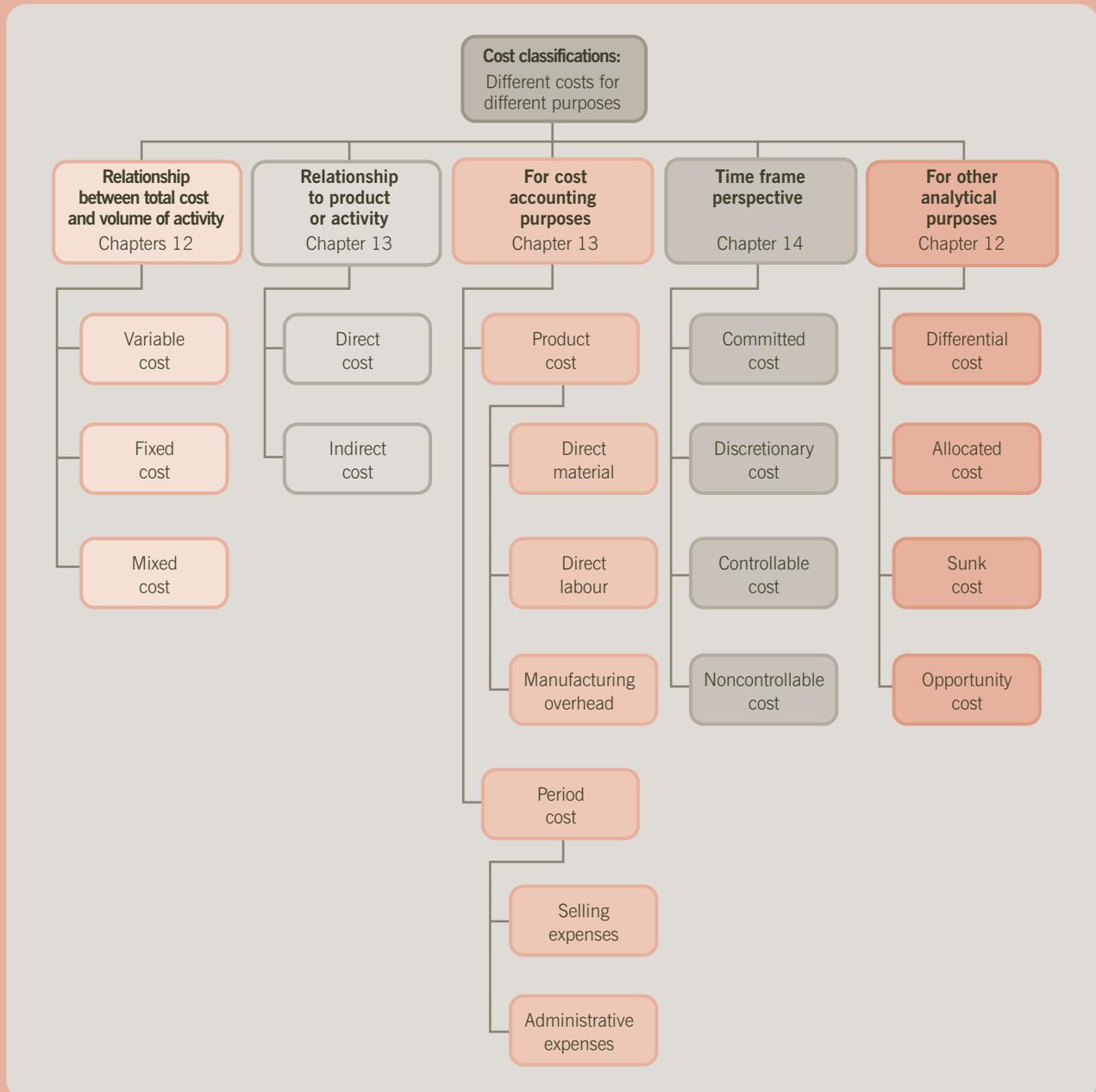
After studying this chapter you should be able to:

1. Explain the need for planning by management and the control cycle.
2. Identify the major differences between financial accounting and management accounting.
3. Explain the difference between variable and fixed cost behaviour patterns, and the simplifying assumptions made in this classification method.
4. Explain why expressing fixed costs on a per unit of activity basis is misleading and may result in faulty decisions.
5. Describe the kinds of costs that are likely to have a variable cost behaviour pattern and those that are likely to have a fixed cost behaviour pattern.
6. Use the high–low method to determine the cost formula for a cost that has a mixed behaviour pattern.
7. Explain the difference between the traditional income statement format and the contribution margin income statement format.
8. Explain the contribution margin and use it in CVP analysis.
9. Explain the meaning and significance of the break-even point and calculate the break-even point.
10. Explain the concept of operating leverage.
11. Discuss the meaning and application of the following cost terms: *differential*, *allocated*, *sunk* and *opportunity*.
12. Describe how costs are determined to be relevant for short-run decisions.
13. Determine a special pricing decision when a firm is operating at full, rather than idle, capacity.
14. Analyse relevant costs in the make or buy decision.
15. Determine a product-mix decision when confronted with scarce resources.

**OVERVIEW** When asked by a marketing or production manager what a certain item or service activity costs, the management accountant who asks ‘Why do you want to know?’ is not being smart; he or she is being user-focused or customer-driven. Costs used for valuing inventory are different from the costs that should be considered when analysing a product modification or a potential new product.

**Management accounting**, sometimes called *managerial accounting*, involves using economic and financial information to plan and control many of the activities of the entity and to support the management decision-making process. Management accounting has an internal orientation, as

**EXHIBIT 12-1** / Cost classifications—THE BIG PICTURE



opposed to the primarily external orientation of financial accounting. The transactions generated by the accounting information system and used for financial reporting purposes are also used in management accounting, but management accounting is more likely to have a future orientation, such as in the preparation of budgets. As with financial accounting, management accounting has special terminology or, as many would say, *jargon*. Most of these terms relate to different types of costs. An important early lesson about management accounting is that *there are different costs for different purposes*.

This chapter looks briefly at the management process, identifies several of the contributions that the management accountant makes to that process, and introduces a model for cost classifications. Subsequent chapters describe these costs and illustrate how they are used for planning, control and the decision-making processes.

**Cost–volume–profit (CVP) analysis** involves using cost behaviour patterns to interpret and forecast the changes in profit that result from changes in sales revenue, costs or volume of activity. One especially important application of CVP analysis is the determination of the break-even point for a company (or one of its units or products). Because CVP analysis emphasises the cost behaviour pattern of various costs, and the impact on costs and profits of changes in the volume of activity, it is useful for planning and for evaluating actual results achieved.

The chapter also examines several examples of short-term decisions, and establishes a way of thinking about the costs involved in the decision-making process. The analysis necessary for those unique opportunities that present themselves on a random basis, such as special discounted price offers a firm receives for a one-time sale of its product, will be significantly different from the holistic cost analysis sometimes required.

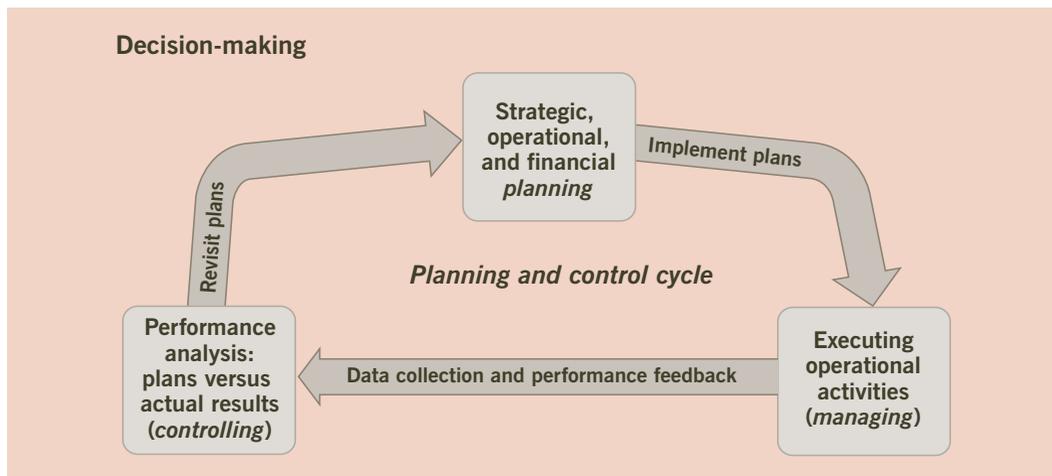
## Management accounting contrasted with financial accounting

Management accounting supports the internal planning (future-oriented) decisions made by management. Financial accounting has more of an accountability (score-keeping) or historical orientation, although data produced by the financial accounting process form some of the foundation on which plans are based. Planning is a key part of the **management process** and, although there are many descriptions of that process, a generally acceptable definition would include reference to the process of planning, organising and controlling an entity's activities so that the organisation can accomplish its purpose. A schematic model of the process is shown below.



### 1 learning objective

Explain the need for planning by management and the control cycle.



The diagram suggests that control is achieved through feedback. Actual results are compared with planned results and, if a variance exists between the two, then either the plan or the actions, or perhaps both, have changed. Managers, therefore, make decisions in each phase of the planning and control cycle, using information provided by the management accounting information system.

Not all of a firm's objectives are stated in financial terms. For example, market share, employee morale, absence of lay-offs, a safe working environment and responsible corporate citizenship are important objectives that are expressed in non-financial terms. However, many of the firm's goals will be financial in nature (e.g. return on assets (ROA), return on equity (ROE), growth in sales, earnings and dividends, to name just a few). The accountant plays a major role in identifying these goals, helping to achieve them, and measuring the degree to which they have been accomplished.

Emphasis on the future is a principal characteristic that makes management accounting different from financial accounting. Anticipating what sales revenue will be, and forecasting the expenses that are likely to be incurred to achieve those sales, are critical activities of the budgeting process. Another difference between management accounting and financial accounting that is emphasised in planning is the breadth of focus. Financial accounting deals primarily with the financial statements for the organisation as a whole; management accounting is more concerned with operating units within the organisation. Thus, even though an overall company ROA objective is established, effective planning requires that the planned impact of the activities and the results of each unit of the organisation (division, product line, plant, sales territory and so on) be considered.

Measuring results involves the use of historical data of financial accounting and, because of the time required to perform some financial accounting processes and auditing procedures, there is usually a time lag of weeks or months between the end of an accounting period and the issuing of financial statements. However, for performance feedback to be most effective, it should be provided as quickly as possible after action has been completed. Management accounting is not constrained by Australian International Financial Reporting Standards, so approximate results can be generated quickly for use in the control process. In other words, relevant data, even though not absolutely accurate in a financial accounting sense, are useful for evaluating performance soon after an activity has been completed. Managers, being inside the firm and in the know, can cope with a level of approximation without much difficulty.

Exhibit 12-2 summarises the principal differences between management accounting and financial accounting.

If time and effort have been devoted to developing a plan, it is sensible to attempt to control the activities of the organisation so that the goals of the plan are accomplished. Many of the activities of the management accountant are related to cost control; this *control* emphasis occurs in most of the management accounting concepts that are explained in these chapters.

Another management concept relevant to the control process is that, if an individual is to be held accountable, or responsible, for the results of an activity, that individual must also have the authority to influence those results. If a manager is to be held responsible for costs incurred by a unit of the organisation, the financial results reported for that unit should not include costs incurred by other units that have been *arbitrarily* assigned to the unit being evaluated. In other words, the results should not reflect costs that the manager being held responsible cannot control.

Management accountants work extensively with people in other functional areas of the organisation. For example, industrial engineers and management accountants work together to develop **production standards**, which are the expected or allowed times and costs to make a product or perform an activity. Management accountants help production people interpret performance reports, which compare actual and planned production outputs and costs. Sales personnel, the marketing staff and management accountants are involved in estimating a

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learning objective

Identify the major differences between financial accounting and management accounting.

## EXHIBIT 12–2 / Management accounting compared with financial accounting

Characteristic	Management accounting	Financial accounting
Service perspective	Internal report to managers and other stakeholders	External report to investors, creditors
Time-frame	Present and future for planning and control	Past—financial statements are historical
Breadth of concern	Micro—individual units of the organisation plan and act	Macro—financial statements are for the organisation as a whole
Reporting frequency and promptness	Control reports issued frequently (e.g. daily) and promptly (e.g. one day after period-end)	Audited financial statements issued annually with interim results after six months
Degree of precision of data used	Reasonable accuracy desired, but ‘close counts’; relevance is often more important than reliability	High accuracy desired, with time usually available to achieve it; reliability is of utmost importance, enforced by the requirements of an audit
Reporting standards	None imposed because of internal and pragmatic orientation	Imposed by Australian International Financial Reporting Standards issued by the AASB

future period’s sales. Human resource professionals and management accountants work together to determine the cost effect of compensation changes. And the management accountant will play a significant role in the firm’s systems development life-cycle process by providing insight into the planning, analysis, design and implementation phases of an organisation’s information systems projects. These few examples illustrate the need for management accountants to have a breadth of knowledge about the organisation and its operating environment. The examples also suggest that it is appropriate for persons in other functional areas to have a general understanding of management accounting. Helping readers to achieve that general understanding is the objective of the remaining chapters of the book.

1. What does it mean that management accounting has a different time-frame from financial accounting?
2. What does it mean to have feedback for control purposes?

**what** does it mean?

## Cost classifications



The term *cost* means different things to different people, and in the management planning and decision-making processes it is important to use costs that are appropriate to the situation. Likewise, management accountants should make sure that everyone involved in any given situation understands the costs being used. Exhibit 12-1 presents the cost classifications most frequently encountered. Study it and see where the cost topics covered in this chapter fit in.

These classifications are not mutually exclusive; a cost might be identified as a ‘controllable, variable, direct, product cost’, for example. Overall, this basic concept of *different costs for different purposes* is fundamental to an understanding of the planning, control and decision-making process. From the perspective of this model you will be introduced to these cost concepts as they relate to the planning, control or decision-making theme being developed.

## what does it mean?

### 3. What does it mean to state that there are different costs for different purposes?

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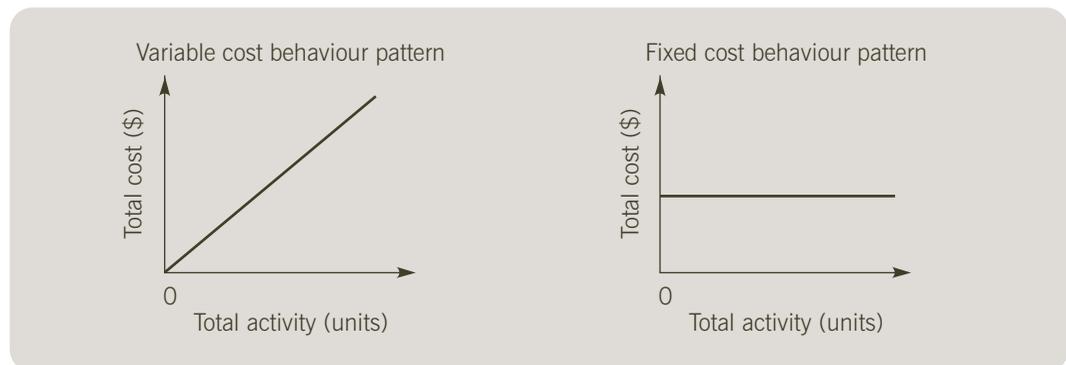
#### learning objective

Explain the difference between variable and fixed cost behaviour patterns, and the simplifying assumptions made in this classification method.

## Relationship of total cost to volume of activity

The relationship of total cost to volume of activity describes the **cost behaviour pattern**, one of the most important cost classification methods to understand. A **variable cost** is one that changes *in total* as the volume of activity changes. A cost that does not change *in total* as the volume of activity changes is a **fixed cost**. For example, raw material cost incurred to manufacture a product has a variable cost behaviour pattern, because the greater the number of units produced, the higher the total raw material costs incurred. On the other hand, factory building depreciation expense is a fixed cost because total depreciation expense will not change regardless of the level of production (unless, of course, the units of production method is used to calculate depreciation, in which case this cost would be variable). The distinction between fixed and variable cost behaviour patterns is illustrated graphically in Exhibit 12-3.

### EXHIBIT 12-3 / Cost behaviour patterns



The fixed or variable label refers to the behaviour of total cost, relative to a change in activity. Activity is a measure of how busy the firm is, and it can be measured in an almost infinite number of ways (e.g. number of units provided, number of hours worked, litres produced, kilometres covered). Different measures of activity can be used for control purposes in different parts of the firm. When referring to the behaviour of unit costs, however, the labels may be confusing, because variable costs are constant per unit but fixed costs per unit will change as the level of activity changes. Thus, it is necessary to understand the behaviour pattern on both a total cost basis and a per-unit basis, as illustrated below. Variable costs change in total as activity changes but are constant per unit. Fixed costs do not change in total as activity changes but will vary if expressed on a per-unit of activity basis.

**THE INSIDER'S VIEW**

## How we use accounting in our business

We purchased a franchise business in 2002—Looksmart Alterations, in Warringah Mall—and decided to do our own accounting. Weekly financial reporting was part of our franchisee requirements.

In 2005 we also opened a start-up business—STICKY + MOO (a café)—for which financial budgeting and management required key accounting skills.

We also acquired accounting knowledge from our accountant, Steph's BCom degree and Leigh's hospitality industry cost-controlling experience.

We are in business to pursue financial goals. Hence we have weekly financial projections and budgets which we aim towards in order to achieve these goals. Our financial performance determines the level of external marketing that we need to implement.

You need to know the major variables and how to

manipulate them in order to achieve your profit objectives. In the restaurant industry there are two main variable costs: staff costs and food costs. Both of these costs need to be controlled. If we cannot achieve our target figures, we may as well not open in the first place, as we would be giving away money.

Our career goals are:

- to be financially independent after a lot of hard work to record capital gains from the sale of a number of small businesses and property developments and to develop a sustainable ongoing passive income
- to be retired by 2015
- to achieve excellence in an industry where people are used to receiving mediocrity in food quality, service, ambience etc.

**Leigh Hudson, Stephanie Leong**

Owners, STICKY + MOO Restaurant

As activity changes		
	Total cost	Per unit cost
Fixed cost	Remains constant	Changes inversely
Variable cost	Changes directly	Remains constant

Knowledge of the cost behaviour pattern is important to the planning process, and several simplifying assumptions are usually made to facilitate the use of this analytical tool. The most significant assumption has to do with the range of activity over which the identified or assumed cost behaviour pattern exists. This is the **relevant range** assumption, and it is most applicable to fixed costs. Returning to the example of depreciation expense, at some point an increase in the volume of production would require more plant capacity, and depreciation expense would increase. On the other hand, if substantially lower production volumes were anticipated in the future, some of the factory would be closed down or converted to another use, and depreciation expense would decrease. To say that depreciation expense is fixed is to say that over some relevant range of production the total cost will not change. Different fixed expenses will have different relevant ranges over which they have a fixed cost behaviour pattern. When a cost is identified as fixed and cost projections are made based on that cost behaviour pattern classification, the limits of the relevant range assumption must be considered. The other major simplifying assumption is that the cost behaviour pattern is *linear*, not curvilinear. This assumption relates primarily to variable costs. Because of economies of scale, quantity discounts and other factors, variable costs will change slightly when expressed on a per-unit basis. These changes are usually not significant, but, if they are, appropriate adjustment in unit costs should be made in analyses based on cost behaviour patterns. These assumptions are illustrated and described in more detail later in the chapter.

At first glance the classifying of costs as either variable or fixed is limited. Some costs are partly fixed and partly variable. Sometimes costs with this mixed behaviour pattern are called **semi-variable costs**. Water, light and electricity for the factory, for example, have a mixed

behaviour pattern, because, when the plant is not operating, some lights must be kept on for safety and security, but as production increases more electricity is required. Analytical techniques can break this type of cost into its fixed and variable components, and a **cost formula** can be developed, expressed as:

$$\begin{aligned} \text{Total cost} &= \text{Fixed cost} + \text{Variable cost} \\ &= \text{Fixed cost} + (\text{Variable rate per unit} \times \text{Activity}) \end{aligned}$$

This cost formula can then be used to forecast the total cost expected to be incurred at various levels of activity. For example, assume that it has been determined that the fixed cost for water, light and electricity is \$350 per month and that the variable rate for water, light and electricity is 30 cents per machine hour. Total estimated water, light and electricity cost for a month in which 6000 machine hours were planned would be:

$$\text{Total cost} = \$350 + (\$0.30 \times 6000 \text{ machine hours}) = \$2150$$

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**learning objective**

Explain why expressing fixed costs on a per unit of activity basis is misleading and may result in faulty decisions.

Great care must be taken with the use of fixed cost per unit data, because any change in the volume of activity will change the per-unit cost. As a general rule, do not unitise fixed expenses, because *they do not behave on a per-unit basis*. For example, many of the costs of a university library—salaries, depreciation, and water, light and electricity—are fixed; to calculate the ‘cost’ of issuing a book by dividing library costs by the number of books issued in a period of time will give a misleading result, as illustrated in Exhibit 12-4. Sometimes fixed costs must be unitised, as in the development of a predetermined overhead application rate (described in Chapter 13). It is also important to recognise that the relevant range is often quite wide, and significant increases in activity can be achieved without increasing fixed costs (i.e. there are economies of scale to be achieved that result in efficiencies and a reduction of fixed cost per unit). However, whenever fixed costs are unitised, be very careful about drawing conclusions from that data.

**EXHIBIT 12-4 / The error of unitising fixed costs**

A university library operates from 9 am until 6 pm five days a week and on the weekend during the 16 weeks of both semesters (including the examination weeks) from 10 am until 5 pm. The library’s annual expenses, paid monthly, consist of:

	\$
Salaries and wages	1 000 000
Subscriptions to electronic resources	2 500 000
Book acquisitions	500 000
Computer maintenance	250 000
Paper	100 000
Water, light and electricity	120 000
Annual costs (mostly fixed)	4 470 000

We could allocate this figure over the number of students expected to use the library, the number of hours the library was open, the number of books taken out or the number of electronic resources accessed. Each one would give a significantly different number. Could they all be right? Could they all be useful under different circumstances some of the time?

**what does it mean?**

4. What does it mean to say that determination of a cost behaviour pattern involves some implicit assumptions?
5. What does it mean to develop a cost formula?

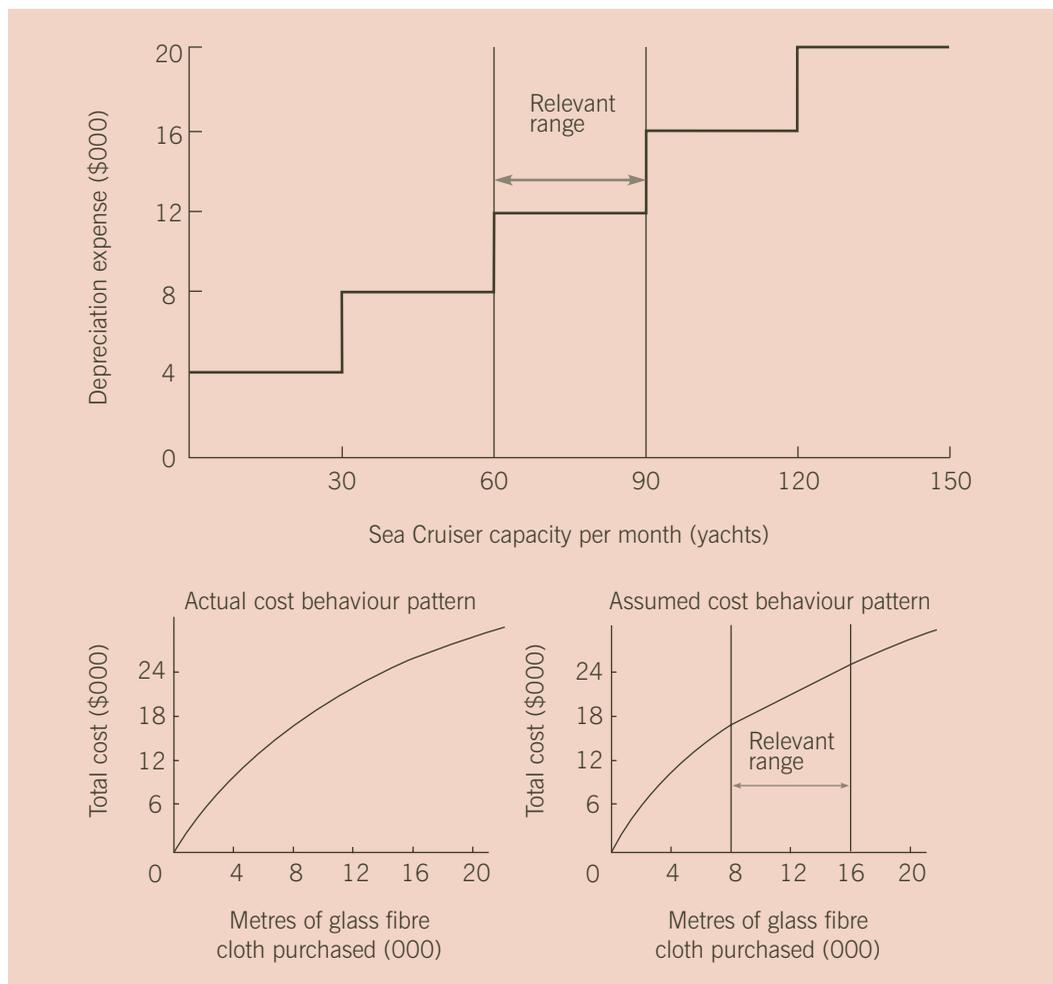
# Applications of cost–volume–profit analysis



## Cost behaviour pattern: the key

Recall the two simplifying assumptions that are made in connection with the determination of cost behaviour patterns. First, the behaviour pattern is true only within a relevant range of activity; if activity moves beyond the relevant range, the cost will change. Second, the cost behaviour pattern identified is assumed to be linear within the relevant range, not curvilinear.

The relevant range idea relates to the level of activity over which a particular cost behaviour pattern exists. For example, if the production capacity of the plant of Cruisers Ltd is 90 Sea Cruiser yachts per month, additional equipment would be needed if production of 120 yachts per month was required. The investment in additional equipment would result in an increase in depreciation expense. On the other hand, if the long-term demand for yachts could be satisfied with a capacity of only 50 yachts per month, it is likely that management would ‘mothball’ (or dispose of) some of the present capacity and depreciation expense would fall. The following graph illustrates a possible relationship between depreciation expense and capacity. The relevant range for depreciation expense of \$12 000 per month is production capacity of 60 to 90 yachts. As long as capacity remains in this range, the total fixed expense for depreciation will not change, but if capacity changes to another relevant range, then the amount of this fixed expense will also change.



The linearity assumption means that the cost behaviour pattern will plot as a straight line within the relevant range. Although applicable to both fixed and variable costs, the significance of this assumption is best illustrated with a variable cost such as raw materials, for example fibreglass cloth. Because of quantity discounts and invoicing efficiencies, the cost per unit of the raw material will decrease as the quantity purchased increases. This is illustrated in the left graph of the second set of graphs above. For analytical purposes, however, it may be assumed that the cost is linear within a relevant range, as shown in the right graph. Even though the cost per metre does vary slightly at different activity levels, for the purposes of using cost–volume–profit analytical techniques it will be assumed constant per metre (variable in total) when purchases total between 8000 and 16 000 metres per month.

If these assumptions are overlooked, or if costs are incorrectly classified or described, the results of the analytical process illustrated later in the chapter will be inaccurate. Cost–volume–profit analysis is a valuable tool to use in many situations, but the cost behaviour assumptions made are crucial to the validity and applicability of its results, and they must be kept in mind when evaluating these results.

5

#### learning objective

Describe the kinds of costs that are likely to have a variable cost behaviour pattern and those that are likely to have a fixed cost behaviour pattern.

Generally speaking, raw materials and direct labour costs of manufacturing units of product are variable costs. In addition, some elements of overhead (see the discussion of overhead in Chapter 13 for more detail) will have a variable cost behaviour pattern. For example, maintenance and housekeeping materials used, as well as the variable portion of water, light and electricity, will be a function of the level of activity. Other overhead costs are fixed, including depreciation expense, supervisory salaries, and the fixed portion of water, light and electricity costs.

Selling, general, administrative and other operating expenses also fit both patterns. Sales commissions, for example, could vary in proportion to sales revenue or the quantity of product sold. Alternatively, sales people could earn a basic salary plus a commission on sales over a set number of units sold or dollar amount of sales. In this case, the cost of the salesperson's salary is a composite of a fixed amount (base salary) plus a variable amount (true commission). The wages associated with employees who process orders or handle payments from customers may be variable if those functions are organised so that the number of workers can be expanded or contracted rapidly in response to changes in sales volume (typically, where there are a number of permanent full-time staff, and casual staff are employed when required, in peak periods). Business organisation (and reward for services provided), therefore, predicts the nature of the expense classification. On the other hand, advertising costs are usually fixed (committed) in the short run; once approved, the money is spent and it is difficult to relate specific sales volume changes directly to advertising expenditures. The whole advertising campaign can be evaluated after the fact (was the money well spent?), but on an individual product level this is an almost impossible task, so advertising is most often treated as a fixed cost.

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#### learning objective

Use the high–low method to determine the cost formula for a cost that has a mixed behaviour pattern.

## Estimating cost behaviour patterns

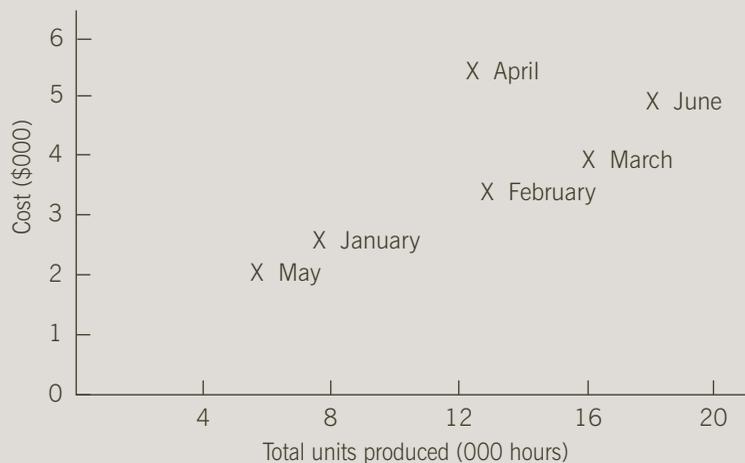
A particular cost's estimated behaviour pattern is determined by analysing cost and activity over a period of time. One of the analytical techniques involves using a scattergram to identify high and low cost–volume data and then simple arithmetic is used to calculate the variable rate and the cost formula. This 'high–low' method is illustrated in Exhibit 12-5. More complex techniques, including simple and multiple regression analysis, can also be used, but at some point the perceived increase in accuracy is offset by the simplifying assumptions involved in using the cost formula for planning and control purposes.

## EXHIBIT 12-5 / High-low method of estimating a cost behaviour pattern

**Assumption:** During the months of January to June, the following water, light and electricity costs were incurred at various service levels:

Month	Total water, light, elect'y cost	Total production volume
	\$	(billable hours)
January	2 500	8 000
February	3 500	13 000
March	4 000	16 000
April	5 500	12 000
May	2 000	6 000
June	5 000	18 000

### The scattergram



Observe in the scattergram that a cost-volume relationship does exist because of the approximate straight-line pattern of most of the observations. However, the April data do not fit the pattern. This might be due to an error or to some unusual condition. This observation is an 'outlier' and will be ignored in the calculation of the cost formula because of its variation from the cost-volume relationship that exists between the other data.

### Calculation of the variable cost behaviour pattern

The high-low method of calculating the variable cost behaviour pattern, or variable cost rate, relates the change in cost to the change in activity, using the highest and lowest *relevant* observations.

$$\begin{aligned}\text{Variable rate} &= \frac{\text{High cost} - \text{Low cost}}{\text{High activity} - \text{Low activity}} \\ &= \frac{\$5000 - \$2000}{18\,000 \text{ hrs} - 6\,000 \text{ hrs}} \\ &= \$3000/12\,000 \text{ hrs} \\ &= \$0.25 \text{ per hour}\end{aligned}$$

## EXHIBIT 12-5 / High–low method of estimating a cost behaviour pattern *continued*

### The cost formula

Knowing the variable rate, the fixed cost element can be calculated at either the high or the low set of data, and the cost formula can then be developed, because total cost is equal to variable cost plus fixed cost.

At 18 000 hours of activity, the total variable cost is 18 000 hours  $\times$  \$0.25 per hour = \$4500.

Fixed cost calculation:

$$\begin{array}{r} \text{Total cost at 18 000 hours} = \$5000 \\ \text{Variable cost at 18 000 hours} = \underline{4500} \\ \text{Fixed cost} = \underline{\underline{\$500}} \end{array}$$

At 6000 hours of activity, the total variable cost is 6000 hours  $\times$  \$0.25 per hour = \$1500.

Fixed cost calculation:

$$\begin{array}{r} \text{Total cost at 6000 hours} = \$2000 \\ \text{Variable cost at 6000 hours} = \underline{1500} \\ \text{Fixed cost} = \underline{\underline{\$500}} \end{array}$$

The cost formula for water, light and electricity is:

$$\begin{aligned} \text{Total cost} &= \text{Fixed cost} + \text{Variable cost} \\ &= \$500 + \$0.25 \text{ per hour produced} \end{aligned}$$

This cost formula now can be used to estimate total utility costs at any level of activity (within the relevant range). For example, if production volume for the month of July is expected to be 14 000 hours, the estimated total utility cost would be:

$$\begin{aligned} \text{Total cost} &= \text{Fixed cost} + \text{Variable cost} \\ &= \$500 + (\$0.25 \times 14\,000) \\ &= \$4000 \end{aligned}$$

Note that it is considered a coincidence if the cost formula explains total cost accurately at points not used in the high–low calculation. This is because the calculation assumes a linear relationship between the observations used and, in practice, *exact* linearity will not exist. Prior to extracting a high point and a low point, a quick graph should first be drawn to ensure that the items chosen are not outside the normal pattern (i.e. are not outliers).

In this example, the application of the high–low method has been applied to activity measured in hours. It could just as easily have been applied to activity measured in units produced or labour hours worked.

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### learning objective

Explain the difference between the traditional income statement format and the contribution margin income statement format.

## A modified income statement format

The traditional income statement format classifies costs according to the reason (function) they were incurred: cost of goods sold, selling expenses, marketing expenses, administrative expenses, research and development expenses, and so on. The income statement format used in CVP analysis is frequently referred to as the **contribution margin format**, and classifies costs according to their behaviour pattern—variable or fixed. The alternative formats are:

Traditional format (expenses classified by function)		Contribution margin format (expenses classified by cost behaviour pattern)	
\$		\$	
Sales revenue	_____	Sales revenue	_____
Cost of goods sold	_____	Variable costs	_____
Gross profit	_____	Contribution margin	_____
Operating expenses	_____	Fixed costs	_____
Operating profit	_____	Operating profit	_____

Revenues and profit (profit before interest and taxes) are the same under either alternative. The difference is in the classification of expenses: functional in the traditional format and according to cost behaviour pattern in the contribution margin format. Although the behaviour pattern classification could be carried beyond profit to other income and expense, and income taxes, it usually is not, because the greatest benefits of the contribution margin approach are realised in the planning and control and evaluation processes applied to a firm's operations.

The contribution margin format derives its name from the difference between sales revenue and variable expenses. **Contribution margin** means that this amount is the contribution to fixed expenses and profit from the sale of a product or the provision of a service. The key to this concept lies in understanding cost behaviour patterns. As revenue increases as a result of selling more products or providing more services, variable costs will increase proportionately, and so will contribution margin. However, *fixed costs will not increase* because they are not a function of the level of revenue-generating activity.

Use of the traditional income statement model can result in misleading and erroneous conclusions when changes in activity levels are being considered, because it is assumed that all expenses change in proportion to changes in activity. This error is made because cost behaviour patterns are not disclosed. The error is avoided when the contribution margin model is used correctly. For example, assume that a firm currently has sales revenue of \$100 000 and profit of \$10 000. If sales revenue were to drop by 20 per cent to \$80 000, a quick conclusion would be that profit would also decline by 20 per cent, to \$8000. However, analysis using the contribution margin format results in a much more accurate, and disturbing, result:

	Current results	Results assuming a 20% decline in revenue
	\$	\$
Sales revenue	100 000	80 000
Variable costs (60%)	60 000	48 000
Contribution margin (40%)	40 000	32 000
Fixed costs	30 000	30 000
Profit	10 000	2 000

The 20 per cent reduction in sales revenue resulted in a 20 per cent reduction in contribution margin amounting to \$8000. This carried through to reduce profit by \$8000 since fixed costs did not change. This is an example of why it is misleading to think of fixed costs on a per-unit basis. Although management cannot ignore fixed costs, it must be recognised that they behave differently from variable costs.

The **contribution margin ratio** is the ratio of contribution margin to sales revenue. Think of the ratio as the portion of each sales dollar that remains after covering the variable costs and that is available to cover fixed costs or provide for profits. This ratio can be used to calculate

directly the change in contribution margin for a change in sales revenue. Continuing with the same data used above, a \$12 000 increase in revenue would result in a \$4800 ( $40\% \times \$12\ 000$ ) increase in contribution margin and a \$4800 increase in profit.

## what does it mean?

6. What does it mean to rearrange the income statement model from the traditional format to the contribution margin format?
7. What does it mean to state that the contribution margin model is more useful than the traditional model for determining the effect on profit of changes in activity?

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### learning objective

Explain the contribution margin and use it in CVP analysis.

The importance of distinguishing fixed costs from variable costs in management accounting has already been established. Thus, it should come as no surprise that a cost formula has been developed which allows assessment of the impacts of various changes on expected outcomes in all types of scenarios.

Typical questions that need to be resolved in the process of managing a business include:

- What is the contribution unit amount and per cent ratio?
- What would the impact of a change in selling price be on profit, given the probability of a change in the volume of sales?
- What would the impact of a change in selling price be on profit, given the probability of a change in the volume of sales, if the fixed costs of advertising were also to be increased?
- What is the volume of sales needed to cover total costs?
- If there is a change in either a fixed cost or a variable cost, or both, what impact would that have on the sales volume needed to cover costs?
- What must sales volume be to achieve a target after-tax profit?

One formula can solve ALL these questions:

$$Sx = VCx + FC + P$$

Where S = selling price per unit  
 VC = variable costs per unit  
 FC = fixed costs  
 P = profit  
 x = volume of units

To illustrate the use of the formula, assume that management wants to know the profit from a product that has the following revenue, cost and volume characteristics:

Selling price per case	\$15
Variable expenses per case	9
Fixed expenses associated with the product	\$40 000
Sales volume in cases	9000 cases

$$\begin{aligned}
 Sx &= VCx + FC + P \\
 (15 \times 9000) &= (9 \times 9000) + 40\ 000 + P \\
 P &= \$14\ 000
 \end{aligned}$$

could be simplified to focus on profit and the contribution margin concept as follows:

$$\begin{aligned}
 P &= x(S - VC) - FC \\
 &= 9000(15 - 9) - 40\ 000 \\
 P &= \$14\ 000
 \end{aligned}$$

Now assume that management wants to know what sales volume is necessary to break even. Break even point is where total sales revenue equals total cost or the point at which profit is zero. In the examples that follow, the two approaches have been put side by side. Focus on the method you understand best and apply this to problems.

$Sx = VCx + FC + P$ $15x = 9x + 40\,000 + 0$ $x(15 - 9) = 40\,000$ $x = 40\,000 / (15 - 9)$ $x = 6666.7$ $x = 6667 \text{ units rounded to}$ $\text{next complete unit}$ <p style="margin-left: 40px;">In dollars, <math>6667 \text{ units} \times \\$15</math></p> $= \$100\,005$ <p style="margin-left: 40px;">Covers <math>40\,000 + 6667 \times 9 = 100\,003</math></p>	<p style="text-align: center;">OR    simplified: <math>x(S - VC) = P + FC</math></p> $x = P + FC / (S - VC)$ $x = 0 + 40\,000 / (15 - 9)$ $x = 6666.66$ <p style="margin-left: 40px;"><math>x = 6667 \text{ units rounded to}</math></p> <p style="margin-left: 40px;"><math>\text{the next complete unit}</math></p> <p style="margin-left: 40px;">In dollars, <math>6667 \times \\$15</math></p> $= \$100\,005$
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Another situation may require working with a variety of products where control is maintained by having a standard contribution margin. In this case, selling price can be regarded as being 100 per cent, with variable expenses expressed as a percentage of that selling price.

To illustrate the use of the formula, assume that management wants to know the profit from a product that has the following revenue and cost characteristics in respect of many products with a uniform contribution margin ratio:

	\$
Sales	135 000 (100%)
Variable costs	81 000 (60%)
Fixed costs associated with the product	40 000

$\text{Sales} = \text{Total VC} + \text{FC} + \text{P}$ $135\,000 = 81\,000 + 40\,000 + \text{P}$ $\$14\,000 = \text{P}$	<p style="text-align: center;">OR    Simplified: <math>\text{Sales} - \text{Total VC} - \text{FC} = \text{P}</math></p> $135\,000 - 81\,000 - 40\,000 = \text{P}$ $\$14\,000 = \text{P}$
--	--

This could also be solved with percentages:

$$\text{FC} + \text{P} = 40\% \text{ S}$$

$$\text{P} = 0.4 \times 135\,000 - 40\,000$$

$$\text{P} = \$14\,000$$

**8. What does it mean that fixed expenses should not be unitised because they don't behave that way?**

**what does it mean?**

The **break-even point** is usually expressed as the amount of revenue that must be realised for the firm (or product or activity or group of products or activities) to have neither a profit nor a loss (i.e. profit equal to zero). The break-even point is useful to managers because it expresses a minimum revenue target, and managers frequently find it easier to think in terms of sales revenue rather than variable and fixed expenses. In addition, the amount of sales (or sales revenue) generated by the firm is easily determined on a daily basis from the accounting system.

Once again, the formula can be used to solve the problem.

**9**  
**learning objective**

Explain the meaning and significance of the break-even point and calculate the break-even point.

## The importance of a knowledge of accounting, finance and so on

My secondary school teachers must have known best, because they had tried to convince me to study commerce in the first place. I thought that I was better suited to science, but after a disastrous year at university I returned to accounting and undertook a commerce degree part-time while working for a chartered accounting firm. The knowledge of tax and accounting was useful, but probably auditing gave me a better understanding of business issues, and I found that it was auditing that gave me the discipline to undertake future positions. Auditing trains you in the knowledge of a wide range of business types, business controls, benefits, policies and procedures and internal controls. Skills in finance and marketing really did not come until later, until I had left public practice and joined the private education system. Then I really found out the importance of looking after every dollar, getting market share, and the sensitivity of the customers to delivering a quality service.

### Assessing financial risk

Financial risk can be assessed using some modelling. For example, what is the impact of sales dropping by 20 per cent, 50 per cent? If we build this new factory, what levels of sales do we need to break even? What is the likely chance of the risk occurring? Take this example: There were two competitors. One was consolidating smaller businesses at an alarming rate without much regard for the quality of the business, the impact of additional offices on staff,

quality of work, etc. The other competitor appeared to be very selective, undertaking due diligence studies, making sure of the fit, taking it slowly in a measured way. Some thought this competitor was too conservative and would get left behind. The result? The first business imploded, leaving staff, clients and financiers with no contingency plans.

### Knowing about cost–volume–profit relationships

The relationship between cost, volume and profit is one of the most misunderstood concepts. So many people get their business into trouble because they think if they sell more they will make more. Most banks today use software that analyses this relationship for their clients, and many accountants do the same. The interaction of interest on debt, unpaid debtors, slow-moving inventory and labour costs can all work against the profit and especially the cash position. Questions to ask are:

- Will setting up more branches of the business make more profit?
- Will putting on more staff to handle increased work/sales/production make more profit?
- Will buying a faster machine mean more profit?

Often the answer is NO, NO, NO. This is an example of where business owners are crying out for explanations of what is behind the numbers.

### Richard Trigg

Finance Manager  
Golden Plains Shire Council

	\$
Selling price per unit	12
Variable costs per unit	8
Total fixed costs	45 000

$$Sx = VCx + FC + P \text{ or simplified: } x(S - VC) - FC = P \text{ and simplified further: } x = \frac{FC + P}{S - VC}$$

$$x = \frac{\$45\,000 + \$0}{(12 - 8)}$$

$$x = 11\,250 \text{ units}$$

$$\text{or sales revenue at break-even point} = \text{break-even units} \times \text{unit revenue}$$

$$\$135\,000 = 11\,250 \times \$12$$

Most firms plan for certain target or budget levels of profit and would not be satisfied to simply break even. As illustrated earlier, the contribution margin model can be used

to determine total sales revenue and sales volume in units for any amount of target profit. The break-even formula can also be easily modified to determine these amounts by adding the desired profit to the numerator. To illustrate, assume the same information as above and a desired profit of \$10 000. Profit is profit before tax.

$Sx = VCx + FC + P$  or simplified  $x(S - VC) - FC = P$  and simplified further:  $x = FC + P/S - VC$

$$x = \frac{\$45\,000 + \$10\,000}{(12 - 8)}$$

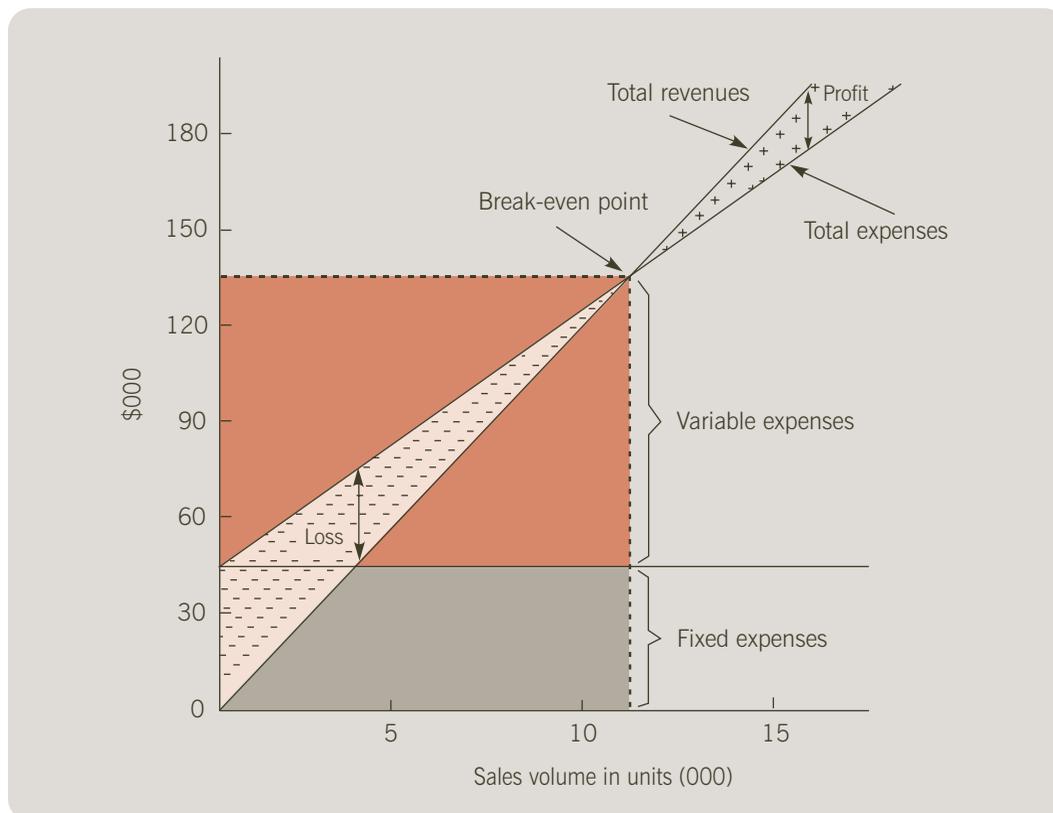
$$x = 13\,750 \text{ units}$$

$$\text{or } 13\,750 \times \$12 = \$165\,000$$

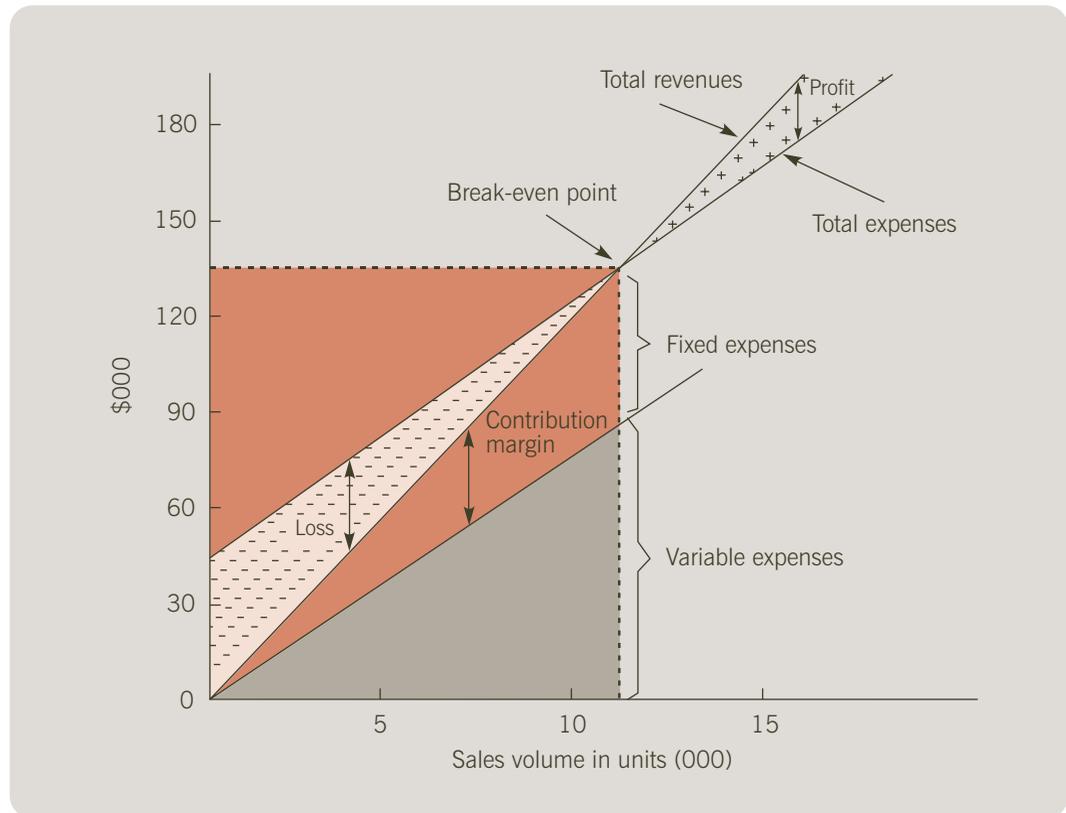
Break-even analysis is frequently illustrated in graphical format, as illustrated in Exhibits 12-6 and 12-7, which use data from the above example. Note that in these graphs the horizontal axis is sales volume in units and the vertical axis is total dollars. In Exhibit 12-6, the horizontal line represents fixed expenses of \$45 000, and variable expenses of \$8 per unit are added to fixed expenses to produce the total expense line. Sales revenue starts at the origin and rises at the rate of \$12 per unit, in proportion to the sales volume in units. The intersection of the total expense line and the total revenue line is the break-even point. The sales volume required to break even (11 250 units) is on the horizontal axis directly below this point, and total sales revenue required to break even (\$135 000) can be read on the vertical axis opposite the intersection.

The amount of profit or loss can be read as the dollar amount of the vertical distance between the total revenue line and total expense line, for the sales volume actually achieved.

**EXHIBIT 12-6 / Break-even graph**



**EXHIBIT 12-7** / Break-even graph featuring contribution margin



Sometimes the area between the two lines is marked as ‘profit area’ or ‘loss area’. Note that the loss area begins with an amount equal to total fixed expenses of \$45 000 (at a sales volume of zero units). As unit sales increase, the loss decreases by the contribution margin per unit of \$4, until the break-even point is achieved—then the profit increases by the contribution margin per unit.

Exhibit 12-7 is another version of the break-even graph. The variable expense line begins at the origin, with fixed expenses added to total variable expenses. Although expenses are rearranged compared with Exhibit 12-6, the total expense line stays the same, and the break-even point and the profit and loss areas are the same. This version permits identification of contribution margin and shows how contribution margin grows as volume increases.

The key to the break-even point calculation (and graphic presentation) is that fixed expenses remain fixed in total, regardless of the level of activity, subject to the relevant range assumption. In addition to that assumption, the linearity and constant **sales mix** assumptions must also be considered. In spite of these simplifications, the contribution margin model and cost behaviour pattern concepts are among the most important management accounting ideas to understand and to be able to apply. The manager encounters many situations in which cost–volume–profit analysis supports decisions that contribute to the achievement of the organisation’s objectives. One of these applications is described in ‘Business in Practice—The 10-cent sale’.

**what** does it mean?

9. What does it mean to break even?

## BUSINESS IN PRACTICE

### The 10-cent sale

The manager of a fast-food and ice-cream business who holds a 10-cent sale in July shows an understanding of cost–volume–profit relationships. Ice-cream sundaes are featured—two for the price of one, plus 10 cents. None of the other menu items are on sale.

The sundaes usually sell for a price of \$1.25 to \$1.75, but even with generous estimates it is hard to come up with variable costs (ice-cream, topping, cup and spoon) much greater than 30 per cent of the usual selling price. So, even when the price is effectively cut in half, there is still a positive contribution margin. And what happens to the store's fixed costs during the sale? They are probably not affected at all.

The fixed costs (including employees' wages) will be incurred whether or not extra customers come in for the sundae special. And, of course, many of those customers will probably buy other items at the regular price.

The net result of the special promotion is that the store builds traffic and business at a time of otherwise low activity (assuming that normal demand for sundaes is low in July). All of the additional sales volume generates a positive contribution margin, fixed expenses are the same as they would have been without the promotion, and profit is increased over what it would otherwise have been.

### Operating leverage

When an entity's sales revenues change because the volume of activity changes, variable expenses and contribution margin will change proportionately. But the presence of fixed expenses, which do not change as the volume of activity changes, means that profit will change proportionately more than the change in sales revenue. This magnification of the effect on profit of a change in sales revenue is called **operating leverage**. It was illustrated in the discussion of the contribution margin format income statement earlier in the chapter (pages 382–83). In the example, there was a 20 per cent decline in volume, with sales revenue, variable expenses and contribution margin also declining by 20 per cent, but profit declined 80 per cent (from \$10 000 to \$2000). Note the similarity of operating leverage and financial leverage, explained in Chapter 11, in which fixed interest expense causes a proportionately greater change in ROE than the percentage change in ROA resulting from any given change in profit.

Just as high financial leverage increases the risk that a firm may not be able to meet its required interest payments, high operating leverage increases the risk that a small percentage decline in sales revenue will cause a relatively large percentage decline in profit. *The higher a firm's contribution margin ratio, the greater its operating leverage.* Management can influence the operating leverage of a firm by its decisions about incurring variable versus fixed costs. For example, if a firm substitutes automated production equipment for employees, it has changed a variable cost (assuming that the employees could be laid off if demand for the firm's products declined) to a fixed cost (the machine will depreciate, be insured and be included in the insurance premiums, whether or not it is being used), and it has increased its contribution margin ratio and operating leverage. If the management of a firm anticipates a decline in demand for the firm's products or services, it may be reluctant to change the firm's cost structure by shifting variable costs to fixed costs, even though productivity increases could be attained, because the equipment has to be operating to realise the benefits of productivity gains.

The effect of different cost structures on operating leverage is illustrated in Exhibit 12-8 (page 391). Observe that, with the alternative cost structures and a volume of 10 000 units, Company A and Company B achieved an identical amount of profit of \$100 000. This exhibit illustrates an important element of the decision-making process, involving the trade-off between fixed cost (capital-intensive) and variable cost (labour-intensive) alternatives, referred

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learning objective

Explain the concept of operating leverage.

to as the **indifference point**. The indifference point is found by setting the same cost structure (total cost) for each alternative (Company A and Company B in this example) and solving for the volume of activity that equates total cost. For example:

Company A	=	Company B
Fixed costs + (Variable cost per unit × Vol.)		Fixed costs + (Variable cost per unit × Vol.)
\$50 000 + (\$35 × Volume)		\$200 000 + (\$20 × Volume)
\$15 × Volume		= \$150 000
Volume		= 10 000 units

Parts 2 and 3 of Exhibit 12-8 illustrate that, as a change in volume moves each company away from the indifference point, the effect on profit is more dramatic, with Company B's higher proportion of fixed cost to variable cost relative to Company A. The relatively higher operating leverage provides for a faster accumulation of profit for increases in volume, but also indicates that profit will decrease faster when volume decreases. Microsoft's performance during the 1990s is a good example of the effect that operating leverage can have on an organisation's profit. During this period of time, Microsoft's profits grew by an average annual rate of 47 per cent, which was much faster than the 38 per cent average annual rate of growth in sales. Another example is described in 'Business in Practice—Cost structures of emerging technologies'. The effect of operating leverage on profit is a key information component in the selection of a cost structure.

**what** does it mean?

10. What does it mean to state that a firm has a relatively high degree of operating leverage?

## BUSINESS IN PRACTICE

### Bookkeeping language in everyday English

CCH Incorporated in its current form was founded in 1913 and is well respected among accountants and lawyers as a leading provider of tax and business law information. The company produces approximately 700 publications in print and electronic form for accounting, legal, human resources, banking, securities, insurance, government and health care professionals. At its website, <[www.cch.com](http://www.cch.com)>, CCH provides access to an online Business Owners' Toolkit,

<[www.toolkit.cch.com](http://www.toolkit.cch.com)>, that includes ready-to-use tools such as model business documents, financial spreadsheet templates, and checklists. Go to <[www.toolkit.cch.com/text/PO6\\_7000.asp](http://www.toolkit.cch.com/text/PO6_7000.asp)> for a discussion of cost–volume–profit analysis, including examples of fixed and variable costs, break-even analysis, contribution margin analysis and operating leverage.

@

**THE  
INSIDER'S  
VIEW**

### How I came to a career using accounting?

After completing my Bachelor of Business, majoring in Marketing at the University of Technology, Sydney, in 1992, I travelled overseas. When I returned, I was employed in January 1994 by Blackmores, a vitamin, minerals, herbs and supplement

company as a sales representative in New South Wales. I didn't use accounting a lot in this role.

In February 1996 I was offered a job as an assistant product manager, and I started to use accounting more—for expense management and also when investigating new

products to determine their viability. This involved having to work with the management accountant, particularly on accruals. Understanding the concept of accruals in a 'real life' situation was an experience! I worked with the financial accountant on new product costings. Both these accountants helped with my accounting development.

In 2000 I moved into the role of project manager for the implementation of a new business system in the company. The main involvement with accounting during this role was managing the financials for the project.

In 2002, at the completion of the project, I moved into the role of Business Manager—International. This role involved new product viability (as per my assistant product manager role) but I am also involved in managing the P&L for the international business. As a public company, Blackmores is responsible to its shareholders. Each year,

Blackmores undergoes a budget process to determine the financials for the year. Every month a report is submitted to the board, which includes all the financials for the company. Each market submits its monthly profit and loss statement, as well as its forecast for the balance of the year. Each month, sales, GP, expenses and EBIT are measured against budget and forecast. I am responsible for managing this process on a monthly basis and reporting variance analysis to my managers.

In the end, any product that Blackmores sells needs to make a certain profit otherwise it is unviable. Every activity that we undertake from a sales and marketing perspective or people management needs to be justified within the context of a profit and loss statement.

**Michele Fitzgibbon**  
Blackmores Ltd

## EXHIBIT 12–8 / Operating leverage

Assume that two companies make similar products, but that the companies have adopted different cost structures. Company A's product is made in a labour-intensive operation with relatively high variable costs but relatively low fixed costs, and Company B's product is made in a capital-intensive operation with relatively low variable costs but relatively high fixed costs. Each firm presently sells 10 000 units of product. Cost structures are given below.

	Company A— Lower operating leverage		Company B— Higher operating leverage	
	Per unit		Per unit	
	\$		\$	
Revenue	50	10 000 units sold	50	10 000 units sold
Variable expenses	35		20	
Contribution margin	<u>15</u>	30%	<u>30</u>	60%
Fixed expenses	<u>50 000</u>		<u>200 000</u>	

### 1. Profit

$$P = Sx - VCx - FC$$

$$P = 10\,000(50 - 35) - 50\,000$$

$$P = \$100\,000$$

or simplified

$$P = x(S - VC) - FC$$

$$P = 10\,000(50 - 20) - 200\,000$$

$$P = \$100\,000$$

### 2. Effect on profit of a 10% increase in volume from 10 000 to 11 000 units

$$P = 11\,000(50 - 35) - 50\,000$$

$$P = \$115\,000$$

P increased by 15%

OR 1000 additional units ×  
contribution margin (\$50 – \$35)  
= \$15 000

15% increase on \$100 000 profit

$$P = 11\,000(50 - 20) - 200\,000$$

$$P = \$130\,000$$

P increased by 30%

1000 additional units ×  
contribution margin (\$50 – \$20)  
= \$30 000

30% increase on \$100 000 profit

## EXHIBIT 12-8 / Operating leverage *continued*

Since the contribution margin ratio was twice as large in the second business, the effect of changes in volume (scale) is twice as large.

This is the case for growth in sales as well as for losses in market.

### 3. Assume that volume dropped 20% from current levels of 10 000 units

Profit for both businesses could be determined according to the formula:

$$P = x(S - VC) - FC$$

$$P = 8000(50 - 35) - 50\,000$$

$$P = \$70\,000$$

P has decreased by 30%

OR Loss of 2000 units  $\times$   $(\$50 - \$35)$

$$\text{Loss} = \$30\,000$$

30% decrease on profit of \$100 000

$$P = x(S - VC) - FC$$

$$P = 8000(50 - 20) - 200\,000$$

$$P = \$40\,000$$

P has decreased by 60%

Loss of 2000 units  $\times$   $(\$50 - \$20)$

$$\text{Loss} = \$60\,000$$

60% decrease on profit on \$100 000

## BUSINESS IN PRACTICE

### Cost structures of emerging technologies

The demise of many Internet-based dot-com companies by late in the year 2000 was a technological phenomenon that history has seen repeated several times. Over a century ago, the railroads provided an early lesson, as reported by Hal Varian:

In the 1880s there were more kilometres of railroad track laid than in any other decade in American history. By the 1890s there were more companies in bankruptcy than in any other decade.

Why do we always seem to over-invest in new technologies? In the case of railroads, the major economic force at work was economies of scale. The primary costs associated with a railroad are the fixed costs—the cost of servicing the debt incurred in laying the track and buying the rolling stock. In the late 1880s, about two-thirds of the total costs of operating a railroad were fixed.

When fixed costs are high, large companies have an inherent advantage, since (as volume increases) they have a lower total cost per shipment. The railroads recognised this and invested heavily in building capacity. But once the capacity was installed, there was inevitable cutthroat competition for freight. There was no way around the fact that there was just too much rail stock relative to demand. Companies went bankrupt, wiping out their obligation to make

debt payments, leading to even more aggressive pricing. The industry sank into a slump from which it took decades to recover. (What can be learned from this episode?) The railroad boom and bust arose because there were large fixed costs and a commodity product—freight transportation. Since there were many providers, price wars were all too likely. The cost structure of this industry bears a remarkable resemblance to long-haul fibre optics. The big fixed cost comes from laying the fibre, with (variable) operating expenses being relatively small. This is a recipe for price wars, and indeed the cost of long-distance telephony—especially in negotiated contracts for large business—has been plummeting.

Many of the dot-com start-ups have invested heavily in building a technology infrastructure to support their business-to-consumer activities. The resulting cost structures provide a high degree of operating leverage and the opportunity for a very big pay-off once the sales revenue from their venture produces enough contribution margin to exceed fixed costs. Of course generating enough revenue proved to be a major challenge for many dot-com start-ups. The large number of business failures illustrates the high risk of high operating leverage.

Source: <[www.nytimes.com](http://www.nytimes.com)>, 'Economic Scene: Technology Rise and Fall Is as American as the Model T', 14 December 2000, by Hal R. Varian. Copyright 2000, by the *New York Times* Co. Reprinted by permission.

# Cost classifications for other analytical purposes

Exhibit 12-1 (page 372) highlights the final branch of the cost classification model and presents the cost terminology and concepts used in the decision-making process.

**Differential costs** are brought into focus when possible future activities are analysed. A differential cost is one that will differ according to the alternative activity that is selected. For example, if a modification of an existing product is being considered, only the changes in cost resulting from the modification need to be considered, relative to the additional sales revenue expected to result from the modification. Those costs that will continue to be incurred whether or not the modification is made are not relevant to the decision.

**Allocated costs** are those that have been assigned to a product or activity (a 'cost centre') using some sort of arithmetic process. For example, overhead costs are allocated to production runs using the overhead application rate, the derivation of which will be further described in Chapter 13. At this point, a reminder about cost allocations is appropriate. Many cost allocation methods are arbitrary and do not result in assigning costs in a way that reflects the reasons the costs were incurred. Therefore, managers must be very careful about the conclusions drawn from an analysis that includes allocated costs. A general rule, similar to that prescribing the unitisation of fixed costs, is useful to learn: *Do not arbitrarily allocate costs to a cost centre because the allocated costs may not behave the way assumed in the allocation method.*

A **sunk cost** is a cost that has been incurred and cannot be 'un-incurred', or reversed, by some future action. For example, if a firm has acquired a special purpose asset that would not be useful to any other organisation, the cost of the asset represents a sunk cost. If the asset is put in use, its cost will be shown as depreciation expense over its life; if scrapped, its net book value will be recorded as a loss. Either way, the cost of the asset will be reflected in the income statement. When a new car is driven out of the dealer's yard, a sunk cost has been incurred that is equal to the loss in value, because the car is now 'used'. *Sunk costs are never relevant to the analysis of alternative future actions (i.e. they are never differential costs) because they have been incurred and will not change.*

**Opportunity cost** is an economic concept that is too frequently overlooked in accounting analyses. Opportunity cost is the income forgone because an asset was not invested at a rate of return that could have been earned. For example, assume that you keep a \$200 minimum balance in a non-interest-bearing cheque account. If your next best alternative is to invest the \$200 in a 6 per cent savings account, the opportunity cost of your decision is \$12 per year ( $6\% \times \$200$ ) before tax. Because opportunity cost relates to a transaction that did not occur, no record of it is made in the financial accounting process, and so it is easily overlooked. Awareness of opportunity cost raises this question: What other alternatives are there for earning a return on a particular asset?



11

## learning objective

Discuss the meaning and application of the following cost terms: *differential, allocated, sunk and opportunity.*

11. What does it mean to state that a cost is a sunk cost?

what does it mean?

# Short-run decision analysis

## Relevant costs

While carrying out their daily management responsibilities, managers are faced with decisions that may affect only the next few days, weeks or months. These short-run decisions could involve the use of resources not otherwise active, or the opportunity to reduce costs by outsourcing the production of certain components that will be used in production. Or a manager might have the ability to improve profits by choosing to sell a product at a certain point in the production process or by choosing to refine the product further and in doing so attract a higher selling price. **Relevant costs** are those future costs that represent differences between these decision



12

## learning objective

Describe how costs are determined to be relevant for short-run decisions.

alternatives and they are the key to effective decision-making. Past transaction costs, while appropriately recorded in the accounting system as a result of the financial accounting process, represent costs that are never relevant and can only overwhelm the manager presented with the challenge of correctly analysing costs in any decision. The concept of relevant costs helps significantly with the manager's constant burden of information overload.

The discussion of the many cost classification concepts presented in Exhibit 12-1 and in Chapters 13 and 14 emphasises the theme of *different costs for different purposes* by describing how costs are viewed from different perspectives for planning and control purposes. Those same costs are analysed as being relevant or irrelevant, depending on the question being addressed by the decision alternatives. Variable or fixed costs may or may not be relevant to a decision; it simply depends on whether they represent a difference between the alternatives. To illustrate, suppose that Air Comfort Ltd produces a heating and cooling system that sells for \$1800 and requires the following production costs:

	\$
Direct materials	600
Direct labour	400
Variable overhead	200
Fixed overhead	300

Next, assume that Air Comfort's design engineers have developed a more efficient air filtration system that would increase the efficiency of the current model. The only changes to the cost structure to produce the more efficient model would be direct materials that would now cost \$850. Air Comfort's marketing manager suggests that the more efficient version of the system could sell for \$2000 in the current marketplace for similar systems. What are the relevant costs to consider in deciding whether to sell the current system as is or to produce the more efficient system?

The relevant costs are those costs in the current system that are different from those of the more efficient system: direct materials in the amount of \$250 (\$850 new material cost – \$600 current material cost). Note that the analysis requires the decision-maker to think independently about each cost item presented; one cannot rely on the general cost classifications presented earlier for planning and control purposes. Costs in this example can be classified as direct (materials and labour) and indirect (overhead), or costs can be classified as variable (materials, labour and variable overhead) and fixed (fixed overhead). However, a cost will not necessarily be relevant or irrelevant in a decision simply because it is direct rather than indirect, or variable rather than fixed. Costs for decision-making purposes presented in this chapter are viewed as a *way of thinking* about their relevance to any decision by asking the fundamental question 'Does it make a difference?'

Should Air Comfort sell the system as it is or produce the more efficient system? The relevant cost of producing the more efficient system has been identified as \$250, but before making the final decision the \$250 must be compared with the difference in selling price that would be available from the more efficient system. The relevant cost analysis below indicates that it would not be wise to produce and sell the more efficient system, given the current marketplace.

	\$
Difference in selling price (\$2000 – \$1800)	200
Difference in materials cost (\$850 – \$600)	250
Difference in profit	(50)

In the Air Comfort example, the direct material cost is a differential cost and the selling price of the more efficient model is an opportunity cost—both items are considered relevant. The fixed overhead in the product cost is an allocated cost and the design engineering cost is a sunk cost—both costs are considered irrelevant. These cost classification concepts presented earlier in the chapter are used in decision analysis:

Relevant	Irrelevant
Differential cost—will differ according to alternative activities being considered.	Allocated cost—a common cost that has been arbitrarily assigned to a product or activity.
Opportunity cost—income forgone by choosing one alternative over another.	Sunk cost—has already been incurred and will not change.

## Relevant costs in action—the special pricing decision

While many examples illustrate relevant cost analysis for short-run decision-making, the special pricing decision offers several compelling issues. The product or service pricing decision, in general, is a long-run decision. In the long run, the product or service price must be adequate to recover all costs identified in the organisation’s value chain (R&D, design, production, marketing, distribution and customer service), as well as provide for the necessary ROA. In many situations, the marketplace and those firms competing in the marketplace determine the product or service price. If an organisation wants to compete, the key issue is whether the firm can strategically manage costs within the value chain over the life of the product or service to produce the desired ROA. This cost management concept is referred to as **target costing**. The target cost is the maximum cost that can be incurred, which—when added to the desired amount of ROA—results in an amount equal to the marketplace selling price.

On certain occasions the firm may be presented with a special offer for its product or service at a price below the normal selling price. In addition to an analysis of relevant costs, the special pricing decision requires an understanding of where the firm is operating relative to its capacity. Assume that MicroTech Ltd (MTL) produces a laptop computer that normally sells in the marketplace for \$2400. Also assume that World University (WU) wants to provide each of its business students with a laptop computer so they can participate in online courses with faculty and other students from all over the world. WU estimates that in July it will need to acquire 500 laptops for its business students and therefore makes an offer to MTL for 500 laptops at a price of \$1800 each.

MTL has the capacity to produce 5000 laptop computers each month and uses this capacity as the denominator activity for computing predetermined fixed overhead rates. For the month of July, the operating budget calls for the sale and production of 4400 laptops. In addition to a standard sales commission of 5 per cent paid on the sale of each laptop, which would not be paid on the WU special order, standard manufacturing costs are as follows:

	\$
Manufacturing costs:	
Direct materials	800
Direct labour	450
Variable overhead	250
Fixed overhead	<u>500</u>
Total unit cost	<u>2000</u>

### 13 learning objective

Determine a special pricing decision when a firm is operating at full, rather than idle, capacity.

At first glance, it appears that MTL should reject an offer of \$1800 when the cost of each laptop is \$2120 [\$2000 manufacturing cost plus \$120 commission ( $\$2400 \times 5\%$ )]. But what are the relevant costs for MTL in the decision to accept or reject this special pricing offer? Exhibit 12-10 presents a relevant cost analysis for this special pricing decision. Notice in the first section that in the month of July MTL has **idle capacity** of 600 units (5000 units total capacity less 4400 units in the current production budget). This unscheduled capacity allows MTL to consider adding 500 units of production without adding production capacity. Note that the analysis is presented in the contribution format that highlights cost behaviour as activity changes. The current selling price of \$2400 generates \$780 of contribution margin per unit towards covering total fixed costs of \$2 500 000 and providing a profit.

An examination of the relevant costs for the special order of 500 laptops at a price of \$1800 each reveals that the variable cost items of direct material, direct labour and variable overhead are relevant costs because they represent the additional productive resources necessary to produce 500 additional laptop computers. Variable sales commission, however, is not relevant to the special order, because commissions will not be paid on the 500 laptops. Variable costs that can be avoided in the special pricing decision are never relevant costs. The special offer price of \$1800 generates a contribution margin of \$300 per unit and this positive contribution margin flows directly to the bottom line as \$150 000 additional profit, because no additional fixed costs were incurred, given the idle capacity. Fixed overhead, assigned for accounting purposes at the predetermined overhead rate of \$500 per unit, is not relevant to the special pricing offer but is often incorrectly included in an analysis that does not focus on relevant costs. It should be apparent from Exhibit 12-10 that any price offered above the relevant variable costs of \$1500 will generate a positive contribution margin and should be accepted, as long as no other more profitable opportunity for the 600 units of idle capacity can be identified. MicroTech, by accepting the offer of \$1800 per laptop from World University, improved profit by 16 per cent for the month of July.

How would the analysis of relevant costs change if the firm were operating at **full capacity**? The second and third sections of Exhibit 12-10 assume that MTL is currently producing and selling at full capacity of 5000 laptops in July. Illustrating the option of rejecting the special offer, the second section determines the maximum profit that MTL can expect to earn with a selling price of \$2400 per laptop. When operating at full capacity, there is no reasonable explanation for considering any price less than the normal selling price, unless an opportunity is provided to avoid more cost than the related decrease in revenue. Any combination of price minus variable cost that produces less than \$780 of contribution margin will lower total profit.

The third section of Exhibit 12-10 illustrates the effect on profit of accepting the special offer when operating at full capacity. Note that the profit has decreased by \$240 000 ( $\$1\,400\,000 - \$1\,160\,000$ ) as a result of generating \$480 ( $\$780 - \$300$ ) less contribution margin on the 500 special offer laptops ( $\$480 \times 500 = \$240\,000$ ) than was earned on the full capacity sales. The difference in contribution margin of \$480 per laptop is a relevant opportunity cost—the profit forgone by choosing to accept, rather than reject, the special offer. As discussed earlier, contribution margin analysis is a powerful tool for managers to use to determine the effects on profits of decisions involving changes in selling prices, variable or fixed costs, or the volume of operating activity.

To summarise, MTL has an opportunity to maximise profit, regardless of whether it is operating at full or idle capacity, and the decision to accept or reject the special offer from WU hinges on the proper interpretation of relevant costs. By properly accepting the \$1800 offer while experiencing conditions of idle capacity, MTL will improve its bottom line by 16 per cent and put inactive resources to work. On the other hand, by properly rejecting the \$1800 offer when operating at full capacity, MTL will avoid an unnecessary 17 per cent decline in profits.

**EXHIBIT 12–10 /** Relevant cost analysis for special pricing decisions

**Idle capacity = 600 laptops, special offer accepted**

	Current sales 4400 laptops		Special offer 500 laptops		July total 4900 laptops
	Unit	Total	Unit	Total	Total
	\$	\$	\$	\$	\$
Sales	2 400	10 560 000	1 800	900 000	11 460 000
Less: Variable costs:					
Direct material	800	3 520 000	800	400 000	3 920 000
Direct labour	450	1 980 000	450	225 000	2 205 000
Variable overhead	250	1 100 000	250	125 000	1 225 000
Sales commission	120	528 000	—	—	528 000
Contribution margin	<u>780</u>	<u>3 432 000</u>	<u>300</u>	150 000	<u>3 582 000</u>
Less: Fixed costs*		<u>2 500 000</u>		—	<u>2 500 000</u>
Profit		<u>932 000</u>		<u>150 000</u>	<u>1 082 000</u>



**Per cent change in profit**

+ 16 %

**Full capacity, special offer rejected**

	Current sales 5000 laptops		500 laptops	July total
	Unit	Total		Total
	\$	\$		\$
Sales	2 400	12 000 000		12 000 000
Less: Variable costs:				
Direct material	800	4 000 000		4 000 000
Direct labour	450	2 250 000		2 250 000
Variable overhead	250	1 250 000		1 250 000
Sales commission	120	600 000		600 000
Contribution margin	\$780	<u>\$3 900 000</u>		<u>\$3 900 000</u>
Less: Fixed costs*		2 500 000		2 500 000
Profit		\$1 400 000		\$1 400 000

**Full capacity, special offer accepted**

	Current sales 4500 laptops		Special offer 500 laptops		July total 5000 laptops
	Unit	Total	Unit	Total	Total
	\$	\$	\$	\$	\$
Sales	2 400	10 800 000	1 800	900 000	11 700 000
Less: Variable costs:					
Direct material	800	3 600 000	800	400 000	4 000 000
Direct labour	450	2 025 000	450	225 000	2 250 000
Variable overhead	250	1 125 000	250	125 000	1 250 000
Sales commission	120	540 000	—	—	540 000
Contribution margin	<u>780</u>	<u>3 510 000</u>	<u>300</u>	150 000	<u>3 660 000</u>
Less: Fixed costs*		<u>2 500 000</u>		—	<u>2 500 000</u>
Profit		<u>1 010 000</u>		<u>150 000</u>	<u>1 160 000</u>
Per cent change in profit					<u>– 17%</u>

\* Total fixed costs for month (5000 units × \$500).

Relevant cost analysis provides a quantitative framework for the special pricing decision. However, every quantitatively indicated decision should also be passed against a qualitative framework that could result in not carrying out the decision outcome. For example, the special order may not be accepted when operating with idle capacity, even though the special price more than covers incremental costs, because regular customers might learn of the special price and demand it for their 'regular' business. Another example could be related to an unanticipated increased volume in the near future; sales at a special price less than the regular price would absorb capacity that could be used for new regular sales. Finally, management must be certain that the special price does not violate the *Trade Practices Act*. 'Business on the Internet' (below) outlines how to find out more about this ingredient of business life.

## BUSINESS ON THE INTERNET

The Australian Competition and Consumer Commission enforces a variety of consumer protection laws. The commission seeks to ensure that the nation's markets function competitively and are vigorous, efficient and free of undue restrictions.

Use the search engine at <[www.accc.gov.au](http://www.accc.gov.au)> to locate specific information about 'country of origin' and answer these questions:

- When can I claim that my product is 'made in Australia'?
- What if some of my product (components or ingredients) is imported?
- What if some of my product (components or ingredients) is imported, but only sometimes?

@

### what does it mean?

12. What does it mean to only consider relevant costs when faced with a short-term operational decision?

### Relevant costs in action—the make or buy decision

Another decision-making situation that illustrates the use of relevant costs is the make or buy decision. For example, how does a manager evaluate the alternatives of producing a component part of a product internally versus buying that component from an outside source? Any number of reasons could exist that might create an advantage for buying from outside the company. This question of **outsourcing** is prevalent in organisations looking to add value to the products and services they provide. The goal is to reduce costs while simultaneously improving the quality and/or functionality of the product or service. Producing a component part internally may be more costly if other organisations specialise in producing that component and consider it within their core competencies. As such, these outside sources may provide an advantage in terms of newer, more specialised equipment and technologies or certain skilled labour. Alternatively, being presented with a more profitable use of the capacity needed to produce a component part internally might make it desirable to outsource that part's production. Organisational services such as payroll, tax return preparation, information technology or the operation of the employee canteen could also be candidates for the outsourcing decision.

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#### learning objective

Analyse relevant costs in the make or buy decision.

What are the relevant costs in a make or buy decision? Suppose that MicroTech Ltd currently produces the motherboards used in the laptop computers that were described in the special pricing decision. As such, MTL incurs the following production costs:

	\$
Manufacturing costs:	
Direct material	120
Direct labour	80
Variable overhead	50
Fixed overhead	<u>100</u>
Total unit cost	<u>350</u>

The laptop product manager has determined that a motherboard of comparable quality is now available and could be acquired from Integrated Technologies Ltd at a purchase cost of \$300 plus a \$5 delivery charge per motherboard. At first glance this appears to be a simple decision but, until the analysis of relevant costs is performed, the risk of an incorrect decision is considerable.

In a make or buy decision the relevant cost of making a component or providing a service internally is the cost that can be avoided by acquiring the resource or service from a source outside the company. Therefore, avoidable costs are the relevant costs for this decision. In evaluating each item of cost, the important question to ask is ‘Will this cost continue if the resource is purchased from the outside?’ If the cost will continue, regardless of whether the resource is made internally or purchased from outside, it is not relevant to the decision. Using the MTL information to illustrate this concept, assume that 20 per cent of the fixed overhead amount that has been allocated to each unit represents the cost (in terms of salary) of the motherboard production manager, who would not be retained if the motherboards were not produced by MTL. Also assume that there is no other use for the production resources being used to produce the motherboards. An analysis of avoidable costs for this decision is:

	Avoidable cost to make	Cost to buy
		\$
Purchase costs:		
Motherboard cost		300
Shipping cost		<u>5</u>
Manufacturing costs:		<u>305</u>
Direct material	120	
Direct labour	80	
Variable overhead	50	
Fixed overhead (\$100 × 20%)	<u>20</u>	<u>20</u>
Total unit cost	<u>270</u>	<u>325</u>
Advantage to make	<u>35</u>	

It should be clear that the variable production costs will not be necessary if the motherboards are purchased, but notice that only 20 per cent of the fixed overhead is included in the relevant cost analysis, because the remainder of these fixed costs are sunk,

unavoidable and provide no alternative use. How would the analysis change if there were alternative uses for the capacity resources being used to produce the motherboards? Suppose that MTL could apply the resource capacity being used to produce the motherboards to expand production of flat-screen monitors, which provide a contribution margin of \$50 per unit. In this scenario, an opportunity cost has been introduced into the picture and it must be remembered that opportunity costs are always relevant for decision-making. A revised relevant cost analysis is:

	Avoidable cost to make	Cost to buy
		\$
Purchase costs:		
Motherboard cost		300
Shipping cost		5
Manufacturing costs:		
Direct material	120	
Direct labour	80	
Variable overhead	50	
Fixed overhead (\$100 × 20%)	<u>20</u>	
Total unit cost	270	
Opportunity cost of not using available capacity to produce monitors	<u>50</u>	
Total relevant costs	<u>320</u>	<u>305</u>
Advantage to make		<u>15</u>

A final decision to outsource a product component or other service should not be made merely on the basis of the quantitative analysis, without considering important qualitative factors. Important dependencies will exist with suppliers, and the need to manage the supplier relationship is always important. Concerns about the quality of parts or services received should be addressed, and testing and measurement systems should be defined, to ensure the necessary quality. Delivery times and having products or services when they are needed could also be at risk. On the other hand, it is possible that even higher quality and service could be achieved through outsourcing, because of the unique expertise or technology that the outside resource or service provider can bring to the organisation.

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**learning objective**

Determine a product-mix decision when confronted with scarce resources.

## Short-term allocation of scarce resources

As a final example of how relevant costs are used in decision-making, consider how production resources might be allocated to a mix of products when product demand exceeds the currently available production capacity. In the short-term, capacity constraints may force a decision about which product(s) should be produced next. The objective is to maximise contribution margin, given the demand and capacity constraints. To illustrate, assume that Integrated Technologies Ltd (ITL) produces the following items, which use the same circuitry production line. Demand is such that ITL can produce and sell as much of either product as it can process through the circuitry production line. Selling prices, variable costs and contribution margins per unit are presented below: +

	Motherboards	Video circuit boards
	\$	\$
Selling price	300	200
Variable costs	<u>150</u>	<u>100</u>
Contribution margin per unit	<u>150</u>	<u>100</u>

It would appear that the motherboards are the more profitable product and should be a production priority. However, when capacity constraints (or any limiting factor) exist, it is important to view the contribution margin of each product in terms of the capacity constraint (or other limiting factor). Assume that one hour is required to produce a video circuit board and two hours are required to produce a motherboard on the circuitry production line, which has only 120 hours available each week. Does this information about the production time requirements of each product relative to the constrained resource change your view of profitability? Expressing the contribution margin of each product in terms of circuitry production line hours would generate the following results:

	Motherboards	Video circuit boards
	\$	\$
Selling price	300	200
Variable costs	<u>150</u>	<u>100</u>
Contribution margin per unit	<u>150</u>	<u>100</u>
Circuitry line hours required	<u>2</u>	<u>1</u>
Contribution margin per hour	<u>75</u>	<u>100</u>

The contribution margin per hour of the scarce resource indicates that profit will be maximised with the production of video circuit boards. If all 120 available hours were used to produce video circuit boards, the contribution margin generated would be \$12 000 (\$100 × 120 hours). Only to the extent that any hours were unused for video circuit boards should any motherboards be produced.

Other limiting factors or resource restraints could include available skilled labour or raw materials.

## THE INSIDER'S VIEW

### Non-quantitative decisions

Any one who says that money is not important has plenty! For many years I had no money and I was constantly stressed about paying the bills. Knowing the numbers and what they mean is important to help reduce general stress!

I didn't start the business to make money. I was desperately unhappy in my job and had to get involved in doing something I loved. For quite a while I was watching

every cent I made, but it didn't matter as I was doing something that I loved!

Richard Branson has had a huge influence on me. In his book *Losing my Virginity*, he writes: 'I can honestly say that I have never gone into any business purely to make money. If that is the sole motive then I believe you are better off not doing it. A business has to be involving; it has to be fun, and it has to exercise your creative instincts.'

## THE INSIDER'S VIEW

### Non-quantitative decisions *continued*

I own the Step into Life Group Outdoor Personal Training franchise in Cheltenham. I started the operation in October 2004. Since then I have grown to be one of the biggest in Australia with over 100 loyal clients. In 2005 I won Franchise of the Year.

After many years of working in the corporate world I have found where I really belong. The interaction of members is awesome. There is lots of laughter at my sessions; they work hard and get amazing results. I am grateful every day for having a job that I love and am happy to do—even at 5 am!

**Donna Douglas**  
Step into Life

My goals are now more personal than career-oriented, because I have exceeded the financial or career goals I set myself. Now my main goal is to try to get more balance into my life and have other people do some of the things that I do. I would like more time to look after my family and myself. My family have invested a lot of time in me and I have to give that back now.

**Chris Shellabear**  
Shellabear Real Estate

## SO WHAT DO YOU THINK?

The Lansdowne Delivery Company provides a furniture delivery service for a number of major retail outlets across the Sydney metropolitan area. The company currently has a fleet of 15 trucks, and up to 900 hours per week are spent making deliveries to customers. The company has assessed that it incurs the following costs per delivery hour:

Direct labour	\$30
Variable overhead	\$18
Fixed overhead	\$45

The company charges customers \$50 per delivery and makes three deliveries per hour on average.

A new retail outlet has recently approached the company and asked if the company could make deliveries to its customers. As the new retail outlet sells large items of furniture, it is expected that each delivery would consume more time, and that, on average, only two deliveries would be able to be made per hour. It is expected that the extra deliveries would consume about 100 hours of delivery time per week.

As an incentive to accept the offer, the retail outlet has indicated that it would provide Lansdowne with an extra \$4000 each week, in addition to the amount it charges customers.

The company's CEO, Mike Brady, is seriously considering accepting this offer, but he is concerned that Lansdowne will not have the capacity to make the extra deliveries. While the company has been spending only approximately 700 hours per week making deliveries recently, the market is currently in a dry patch, and Lansdowne normally spends the whole 900 hours available making deliveries.

Mike is extremely keen to provide deliveries for the new outlet and has investigated the possibility of outsourcing deliveries to some private contractors. Two separate contractors have indicated that they would provide the deliveries at a cost of \$75 and \$80 per hour respectively. Mike approaches you in your role as the financial controller of Lansdowne and says: 'We should definitely take on the deliveries for this additional retail outlet as we will get an additional \$4000 for making the deliveries. We should also look into outsourcing more deliveries, as the two private contractors can provide deliveries cheaper than we can. They can provide deliveries for \$75 and \$80 per hour, whereas we incur costs of \$93 per hour.'

1. How would you reply to Mike's comment?
2. Assess the relevant costs and sales revenue involved with providing the extra deliveries under each of the following scenarios:
  - (a) Lansdowne is spending 700 hours per week making deliveries and does not outsource any deliveries.
  - (b) Lansdowne is spending 700 hours per week making deliveries and outsources deliveries to private contractors.
  - (c) Lansdowne is spending 900 hours per week making deliveries and does not outsource any deliveries.
  - (d) Lansdowne is spending 900 hours per week making deliveries and outsources deliveries to private contractors.
3. Should Lansdowne outsource its deliveries?

*Turn to Appendix 3, page t/c, to check your answers with our views.*

**RECAP** Management is the process of planning, organising and controlling an organisation's activities to accomplish its goals. Management accounting supports the management process.

Management accounting differs from financial accounting in several ways. Management accounting has an internal orientation, a future perspective, and often focuses on individual units within the firm rather than on the organisation as a whole. Reasonably accurate data are acceptable for internal analysis, and performance reports tend to be issued on a more frequent basis for management control and decision-making.

There are different costs for different purposes. Cost terminology is important to understand if cost data are to be used appropriately.

The behaviour pattern of a cost relates to the change in total cost for a change in activity. Variable costs change, in total, as activity changes. Fixed costs remain constant in total as activity changes. Assumptions about linearity and relevant range are implicit when a cost is described as variable or fixed. Many costs have a mixed behaviour pattern (i.e. they are partly variable and partly fixed). A cost formula expresses the total amount of a cost for a given level of activity by combining the fixed and variable elements of the total cost. It is inappropriate, and may be misleading, to express a fixed cost on a per-unit basis because, by definition, a fixed cost is constant over a range of activity.

Cost–volume–profit (CVP) analysis uses knowledge about cost behaviour patterns to interpret and forecast changes in profit resulting from changes in revenue, cost or the volume of activity.

When a particular cost is partly fixed and partly variable, the high–low method can be used to develop a cost formula that recognises both the variable and the fixed elements of the cost.

The contribution margin format income statement reclassifies the functional cost categories of the traditional income statement to cost behaviour pattern categories. Contribution margin is the difference between sales revenue and variable expenses. Unless there are changes in the composition of variable expenses, contribution margin changes in proportion to the change in sales revenue.

The profit formula ( $Sx = VCx + FC + P$ ) provides a framework for analysing the effect of revenue, cost and volume changes on profit. A key to using this model is that fixed costs are recognised only in total; they are not unitised.

The contribution margin ratio can sometimes be used to determine the effect of a volume change on profit more quickly and more easily than using unit revenue and variable expense and volume.

The break-even point is the total sales volume (in units or dollars) at which profit is zero. Using the contribution margin model, or the profit formula model, the break-even point is achieved when total contribution margin is equal to fixed expenses or sales revenue equals variable costs plus fixed costs.

Break-even analysis can also be illustrated graphically to provide a visual representation of profit and loss areas and to demonstrate the impact of the contribution margin per unit on profit (or loss).

Operating leverage describes the percentage change in profit for a given percentage change in sales revenue. Since fixed expenses do not change when sales revenue change, profit changes by a greater percentage amount than sales revenue. The higher a firm's fixed expenses relative to its variable expenses, the greater the operating leverage and the greater the risk that a change in the level of activity will cause a relatively larger change in profit than with less leverage. Operating leverage can influence management's decisions about whether to incur variable costs or fixed costs.

When an analysis of costs involved in alternative plans is made, differential costs are those that differ between alternatives. Sometimes cost allocations are made for analytical purposes. If the allocation is made on an arbitrary basis rather than by recognising causal factors, users of the data must be very careful about the conclusions they reach, because cost behaviour has not been accurately reflected. Sunk costs have been incurred and cannot be reversed. Opportunity cost is not reflected in the accounting records but should be recognised when making an economic analysis.

Relevant costs are future costs that represent differences between decision alternatives and represent the key to effective decision-making. Understanding costs for decision-making purposes is viewed as a *way of thinking* in terms of their relevance to any decision by asking the fundamental question 'Does it make a difference?' Differential costs and opportunity costs are always relevant costs; allocated costs and sunk costs are never relevant costs.

The product or service pricing decision, in general, is a long-run decision. In the long run, the product or service price must be adequate to recover all costs identified in the organisation's value chain, as well as to provide for the necessary ROA. However, in the short run, on certain occasions the firm may be presented with a special offer for its product or service at a price below the normal selling price. Any offered price above the relevant variable costs will generate a positive contribution margin and should be accepted, as long as no other more profitable opportunity for idle capacity can be identified, or unless there are overriding qualitative factors that affect the decision. When operating at full capacity, there is no reasonable explanation for considering any price less than the normal selling price unless there is an opportunity to avoid more cost than the related decrease in selling price.

Other decision-making situations illustrate the use of relevant costs. In a make or buy decision, the relevant cost of making a component or providing a service internally is the cost that can be avoided by acquiring the resource or service from outside the company. In the short-term allocation of scarce resources decision, the objective is to maximise contribution margin in terms of the scarce capacity resource.

## KEY TERMS

allocated cost	full capacity
break-even point	idle capacity
contribution margin	indifference point
contribution margin format	management accounting
contribution margin ratio	management process
cost behaviour pattern	operating leverage
cost formula	opportunity cost
cost-volume-profit (CVP) analysis	outsourcing
differential cost	production standard
fixed cost	relevant cost

relevant range  
sales mix  
semi-variable cost

sunk cost  
target costing  
variable cost



Online Learning Centre

Students can visit this comprehensive site for resources directly related to the text.

## SELF-STUDY MATERIAL

### Matching

Following are a number of the key terms and concepts introduced in the chapter, along with a list of corresponding definitions. Match the appropriate letter for the key term or concept to each definition provided. Note that not all key terms and concepts will be used. Solutions are provided in Appendix 3.

- a cost-volume-profit (CVP) analysis
- b cost formula
- c contribution margin
- d contribution margin format income statement
- e linearity assumption
- f contribution margin ratio
- g operating leverage
- h sales mix
- i break-even point
- j high-low technique
- k management accounting
- l management process
- m variable cost
- n fixed cost
- o relevant range
- p mixed (semi-variable) cost
- q cost behaviour pattern
- r differential cost
- s allocated cost
- t sunk cost
- u opportunity cost
- v relevant cost
- w full capacity
- x idle capacity

- \_\_\_ 1. The proportion of total sales represented by various products or categories of products.
- \_\_\_ 2. The difference between revenues and variable costs
- \_\_\_ 3. The concept that operating profit changes proportionately more than revenues for any given change in revenues.

- \_\_\_ 4. The amount of revenue required to have neither operating profit nor operating loss.
- \_\_\_ 5. The percentage of each dollar in revenues that is available to cover fixed expenses; revenue minus variable costs, divided by revenues.
- \_\_\_ 6. An income statement presentation in which variable costs are subtracted from revenues to show contribution margin, from which fixed costs are subtracted to determine operating profit.
- \_\_\_ 7. Analysis of the impact on profit of volume and cost changes using knowledge about the behaviour patterns of the costs involved.
- \_\_\_ 8. An arithmetic expression that reflects the fixed and variable elements of a cost.
- \_\_\_ 9. The range of activity over which the fixed or variable cost behaviour pattern exists.
- \_\_\_ 10. A cost that has both a fixed and a variable element.
- \_\_\_ 11. A cost that does not change in total as the level of activity changes within a relevant range.
- \_\_\_ 12. Planning, organising and controlling the activities of an organisation so it can accomplish its purpose.
- \_\_\_ 13. A cost that has been incurred and that cannot be unincurred or reversed by some future action.
- \_\_\_ 14. An economic concept relating to profit foregone because an alternative to earn profit was not pursued.
- \_\_\_ 15. A cost that has been assigned to a product or activity using some sort of arithmetic process.
- \_\_\_ 16. A cost that will differ based on the selection of an alternative activity.
- \_\_\_ 17. A cost classification used in analysing costs of decision alternatives.

## MULTIPLE-CHOICE

For each of the following questions, circle the best response. Solutions are provided in Appendix 3.

1. Management accounting, as opposed to financial accounting, is primarily concerned with:
  - a the financial condition of the organisation as a whole
  - b meeting the requirements of Australian International Financial Reporting Standards
  - c emphasising the future
  - d providing data for investors and creditors
  - e determining exact results
  
2. Contribution margin can be expressed as:
  - a sales minus variable expenses
  - b sales minus cost of goods sold
  - c sales minus fixed expenses
  - d the level of sales required to cover variable expenses
  - e the level of sales required to cover fixed and variable expenses

3. If the percentage change in operating profit resulting from a given percentage change in sales is higher than the percentage change in sales itself, then:
- an increase in the selling price would not alter the contribution margin per unit
  - variable costs per unit have increased
  - variable costs have decreased in total
  - the company has operating leverage
  - the company has no fixed costs
4. Verbeke Art Studios seeks your help in analysing the cost behaviour pattern of its water and electricity costs. At an activity level of 14 000 direct labour hours, total water and electricity costs were \$33 600; at 10 000 hours, total water and electricity costs were only \$28 600. Using the high–low method, the estimated total utility costs at an activity level of 13 000 direct labour hours would be:
- \$16 250
  - \$32 350
  - \$32 600
  - \$37 180
  - none of the above
5. Reynolds Interiors sold 9200 metres of wallpaper last year at a contribution margin of \$3 per metre and incurred \$24 700 in total fixed costs. This year, contribution margin per metre is expected to increase to \$4, and fixed costs are expected to increase to \$29 000. How many units must be sold this year to earn the same operating profit as was earned last year? (Hint: Use the expanded contribution margin model described in the chapter.)
- 6900
  - 7250
  - 7975
  - 10 633
  - none of the above
6. With the following data, how many units must be sold to generate an operating profit of \$12 000?
- |                           |               |
|---------------------------|---------------|
| Fixed expenses            | \$30 000      |
| Selling price             | \$60 per unit |
| Contribution margin ratio | 20%           |
- 700
  - 500
  - 1000
  - 2500
  - 3500
7. If both the fixed costs associated with a product and the variable costs (as a percentage of sales dollars) decrease, what will be the effect on the contribution margin ratio and the break-even point respectively?
- decrease, increase
  - increase, decrease
  - decrease, decrease
  - increase, increase
  - no change, no change

8. The contribution margin income statement:
- a reports expenses based on cost behaviour pattern rather than cost function
  - b unitises fixed costs
  - c shows contribution margin rather than operating profit as the bottom line
  - d is sometimes used for financial reporting purposes
  - e none of the above

**Use the following information for questions 9 and 10.**

Drennen Ltd's 2008 contribution margin income statement shows the following:

Sales @ \$8 per unit	\$128 000
Less: Variable expense	<u>(96 000)</u>
Contribution margin	\$ 32 000
Less: Fixed expenses	<u>(40 000)</u>
Operating profit (loss)	<u>\$ (8 000)</u>

9. If Drennen Ltd's advertising costs increased by \$6000, by how much would sales have to increase for the company to achieve an operating profit of \$4000?
- a \$18 000
  - b \$42 000
  - c \$56 000
  - d \$72 000
  - e none of the above
10. What would Drennen Ltd's operating profit (or loss) be if fixed costs were increased by 10 per cent and sales volume increased by 30 per cent?
- a \$800
  - b \$5600
  - c \$(2400)
  - d \$(7200)
  - e none of the above
11. A sunk cost is a cost that:
- a is always relevant in decision-making
  - b can be relevant in decision-making depending on the circumstances
  - c is never relevant in decision-making
  - d can be recovered in the future
  - e none of the above
12. An opportunity cost is:
- a profit foregone because an opportunity to earn profit was not pursued
  - b never relevant in decision-making
  - c a cost that cannot be avoided
  - d a cost that has been incurred and that cannot be reversed by some future action
  - e present in every decision-making situation

13. In considering whether to accept a special order at a price that is less than the normal selling price of the product when the additional sales will use idle capacity, which of the following costs will *not* be relevant?
- fixed manufacturing overhead that can be avoided
  - direct materials
  - variable overhead
  - depreciation of the manufacturing plant
  - direct labour
14. In a make or buy decision, management should consider all of the following, *except*:
- opportunity costs of making internally
  - costs that are avoidable by buying outside the company
  - costs common to making internally or buying outside the company
  - other qualitative factors
  - none of the above

## EXERCISES

learning objective

3

●○○ EASY

Analytical skill of:  
Routine cognitive  
skills

E12.1

### Cost classifications.

For each of the following costs, tick the column(s) that are most likely to apply.

Cost	Variable	Fixed
Wages of assembly-line workers	_____	_____
Depreciation—plant equipment	_____	_____
Glue and thread	_____	_____
Delivery costs	_____	_____
Raw materials handling costs	_____	_____
Salary of public relations manager	_____	_____
Production run set-up costs	_____	_____
Plant water, light and electricity	_____	_____
Electricity cost of retail stores	_____	_____
Research and development expense	_____	_____

learning objective

3

●○○ EASY

Analytical skill of:  
Routine cognitive  
skills

E12.2

### Cost classifications.

For each of the following costs, tick the column(s) that are most likely to apply.

Cost	Variable	Fixed
Raw materials	_____	_____
Staples used to secure packed boxes of product	_____	_____
Factory cleaners' wages	_____	_____
Order processing clerks' wages	_____	_____
Advertising expenses	_____	_____
Production workers' wages	_____	_____
Production supervisors' salaries	_____	_____
Sales force commissions	_____	_____
Maintenance supplies used	_____	_____

learning objective

3

●○○ EASY

Analytical skill of:  
Routine cognitive skills

learning objective

3

●○○ EASY

Analytical skill of:  
Routine cognitive skills

learning objective

7

●●● HARD

Analytical skill of:  
Routine cognitive skills

Managing director's salary	_____	_____
Electricity cost	_____	_____
Land taxes for:		
Factory	_____	_____
Office	_____	_____

**E12.3 Estimating costs based on behaviour patterns.**

Ryan estimates that the costs of insurance, his licence and depreciation to operate his car total \$320 per month and that the petrol, oil and maintenance costs are 44 cents per kilometre. Ryan also estimates that, on average, he drives his car 1400 kilometres per month.

**Required**

- (a) How much cost would Ryan expect to incur during April if he drove the car 1529 kilometres?
- (b) Would it be meaningful for Ryan to calculate an estimated average cost per kilometre for a typical 1400-kilometre month? Explain your answer.

**E12.4 Estimating costs based on behaviour patterns.**

The following table shows the amount of cost incurred in March for the cost items indicated. During March, 4000 units of the firm's single product were manufactured.

	\$
Raw materials	20 800
Factory depreciation expense	40 500
Direct labour	49 600
Production manager's salary	5 000
Computer rental expense	3 100
Maintenance supplies used	600

**Required**

- (a) How much cost would you expect to be incurred for each of the above items during April, when 5600 units of the product are planned for production?
- (b) Calculate the average total cost per unit for the 4000 units manufactured in March. Explain why this figure would not be useful to a manager interested in predicting the cost of producing 5600 units in April.

**E12.5 Understanding CVP relationships.**

Calculate the missing amounts for each of the following firms:

*Note:  $S_x - VC_x = CM_x$  is the relationship applied to units. The relationship holds true for total sales revenue and total variable costs. Let  $S = 100\%$ .  $VC$  would also be converted into a percentage of sales and then  $CM$  would be a contribution margin per cent.*

	Sales	Variable costs	Contribution margin ratio	Fixed costs	Operating profit (loss)
	\$	\$	%	\$	\$
Firm A	320 000	?	32	?	38 300
Firm B	?	465 050	?	118 000	71 950
Firm C	134 000	?	26	36 700	?
Firm D	?	59 000	20	?	(4 920)

learning objective

7

●●○ MEDIUM

Analytical skills of:  
 analysing  
 reasoning logically  
 conceptualising  
 issues

learning objectives

7 8

●●○ MEDIUM

Analytical skills of:  
 analysing  
 reasoning logically  
 conceptualising  
 issues

learning objective

8

●○○ EASY

Analytical skills of:  
 analysing  
 reasoning logically  
 conceptualising  
 issues

**E12.6 Understanding CVP relationships.**

Calculate the missing amounts for each of the following firms:

	Units sold	Selling price	Variable costs per unit	Contribution margin	Fixed costs	Profit (loss)
	\$	\$	\$	\$	\$	\$
Firm A	11 200	24.00	?	100 800	41 300	?
Firm B	8 400	?	18.20	?	64 500	32 940
Firm C	?	7.30	4.20	10 850	?	(6 750)
Firm D	4 720	?	51.25	41 064	48 210	?

**E12.7 Calculate selling price of new product with a target CM ratio.**

*Note:  $Sx - VCx = CMx$  is the relationship applied to units. The relationship holds true for total sales revenue and total variable costs. Let  $S = 100\%$ .  $VC$  would also be converted into a per cent of sales and then  $CM$  would be a contribution margin per cent.*

Seaport Ltd makes and sells a large number of consumer products. The firm's average contribution margin ratio is 30 per cent. Management is considering adding a new product that will require an additional \$12 000 per month of fixed expenses and will have variable expenses of \$7.00 per unit.

**Required**

- Calculate the selling price that will be required for the new product if it is to have a contribution margin ratio equal to 30 per cent.
- Calculate the number of units of the new product that would have to be sold if the new product is to increase the firm's monthly profit by \$9000.

**E12.8 Calculate selling price of new product; what-if questions; break-even.**

Hancock Corp has annual sales revenue of \$375 000, an average contribution margin ratio of 32 per cent, and fixed expenses of \$150 000.

**Required**

- Management is considering adding a new product to the company's product line. The new item will have \$9.52 of variable costs per unit. Calculate the selling price that will be required if this product is not to affect the average contribution margin ratio.
- If the new product adds an additional \$26 880 to Hancock's fixed expenses, how many units of the new product must be sold at the price calculated in (a) to break even on the new product?
- If 16 000 units of the new product could be sold at a price of \$15.50 per unit, and the company's other business did not change, calculate Hancock's total profit and average contribution margin ratio.
- Describe how the analysis of adding the new product would be complicated if it were to 'steal' some volume from existing products.

learning objective

8

●○○ EASY

Analytical skill of:  
solving problems

Personal skill of:  
thinking  
strategically

learning objective

8

●○○ EASY

Analytical skill of:  
solving problems

Personal skill of:  
thinking  
strategically

learning objective

11

●○○ EASY

Analytical skills of:  
analysing  
reasoning logically

conceptualising  
issues

learning objective

11

●○○ EASY

Analytical skills of:  
analysing  
reasoning logically

conceptualising  
issues

**E12.9 Special promotion—effects of a two-for-one sale.**

Barb and Jan's ice-cream shop charges \$1.50 for a cone. Variable expenses are \$0.42 per cone, and fixed costs total \$2100 per month. A 'sweetheart' promotion is being planned for the second week of February. During this week, a person buying a cone at the regular price would receive a free cone for a friend. It is estimated that 500 additional cones would be sold and that 700 cones would be given away. Advertising costs for the promotion would be \$150.

**Required**

- (a) Calculate the effect of the promotion on profit for the second week of February.
- (b) Do you think the promotion should occur? Explain your answer.

**E12.10 Special promotion—effects of a \$1 sale.**

The management of Primo's Prime Pizzeria is considering a special promotion for the last two weeks of May, which is normally a relatively low-demand period. The special promotion would involve selling two medium pizzas for the price of one, plus \$1. The medium pizza normally sells for \$11.99 and has variable expenses of \$4.00. Expected sales volume without the special promotion is 400 medium pizzas per week.

**Required**

- (a) Calculate the total contribution margin generated by the normal volume of medium pizzas in a week.
- (b) Calculate the total number of medium pizzas that would have to be sold during the \$1 sale to generate the same amount of contribution margin that results from the normal volume.
- (c) What other factors should management consider in evaluating the strengths and weaknesses of the special promotion?

**E12.11 Application of cost terminology.**

Assume that you have decided to drive your car to Margaret River for the summer break. A classmate learns about your plans and asks about riding along with you. Explain how you would apply each of the following cost concepts to the task of determining how much cost, if any, you would take into consideration for the purposes of setting a price to be charged for taking the classmate with you.

- (a) Differential cost
- (b) Allocated cost
- (c) Sunk cost
- (d) Opportunity cost

**E12.12 Give examples of various costs.**

Attending university involves incurring many costs. Give an example of a cost of attending university that could be assigned to each of the following classifications. Explain your reason for assigning each cost to the classification.

- (a) Sunk cost
- (b) Discretionary cost
- (c) Committed cost

- (d) Opportunity cost
- (e) Differential cost
- (f) Allocated cost

learning objective

12

●○○ EASY

Analytical skills of:  
 identifying  
 finding  
 evaluating  
 organising  
 managing  
 information and  
 evidence

**E12.13 Sell or process further?**

Triton Chemical Company manufactures a chemical compound that is sold for \$58 per litre. A new variant of the chemical has been discovered, and if the basic compound were processed into the new variant the selling price would be \$72 per litre. Triton expects the market for the new compound variant to be 10 000 litres initially and determines that processing costs to refine the basic compound into the new variant would be \$150 000. Should Triton produce the new compound variant?

learning objective

12

●○○ EASY

Analytical skills of:  
 identifying  
 finding  
 evaluating  
 organising  
 managing  
 information and  
 evidence

**E12.14 Sell or process further?**

Peabody Company mines an iron ore called Alpha. During the month of August, 175 000 tonnes of Alpha were mined and processed at a cost of \$525 000. As the Alpha ore is mined, it is processed into Delta and Pi, where 60 per cent of the Alpha output becomes Delta and 40 per cent becomes Pi. Each product can be sold as it is or it can be processed into the refined products Super Delta and Precision Pi. Selling prices for these products are:

	Delta	Super Delta	Pi	Precision Pi
Selling price	\$12/tonne	\$18/tonne	\$25/tonne	\$35/tonne

Processing costs to refine Delta into Super Delta are \$840 000; processing costs to refine Pi into Precision Pi are \$560 000.

**Required**

- (a) Should Delta and Pi be sold as they are or refined into Super Delta and Precision Pi?
- (b) Identify any costs in the problem that are not relevant to this decision.
- (c) What is the maximum profit that Peabody Company can expect to earn from the production of the 175 000 tonnes of Alpha?

learning objectives

12 13

●●○ MEDIUM

Analytical skills of:  
 identifying  
 finding  
 evaluating  
 organising  
 managing  
 information and  
 evidence

**E12.15 Accept special sales order?**

Integrated Circuits Ltd (ICL) is presently operating at 50 per cent capacity and manufacturing 50 000 units of a patented electronic component. The cost structure of the component is as follows:

	\$
Raw materials	1.50 per unit
Direct labour	1.50 per unit
Variable overhead	2.00 per unit
Fixed overhead	100 000 per year

A Japanese firm has offered to purchase 30 000 of the components at a price of \$6 per unit, FOB ICL's plant. The normal selling price is \$8 per component. This special order will not affect any of ICL's 'normal' business. Management calculated that the cost per component is \$7, so it is reluctant to accept this special order.

learning objectives

12 13

●●○ MEDIUM

Analytical skills of:  
 identifying  
 finding  
 evaluating  
 organising  
 managing  
 information and  
 evidence

learning objective

14

●●○ MEDIUM

Analytical skills of:  
 identifying  
 finding  
 evaluating  
 organising  
 managing  
 information and  
 evidence

learning objective

14

●●○ MEDIUM

Analytical skills of:  
 identifying  
 finding  
 evaluating  
 organising  
 managing  
 information and  
 evidence

Required

- (a) Show how management came up with a cost of \$7 per unit for this component.
- (b) Evaluate this cost calculation. Explain why it is or is not appropriate.
- (c) Should the offer from the Japanese firm be accepted? Why or why not?

**E12.16 Accept special sales order?**

Fourway Manufacturing Co. makes and sells several models of locks. The cost records for Model B-603 show that manufacturing costs total \$23.25 per lock. An analysis of this amount indicates that \$13.40 of the total cost has a variable cost behaviour pattern, and the remainder is an allocation of fixed manufacturing overhead. The normal selling price of this model is \$31.00 per lock. A chain store has offered to buy 12 000 B-603 locks from Fourway at a price of \$16.25 each to sell in a market that would not compete with Fourway's regular business. Fourway has manufacturing capacity available and could make these locks without incurring additional fixed manufacturing overhead.

Required

- (a) Calculate the effect on Fourway's operating profit of accepting the order from the chain store.
- (b) If Fourway's costs had not been classified by cost behaviour pattern, is it likely that a correct special order analysis would have been made? Explain your answer.
- (c) Identify the key qualitative factors that Fourway managers should consider with respect to this special order decision.

**E12.17 The make or buy decision.**

Chesterfield Engine Ltd produces engines for the watercraft industry. An outside manufacturer has offered to supply several component parts used in the engine assemblies, which are currently being produced by Chesterfield. The supplier will charge Chesterfield \$270 per engine for the set of parts. Chesterfield's current costs for those part sets are direct materials, \$160; direct labour, \$80; and manufacturing overhead applied at 100 per cent of direct labour. Variable manufacturing overhead is considered to be 20 per cent of the total and fixed overhead will not change if the part sets are acquired from the outside supplier. Should Chesterfield Engine Ltd continue to make the part sets or accept the offer to purchase them for \$270?

**E12.18 The make or buy decision.**

Gorlock Company uses a certain part in its manufacturing process that it buys from an outside supplier for \$44 per part, plus another \$6 for shipping and other purchasing-related costs. The company will need 10 000 of these parts in the next year and is considering making the part internally. After performing a capacity analysis, it is determined that Gorlock has sufficient unused capacity to manufacture the 10 000 parts but would need to hire a manager at an annual salary of \$40 000 to oversee this production activity. Estimated production costs are determined to be:

	\$
Direct material	28
Direct labour	12
Variable overhead	6
Fixed overhead (includes manager at \$4 per unit)	<u>10</u>
Total unit cost	<u>56</u>

learning objective

15

●○○ EASY

Analytical skills of:  
 identifying  
 finding  
 evaluating  
 organising  
 managing  
 information and  
 evidence

E12.19

Required

- (a) Identify the relevant costs to make this part internally.
- (b) Should Gorlock produce the part or continue to buy it from the outside supplier?
- (c) What other factors are important to this decision?

**The product-mix decision.**

Product X has a contribution margin of \$150 per unit and requires three hours of machine time. Product Y requires four hours of machine time and provides \$200 of contribution margin per unit.

Required

If the capacity of machine time is limited to 1000 hours and only one product can be produced, what is the maximum amount of contribution that could be generated?

learning objective

15

●○○ EASY

Analytical skills of:  
 identifying  
 finding  
 evaluating  
 organising  
 managing  
 information and  
 evidence

E12.20

**The product-mix decision.**

ABC Company produces Product X, Product Y and Product S. All three products require processing on specialised finishing machines. The capacity of these machines is 1200 hours per month. ABC Company wishes to determine the product mix that should be achieved to meet the high demand for each product and provide the maximum profit. Following is information about each product:

	Product X	Product Y	Product S
Selling price	\$100	\$80	\$25
Variable costs	70	40	20
Machine time per unit	3 hours	2 hours	1 hour
Monthly demand (units)	300	200	500

Required

Determine how the 1200 hours of machine time should be allocated to the three products to provide the most profitable product mix.

## PROBLEMS

learning objective

6

●○○ EASY

Analytical skills of:  
 identifying  
 finding  
 evaluating  
 organising  
 managing  
 information and  
 evidence

P12.21

**High–low method.**

A department of Gamma Ltd incurred the following costs for the month of February. Variable costs, and the variable portion of mixed costs, are a function of the number of units of activity.

Activity level in units	5000
Variable costs	\$10 000
Fixed costs	30 000
Mixed costs	<u>20 000</u>
Total costs	<u>\$60 000</u>

During April the activity level was 8000 units, and the total costs incurred were \$70 500.

learning objective

6

●○○ EASY

Analytical skills of:  
identifying

finding

evaluating

organising

managing  
information and  
evidence

Required

- (a) Calculate the variable costs, fixed costs and mixed costs incurred during April.
- (b) Use the high–low method to calculate the cost formula for mixed cost.

**P12.22 High–low method—missing amounts.**

The following data have been extracted from the records of Puzzle Ltd:

	June	November
Production level, in units	10 000	20 000
Variable costs	\$24 000	\$ ?
Fixed costs	?	36 000
Mixed costs	<u>20 000</u>	<u>?</u>
Total costs	<u>\$80 000</u>	<u>\$118 000</u>

Required

- (a) Calculate the missing costs.
- (b) Calculate the cost formula for mixed cost using the high–low method.
- (c) Calculate the total cost that would be incurred for the production of 16 000 units.
- (d) Identify the two key cost behaviour assumptions made in the calculation of your answer to (c).

**P12.23 Prepare contribution margin income statement and answer what-if questions.**

Shown below is an income statement in the traditional format for a firm with a sales volume of 8000 units.

	\$
Sales revenue	32 000
Cost of goods sold (\$6000 + \$2.10 per unit)	<u>22 800</u>
Gross profit	9 200
Operating expenses:	
Selling (\$1200 + \$0.10 per unit)	2 000
Administration (\$4000 + \$0.20 per unit)	<u>5 600</u>
Operating profit	<u>1 600</u>

Required

- (a) Prepare an income statement in the contribution margin format showing the contribution margin per unit and the contribution margin ratio.
- (b) Calculate the firm's operating profit (or loss) if the volume changed from 8000 units to:
  - (i) 12 000 units
  - (ii) 4000 units.
- (c) Refer to your answer to (a) for total sales revenues of \$32 000. Calculate the firm's operating profit (or loss) if unit selling price and variable expenses per unit do not change, and total sales revenues:
  - (i) increase by \$12 000
  - (ii) decrease by \$7000.

learning objectives

7 8 9

●●○ MEDIUM

Analytical skills of:  
analysing

reasoning logically

conceptualising  
issues

## learning objectives

7 8

●●○ MEDIUM

Analytical skills of:  
 analysing  
 reasoning logically  
 conceptualising  
 issues

**P12.24 Prepare a contribution margin format income statement; answer what-if questions.**

Shown below is an income statement in the traditional format for a firm with a sales volume of 18 000 units.

	\$
Sales revenue	108 000
Cost of goods sold (\$10 000 + \$2.80 per unit)	<u>60 400</u>
Gross profit	47 600
Operating expenses:	
Selling (\$2200 + \$1.00 per unit)	20 200
Administration (\$5000 + \$0.40 per unit)	<u>12 200</u>
Profit	<u><u>15 200</u></u>

**Required**

- (a) Prepare an income statement in the contribution margin format showing the contribution margin per unit and the contribution margin ratio.
- (b) Calculate the firm's profit (or loss) if the volume changed from 18 000 units to:
- 20 000 units
  - 10 000 units.
- (c) Refer to your answer to (a) when total sales revenues were \$108 000. Calculate the firm's profit (or loss) if unit selling price and variable expenses do not change, and total sales revenues:
- increase by \$15 000
  - decrease by \$10 000.

## learning objectives

7 8 9

●●○ MEDIUM

Analytical skills of:  
 analysing  
 reasoning logically  
 conceptualising  
 issues

**P12.25 Prepare a contribution margin format income statement; calculate break-even point.**

Presented below is the income statement for Big Whig Ltd for the month of August:

	\$
Sales (10 000 units)	65 000
Cost of goods sold	<u>56 000</u>
Gross profit	9 000
Operating expenses:	
Operating loss	<u><u>(5 000)</u></u>

Based on an analysis of cost behaviour patterns, it has been determined that the company's contribution margin ratio is 20 per cent.

**Required**

- (a) Rearrange the above income statement to the contribution margin format.
- (b) If sales increase by 30 per cent, what will be the firm's profit?
- (c) Calculate the amount of revenue required for Big Whig Ltd to break even.

## learning objectives

7 8 9

●●○ MEDIUM

Analytical skills of:  
analysingreasoning logically  
conceptualising  
issues**P12.26 Prepare a contribution margin format income statement; calculate break-even point.**

Presented below is the income statement for Doc Ltd for March:

	\$
Sales (20 000 units)	100 000
Cost of goods sold	<u>54 000</u>
Gross profit	46 000
Operating expenses	<u>37 000</u>
Operating profit	<u><u>9 000</u></u>

Based on an analysis of cost behaviour patterns, it has been determined that the company's contribution margin ratio is 30 per cent.

**Required**

- Rearrange the above income statement to the contribution margin format.
- Calculate profit if sales volume increases by 10 per cent. (Do not construct an income statement to determine your answer.)
- Calculate the amount of revenue required for Doc Ltd to break even.

## learning objectives

7 8 9

●●○ MEDIUM

Analytical skills of:  
analysingreasoning logically  
conceptualising  
issuesPersonal skill of:  
strategic thinking**P12.27 CVP analysis—what-if questions; break even.**

Penta Co. makes and sells a single product. The current selling price is \$15 per unit. Variable expenses are \$9 per unit, and fixed expenses total \$27 000 per month.

**Required**

(Unless otherwise stated, consider each requirement separately.)

- Calculate the break-even point, expressed in terms of total sales dollars and sales volume.
- Calculate the monthly profit (or loss) at a sales volume of 5400 units per month.
- Calculate monthly profit (or loss) if a \$2 per unit reduction in selling price results in a volume increase to 8400 units per month.
- What questions would have to be answered about the cost–volume–profit analysis simplifying assumptions before adopting the price-cut strategy of (c)?
- Calculate monthly profit (or loss) that would result from a \$1 per unit price increase and a \$6000 per month increase in advertising expenses, both relative to the original data. Assume a sales volume of 5400 units per month.
- Management is considering a change in the sales staff compensation plan. Currently, each of the firm's two salespersons is paid a salary of \$2500 per fortnight. Calculate the fortnightly profit (or loss) that would result from changing the compensation plan to a salary of \$400 per fortnight, plus a commission of \$0.80 per unit, assuming a sales volume of:
  - 5400 units per fortnight
  - 6000 units per fortnight.
- Assuming that the sales volume of 6000 units per fortnight achieved in (f) could also be achieved by increasing advertising by \$1000 per month instead of changing the sales force compensation plan, which strategy would you recommend? Explain your answer.

learning objectives

7 8 9

●●● HARD

Analytical skills of:  
analysing

reasoning logically

conceptualising  
issues

**P12.28 CVP analysis—what-if questions; sales mix issue.**

Kiwi Co. makes a single product that sells for \$42 per unit. Variable costs are \$27.30 per unit, and fixed costs total \$65 415 per month.

**Required**

- (a) Calculate the number of units that must be sold each month for the firm to break even.
- (b) Calculate profit if 5000 units are sold in a month.
- (c) Calculate profit if the selling price is increased to \$45 per unit, advertising expenditures are increased by \$8000 per month, and monthly unit sales volume becomes 5400 units.
- (d) Assume that the firm adds another product to its product line and that the new product sells for \$20 per unit, has variable costs of \$14 per unit, and causes fixed expenses in total to increase to \$83 000 per month. Calculate the firm's profit if 5000 units of the original product and 4000 units of the new product are sold each month. For the original product, use the selling price and variable cost data given in the problem statement.
- (e) Calculate the firm's profit if 4000 units of the original product and 5000 units of the new product are sold each month.
- (f) Explain why profit is different in (d) and (e), even though sales totalled 9000 units in each case.

learning objectives

7 8 9

●●○ MEDIUM

Analytical skills of:  
analysing

reasoning logically

conceptualising  
issues

Personal skill of:  
strategic thinking  
flexibility

**P12.29 CVP application—expand existing product line?**

Campus Canvas Ltd currently makes and sells two models of backpacks. Data applicable to the current operation are summarised in the columns below labelled 'Current operation'. Management is considering adding a Value model to its current Luxury and Economy models. Expected data if the new model is added are shown in the columns labelled 'Proposed expansion'.

	Current operation		Proposed expansion		
	Luxury	Economy	Luxury	Economy	Value
Selling price per unit	\$20	\$12	\$20	\$12	\$15
Variable expenses per unit	8	7	8	7	8
Annual sales volume (units)	10 000	20 000	6000	17 000	8000
Fixed expenses for year	Total of \$70 000		Total of \$84 000		

**Required**

- (a) Calculate the company's current total overall contribution margin and the current average contribution margin ratio.
- (b) Calculate the company's current amount of profit.
- (c) Calculate the company's current break-even point in dollar sales.
- (d) Explain why the company might incur a loss, even if the sales amount calculated in (c) was achieved and selling prices and costs didn't change.
- (e) Calculate the company's total profit under the proposed expansion.
- (f) Based on the proposed expansion data, would you recommend adding the Value model? Why or why not?
- (g) Would your answer to (f) change if the Value model sales volume were to increase to 10 000 units annually, and all other data remain the same? Why or why not?

learning objectives

8 9

●●● HARD

Analytical skills of:  
analysing

reasoning logically  
conceptualising  
issues

Personal skill of:  
strategic thinking  
flexibility

**P12.30 CVP application—eliminate product from operations?**

Muscle Beach Ltd makes three models of high-performance weight-training benches. Current operating data are summarised below:

	MegaMuscle	PowerGym	ProForce
Selling price per unit	\$140	\$200	\$290
Contribution margin per unit	\$42	\$77	\$58
Monthly sales volume	3000 units	2000 units	1000 units
Fixed expenses per month	Total \$320 000		

**Required**

- Calculate the contribution margin ratio of each product.
- Calculate the firm's overall contribution margin ratio with the current sales mix. (The usual formula,  $S_x = VC_x + FC + P$ , can be modified for total sales revenue as follows:  
 $100\% = VC\% + FC + P$ .)
- Calculate the firm's monthly break-even point in sales dollars. (The usual formula,  $S_x = VC_x + FC + P$ , can be modified for total sales revenue as follows:  
 $100\% = VC\% + FC + P$  BE(in dollars) =  $FC/\%CM$ .)
- Calculate the firm's monthly profit.
- Management is considering the elimination of the ProForce model, due to its low sales volume and low contribution margin ratio. As a result, total fixed expenses can be reduced to \$270 000 per month. Assuming that this change would not affect the other models, would you recommend the elimination of the ProForce model? Explain your answer.
- Assume the same facts as in (e). Assume also that the sales volume for the PowerGym model will increase by 500 units per month if the ProForce model is eliminated. Would you recommend the elimination of the ProForce model? Explain your answer.

learning objectives

8 9 11

●●○ MEDIUM

Analytical skills of:  
analysing

reasoning logically  
conceptualising  
issues

Personal skill of:  
strategic thinking

Appreciative skills of:  
strategic thinking  
applying disciplinary  
and multidisciplinary  
perspectives

**P12.31 CVP analysis—effects of changes in cost structure; break even.**

Greene Co. makes and sells a single product. The current selling price is \$32 per unit. Variable expenses are \$20 per unit, and fixed expenses total \$43 200 per month. Sales volume for January totalled 4100 units.

**Required**

- Calculate profit for January.
- Calculate the break-even point in terms of units sold and total sales revenue.
- Management is considering installing automated equipment to reduce direct labour cost. If this is done, variable expenses will drop to \$14 per unit, but fixed expenses will increase to \$67 800 per month.
  - Calculate profit at a volume of 4100 units per month with the new cost structure.
  - Calculate the break-even point in units with the new cost structure.
  - Why would management seriously consider investing in the automated equipment and accept the new cost structure?
  - Why might management not accept your recommendation but decide instead to maintain the old cost structure?

learning objectives

8 9

●●○ MEDIUM

Analytical skills of:  
analysing

reasoning logically

conceptualising  
issues

Personal skill of:  
strategic thinking

**P12.32 CVP analysis—effects of change in cost structure; break even.**

Hucker Ltd produces small-scale replicas of vintage cars for collectors and museums. Finished products are based on a 1/20th scale of the originals. The firm's income statement showed the following:

	\$
Sales revenue (1200 units)	792 000
Variable expenses	<u>435 600</u>
Contribution margin	356 400
Fixed expenses	<u>260 000</u>
Operating profit	<u><u>96 400</u></u>

An automated stamping machine has been developed that can efficiently produce body frames, hoods and doors to the desired scale. If the machine is leased, fixed expenses will increase by \$29 000 per year. The firm's production capacity will increase, which is expected to result in a 25 per cent increase in sales volume. It is also estimated that labour costs of \$33 per unit could be saved, because less polishing and finishing time will be required.

**Required**

- (a) Calculate the firm's current contribution margin ratio and break-even point in terms of sales revenue.
- (b) Calculate the firm's contribution margin ratio and break-even point in terms of sales revenue if the new machine is leased.
- (c) Calculate the firm's profit assuming that the new machine is leased.
- (d) Do you believe that the management of Hucker Ltd should lease the new machine? Explain your answer.

learning objectives

8 9

●●○ MEDIUM

Analytical skills of:  
analysing

reasoning logically

conceptualising  
issues

**P12.33 CVP analysis with scarce resources and limited demand.**

Australia Advance Ltd manufactures two types of solar-powered frisbees, WildOne and BoldOne. Currently demand outstrips supply and, since the company faces a limited supply of skilled labour required for production, it has decided to limit its production to one line.

	WildOne per unit	BoldOne per unit	Total
Selling price	\$26.00	\$30.00	
Direct materials	2.00	3.00	
Direct labour	5.00	3.75	
Variable production costs	3.40	4.45	
Variable selling costs	0.60	0.80	
Fixed production costs			\$200 000
Fixed selling and admin costs			\$40 000
Time to produce	15 minutes	20 minutes	

Total skilled labour hours available: 24 000.

- (a) Determine which product should be produced.
- (b) Determine the break-even point in units and sales value if the firm limited production to WildOne.

- (c) Given the skills shortage, determine the maximum operating profit that can be achieved if the company limits its production to WildOne and continues to experience unmet demand for its product.
- (d) In business and economic terms, what is the likely outcome for this company in the market?

learning objectives

8 9

●●○ MEDIUM

Analytical skills of:  
**analysing**  
 reasoning logically  
 conceptualising  
 issues

**P12.34 CVP analysis based on percentage capacity and target profit.**

The following information relates to a family-owned restaurant in Melbourne.

Manager's salary	\$82 500 p.a.
Interest	Loan of \$150 000 at an interest rate of 12% p.a.
Depreciation	Equipment, furniture and fittings with a cost of \$180 000 depreciated over 4 years
Licence	\$7500 p.a.
Insurance	\$9000 p.a.
Maintenance	\$6000 p.a.
Other salaries	\$42 000 p.a.
Variable costs	75% of revenue
Before-tax profit target	50% of owners' equity of \$180 000

**Required**

- (a) What sales revenue does the restaurant have to generate in order to make its before-tax profit target?
- (b) The restaurant is closed for four weeks of the year. For the rest of the year it is open every day except Monday. The restaurant has 50 seats and averages two sittings every day and three sittings on the weekend. What must the average cover price be in order to achieve the target profit level?

learning objectives

8 9

●●● HARD

Analytical skills of:  
**analysing**  
 reasoning logically  
 conceptualising  
 issues

**P12.35 CVP analysis based on percentage capacity and target profit.**

Hobart's new Thrifty Hotel has 60 rooms and historically has achieved an average annual occupancy rate of 60 per cent. The hotel's assets have a book value of \$2 700 000 and the owners expect a 'return on assets' of 30% before tax (tax is currently 30 per cent). The hotel has several fixed costs, which include 15 per cent per annum interest charged on a bank loan of \$1 500 000 and \$240 000 annual depreciation, and other fixed costs of \$383 100.

The hotel manager believes that the 60 per cent occupancy level will again be achieved next year and estimates that, at this level of activity, variable operating expenses will be \$510 000.

**Required**

Assuming that the hotel is open 365 days of the year, calculate the room rate that should be charged in order to provide the owners with their target profit level.

learning objectives

8 9

●●○ EASY

Analytical skill of:  
interpreting data

Appreciative

skills of:

thinking and

acting critically

appreciating ethical  
dimensions of  
situations

learning objective

10

●●○ MEDIUM

Routine report  
writing

Analytical skills of:

identifying

finding

evaluating

organising

managing

information and

evidence

learning objectives

8 9 11

●●● HARD

Analytical skills of:

identifying

finding

evaluating

organising

managing

information

interpreting data

P12.36

**CVP application—allow special discount?**

Assume that you are a sales representative for Saturn Lolly Company. One of your customers is interested in buying some lollies that will be given to the members of a high school club, Substance Abuse Awareness Club. The club members will be marching in a community parade and will give the lollies to children who are watching the parade. Your customer has asked that you discount the normal selling price of the lollies by 35 per cent. You know that the contribution margin ratio of this product, based on the regular selling price, is 50 per cent.

**Required**

Identify the strengths and weaknesses of complying with the customer's request, and state the recommendation you would make to your sales manager.

P12.37

**Comparison of operating leverage and financial leverage.**

The concept of financial leverage was introduced in Chapter 6 and expanded upon in Chapters 8 and 11. In this chapter, the concept of leverage was expanded to include operating leverage.

**Required**

- (a) Describe the risks associated with operating leverage.
- (b) Outline the similarities and differences between operating leverage and financial leverage. (Hint: Compare Exhibit 12-8 with the discussion and analysis in Exhibits 11-3.)

P12.38

**Understanding the effects of operating leverage.**

Clarke Ltd and Spence Ltd compete within the same industry and had the following operating results in 2007:

	Clarke Ltd	Spence Co. Ltd
	\$	\$
Sales	420 000	420 000
Variable expenses	<u>84 000</u>	<u>252 000</u>
Contribution margin	336 000	168 000
Fixed expenses	<u>294 000</u>	<u>126 000</u>
Profit	<u>42 000</u>	<u>42 000</u>

**Required**

- (a) Calculate the break-even point for each firm in terms of revenue.
- (b) What observations can you draw by examining the break-even point of each firm, given that they earned an equal amount of profit on identical sales volumes in 2007?
- (c) Calculate the amount of profit (or loss) that you would expect each firm to report in 2008 if sales were to:
  - (i) increase by 20 per cent
  - (ii) decrease by 20 per cent.

learning objectives

8 9 11

●●● HARD

Analytical skills of:

identifying

finding

evaluating

organising

managing

information

interpreting data

- (d) Using the amounts calculated in (c), calculate the increase or decrease in the amount of profit expected in 2008 from the amount reported in 2007.
- (e) Explain why an equal percentage increase (or decrease) in sales for each firm would have such differing effects on profit.
- (f) Calculate the ratio of contribution margin to profit for each firm in 2007. (Hint: Divide contribution margin by profit.)
- (g) Multiply the expected increase in sales of 20 per cent for 2008 by the ratio of contribution margin to profit for 2007 computed in (f) for each firm. (Hint: Multiply your answer in (f) by 0.2.)
- (h) Multiply your answer in (g) by the profit of \$42 000 reported in 2007 for each firm.
- (i) Compare your answer in (h) with your answer in (d). What conclusions can you draw about the effects of operating leverage from the steps you performed in (f), (g) and (h)?

**P12.39 Costing a business plan.**

Having worked in a large bank since leaving school, John Monteview recently decided to take up a retrenchment offer. John has often thought of starting his own wedding car hire business (Beautiful Bridal Cars) and sees the money on offer as the perfect opportunity to pursue his dream. Over the years John has developed a penchant for old-style cars, having purchased two 1950 Jaguars, which he has spent many hours keeping in pristine condition. John has decided to use the retrenchment money to acquire an additional Jaguar (Jag S-Type), as well as two Daimlers, a sedan and a limousine, to cater for larger groups. The retrenchment money will go some way towards acquiring these assets and meeting the various business set-up costs that will be incurred, but John still needs to take out a loan with the bank.

**PART A**

While John is quietly confident that his business will be successful, he is a little uncertain in regards to the expenses that will be incurred and what fees he should charge for the hire of the vehicles. John has identified the following expenses:

- vehicle registration
- vehicle insurance
- petrol
- drinks
- vehicle repairs and maintenance
- salary of an assistant (hired on a full-time basis)
- driver/chauffeur costs
- advertising
- cleaning costs
- rent of garage space to store the cars
- administration costs
- loan repayments.

In order to determine the fees to charge, and to make predictions as to the profitability of the company, John's first priority was to classify each of the costs expected to be incurred as either a fixed cost (i.e. cost incurred irrespective of the number of times each car is hired) or a variable cost (i.e. a cost that is incurred each time the cars are hired).

**Required**

Assume that John has asked you for assistance in understanding how his expenses will be incurred. Can you assist John by classifying each of the above costs as either fixed or variable?

## PART B

After being informed about how costs were likely to behave, John proceeded to make predictions as to the magnitude of each cost. He estimated the costs based on his experience repairing the two Jaguars he has owned for many years. All costs represent average costs expected to be incurred each time a vehicle is hired for a 2.5-hour period. The estimated costs are summarised below.

### Yearly fixed expenses

	Jag Mark 5	Jag Mark 8	Jag S-Type	Daimler sedan	Daimler limo
	\$	\$	\$	\$	\$
Registration	650	550	770	628	930
Insurance	1 350	1 567	1 500	1 331	1 950

### Other fixed expenses

	\$
Rent	15 000
Administration	5 000
Salary of assistant	40 000
Loan repayments	9 000
Advertising	2 000

### Variable expenses (incurred each time vehicle is hired)

	Jag Mark 5	Jag Mark 8	Jag S-Type	Daimler sedan	Daimler limo
	\$	\$	\$	\$	\$
Repairs and maintenance	30	32	28	35	45
Driver and chauffeur costs	75	75	75	75	75
Petrol	15	16	15	17	20
Drinks	20	20	20	20	20
Cleaning costs	30	30	30	30	30

## Required

John is unsure how much to charge for hiring each vehicle. Calculate the hiring charge for each vehicle if John wants to receive a contribution margin ratio of 60 per cent for each vehicle.

## PART C

While a 60 per cent contribution margin ratio was desirable, John felt that the fees were too high and decided to charge the following fees for each vehicle:

	Rate (for 2.5 hours)	Rate for each extra half-hour
	\$	\$
Jaguar Mark 5	395	80
Jaguar Mark 8	320	70
Jaguar S-Type	290	60
Daimler sedan	320	70
Daimler limousine	495	70

While John charges customers an additional amount for each extra half-hour, his main concern is that the vehicles might not be hired enough times for the company to at least break even. Hence, in analysing the cost–volume–profit relationships for the business, John asks you to assume that all cars will be hired for only the basic 2.5-hour period.

#### Required

- Analyse each vehicle separately and assess how many times each vehicle needs to be hired in order to break even. Assume that rent, administration, the salary of the assistant and loan repayments are distributed evenly between the five cars.
- Recalculate the break-even point for each vehicle if the loan repayment cost is split only between the three vehicles that were acquired.
- If it is expected that each vehicle is hired the same amount of times, how many times would each vehicle need to be hired in order for Beautiful Bridal Cars to break even.
- If the Jag Mark 8, the Jag S-Type and the Daimler sedan are expected to be twice as popular as the other two vehicles, how many times would each vehicle need to be hired in order for Beautiful Bridal Cars to break even?
- John has not included a wage for himself in the list of expenses. Assuming that John was earning \$45 000 per year when he left the bank, how many vehicles need to be hired per year in order for John to generate at least the same income as he was earning at the bank? Assume the same sales mix as in (d).

#### PART D

After operating for six months, John decides to evaluate the profitability of his company and reassess the hiring fee for each vehicle. His records reveal the following details in relation to the hiring of each vehicle:

	Jag Mark 5	Jag Mark 8	Jag S-Type	Daimler sedan	Daimler limo
Number of times hired	30	80	85	60	38
Extra hours hired	10	30	25	20	10

John has become aware that a competitor is charging customers substantially less to hire the same cars for the same time (2.5 hours). Specifically, the Prestige Wedding Car Hire Company, which has been in operation for 20 years, is charging the following prices:

	\$
Jaguar Mark 5	350
Jaguar Mark 8	300
Jaguar S-Type	270
Daimler sedan	280
Daimler limousine	450

#### Required

- Calculate the profit generated by the Beautiful Bridal Car Company over the first six months of operation. Assume that each vehicle was hired for only 2.5 hours.
- Determine which expenses are likely to increase if vehicles are hired for longer than 2.5 hours. Assuming that the extra expense is incurred in proportion to the variable expenses listed (i.e. an extra 20 per cent of the cost indicated for 2.5 hours for each extra half-hour),

recalculate the profit generated by the Beautiful Bridal Car Company over the first six months of operation, when extra hire time is considered.

- (c) What actions could John take to improve his company's profitability?
- (d) Given that business has been slower than expected, John is also considering whether to hire the assistant on a casual rather than a full-time basis.
  - (i) How would this decision affect the operating leverage of Beautiful Bridal Cars?
  - (ii) Would the new operating leverage position be good for John, given the performance of his company to date? Discuss.

learning objectives

12 13

●○○ MEDIUM

Analytical skills of:

identifying

finding

evaluating

organising

managing

information and

evidence

**P12.40 Relevant costs, special sales order—idle versus full capacity.**

Delmar Beverages Ltd produces a premium ginger beer that is sold throughout its chain of restaurants. The company is currently producing 1600 litres of ginger beer per day, which represents 80 per cent of its manufacturing capacity. The ginger beer is available to restaurant customers by the mug, in bottles, or packaged in six packs to take home. The selling price of a litre of ginger beer averages \$10 and cost accounting records indicate the following manufacturing cost per litre:

	\$
Raw material	3.00
Direct labour	1.50
Variable overhead	1.00
Fixed overhead	<u>2.50</u>
Total absorption cost	<u>8.00</u>

In addition to the manufacturing costs described above, Delmar incurs an average cost of \$1.00 per litre to distribute the ginger beer to its restaurants.

SaveMore Ltd, a chain of grocery stores, is interested in selling the ginger beer in litre bottles throughout its stores in the Coffs Harbour area during holiday periods and has offered to purchase the ginger beer from Delmar at a price of \$8 per litre. SaveMore believes it could sell 200 litres per day. If Delmar agrees to sell the ginger beer to SaveMore, it estimates the average distribution cost will be \$1.50 per litre.

**Required**

- (a) Identify all the relevant costs that Delmar should consider in evaluating the special sales order from SaveMore.
- (b) How would Delmar's daily profit be affected by the acceptance of this offer?
- (c) Assume that Delmar is currently producing 2000 litres of ginger beer daily. Repeat (a) and (b) above.
- (d) Explain why your answers are different when Delmar is producing 1600 litres per day versus 2000 litres per day.

### P12.41 Relevant costs, special sales order—idle versus full capacity.

Chase Motors Ltd (CML) produces petrol-powered motors for use in lawn-mowers. The company has been growing steadily over the past five years and is operating at full capacity. CML has recently completed the addition of new plant and equipment at a cost of \$6 000 000, thereby increasing its manufacturing capacity to 100 000 motors annually. The addition to plant and equipment will be depreciated on a straight-line basis over ten years.

Sales of motors were 75 000 units prior to the completion of the additional capacity. Cost records indicated that manufacturing costs had totalled \$76 per motor, of which \$60 per motor was considered to be variable manufacturing costs. CML has used the volume of activity at full capacity as the basis for applying fixed manufacturing overhead. The normal selling price is \$100 per motor and CML pays a 10 per cent commission on the sale of its motors.

LawnPro.com has offered to purchase 20 000 motors at a price of \$75 per unit, to test the viability of distributing lawn-mower replacement motors through its website. CML would be expected to produce the motors, store them in its warehouse, and ship individual motors to LawnPro.com customers. As orders are placed directly through the LawnPro.com website, they will be forwarded instantly to CML. There will be no commissions paid on this special sales order and freight charges will be paid by the customer purchasing a motor.

#### Required

- (a) Calculate the cost per motor, for cost accounting purposes, after completion of the additional plant capacity.
- (b) Identify all the relevant costs that CML should consider in evaluating the special sales order from LawnPro.com.
- (c) Should the offer from LawnPro.com be accepted? Why or why not?
- (d) If relevant cost analysis was not considered, is it likely that a correct special order analysis would have been made? Explain your answer.
- (e) Identify the key qualitative factors that CML management should consider with respect to this special order.
- (f) Assume that, with the additional plant capacity, sales of motors in CML's regular market are expected to increase by 20 per cent in the coming 12 months. Identify all the relevant costs that CML should consider in evaluating the special sales order from LawnPro.com. Why is your answer different from that in (b)?
- (g) Assume that sales of motors in CML's regular market are expected to increase by 20 per cent in the coming 12 months. Should the offer from LawnPro.com be accepted? Why or why not?