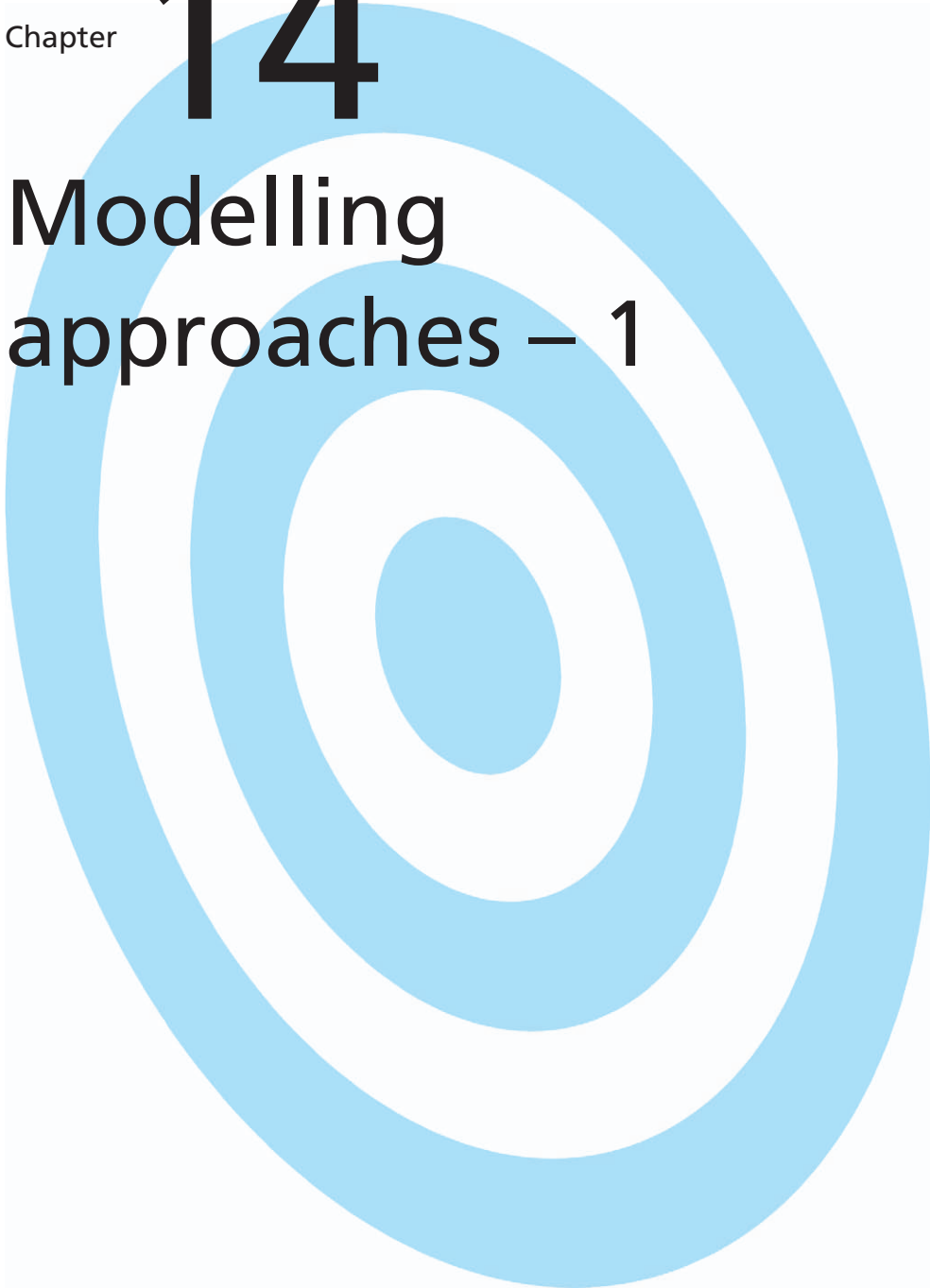Chapter **14**

Modelling approaches – 1

14.1 Learning objectives

When you have read this chapter you should be able to:

(a) understand more fully the role of modelling approaches;

(b) apply financial models to the short-run and long-run evaluation of marketing plans;

(c) appreciate the contribution that cost–volume–profit analysis can make;

(d) carry out appraisals of marketing programmes using discounting methods.

14.2 Introduction

In broad terms a model is anything that is used to represent something else, and models may be classified as descriptive (those that aim to describe real-world processes), predictive (describing both objectives and events, as well as attempting to predict future events) and control models (describing current events, predicting future events and providing a basis for choice among alternative courses of action).

Management science models are typically mathematical in nature, being sets of equations or other expressions that specify the significant variables in a particular situation and indicate the relationship among them. A variable can be defined as any factor that can take on different values under different circumstances, such as:

$$y = a + bx$$

where:

y represents sales turnover (the effect);

x represents consumer income (the cause);

a and b are constants (or parameters), one of which may, for instance, be a time lag.

This shows that management science models are symbolic and are based on the axioms of mathematics. The axioms of probability theory, for example, as one branch of mathematics, will be briefly stated (see pp. 629–30). Furthermore, most mathematical models are based on a small number of highly aggregated factors that are of overriding importance in explaining the way a system works and determining the outcome of different actions.

Models are useful in that they facilitate conceptions of reality that allow the effects of alternative courses of action to be more readily anticipated and measured. Such conceptions, however, are necessarily simplifications of the real situation because this is usually so complex that it could not possibly be explained by a model. The danger is always present that models may be *over*-simplifications of reality, and this renders them useless. Over-simplification is often a trait of corporate model building.

The balance sheet is a form of simplified corporate model governed by the principles of financial accounting, but the annual budget is a better operational example of a corporate model. Such models can be used to examine how the workings of a system affect the flow of inputs and outputs, and are being used with increasing frequency.

Budgeting, as a means of modelling, is limited in its traditional application by:

➡ The inclusion of too few alternative possibilities from which the most satisfactory is to be selected
➡ The difficulty of adjusting traditional operating budgets to rapidly changing conditions – they are at best 'flexible' with respect to changing sales or production levels (see Chapter 8).

It follows that a model permitting the calculation of a larger number of alternatives (based on a larger range of flexible variables and changing parameters) should yield a closer approximation to the ideal solution.

This can be achieved via simulation models, the idea of which is to handle relationships that are too complex to be reduced to simple conclusions by means of mathematical or statistical analysis. These models can then be used to generate predictions about the future course of events.

Two types of simulation are readily identifiable:

1 Analogue simulation, which tends to be a physical representation – such as the use of a model aircraft to predict the behaviour of a full-scale version
2 Symbolic simulation via mathematical modelling, in which the manipulation of the variables within the model simulates the interaction process and is thereby able to predict the outcomes of particular courses of action.

Sensitivity analyses can be performed in the symbolic simulation model by varying the inputs to the system (e.g. time, quantities, funds, etc.) and observing the outputs from each alternative combination of inputs. In this way a pattern of responses can be built up to permit predictions to be made of likely future outcomes.

Probability theory is important in any form of simulation since, for instance, the application of probabilities allows the manipulator to estimate the risk of predictions proving to be wrong. This and related techniques show that the value of simulation to management is in its providing the equivalent of a laboratory in which past or proposed strategies can be examined and experimental evidence produced concerning the probable future outcomes of present decisions.

The building of any model should be carried out by following a *systematic method* such as the following:

1 Specify the objectives to be achieved
2 Formulate the problem to be solved

3 Determine the relationships and major variables in the problem situation, including constraints

4 Construct a model to represent the system under review in such a way that it expresses the effectiveness of the system as a function of the variables isolated in step 3, with at least one of these variables being subject to direct manipulation

5 Derive a solution from the model

6 Test both the solution and the model to ensure that the effects of changes in the system are accurately predicted in the system's overall effectiveness

7 Establish controls over the solution to allow for variations in the relationships among the variables, otherwise the solution may become invalid

8 Implement the tested solution by translating it into a set of operating procedures capable of being understood and applied by the personnel who will be responsible for this use

9 Appraise the results.

Within marketing, many models have been developed that have general application in such areas as brand share and loyalty determination, media selection, measurement of message effectiveness, competitive strategies, transportation and warehouse location, pricing and the determination of competitive bids. However, these models are usually more complex and less precise than those developed for production and administration purposes. This is due to two major factors:

1 The ease of model construction will generally depend on the number of variables involved and the accuracy with which the costs associated with these variables can be measured. The general absence of well-developed costing systems for marketing means that marketing models must handle less precise data than is desirable.

2 The sheer number of variables in the typical marketing decision is huge, many of which are beyond the decision-maker's influence. This results in complex models, as well as the need to make a large number of simplifying assumptions.

In many marketing decisions it is behavioural relationships that are of the essence rather than more easily measured physical or economic factors and, along with other environmental variables, behaviour is difficult to measure in order to accommodate it into a mathematical model. The nature of a behavioural model is shown in Figure 14.1 for predicting sales in the convenience food industry.

This is a *black-box* model that aims to show which given inputs result in a particular output rather than attempting to explain exactly how this occurs.

Decision models (as illustrated in Figure 14.2) permit a higher degree of explanation than is possible with *black-box* models because the variables contained within them are more readily quantified, and the interrelationships contained within these models are less tenuous than in behavioural models.
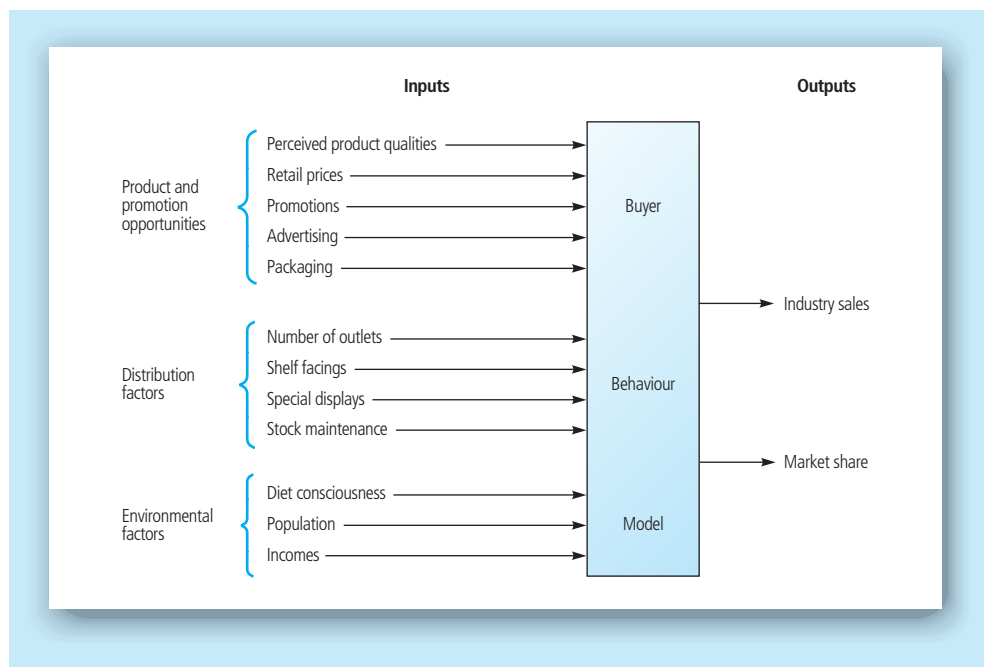
Figure 14.1 Buyer behaviour model

Figure 14.2 Decision model

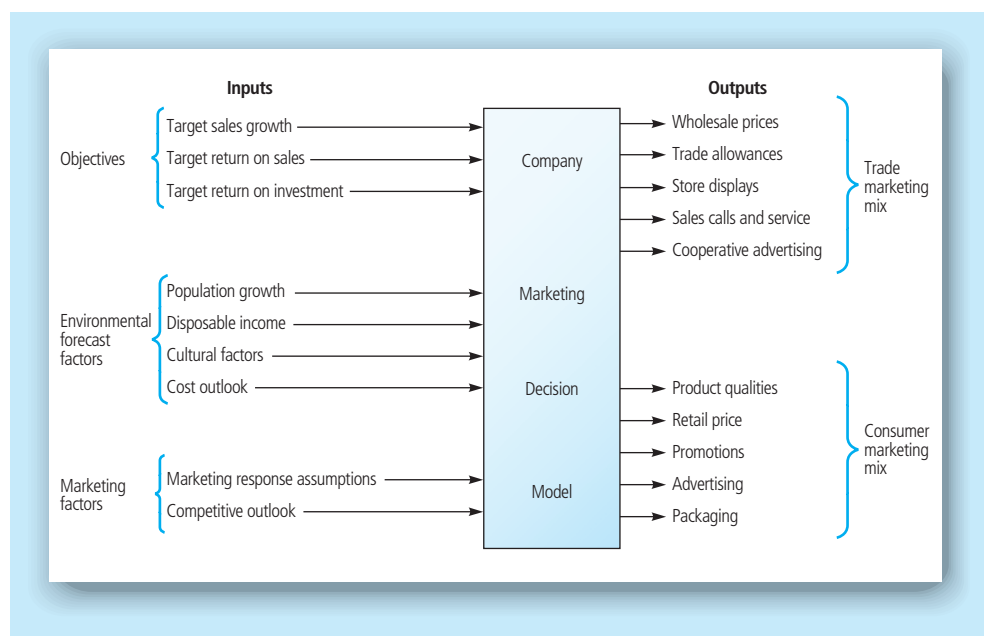Analytical decision models (based on the programming techniques discussed later in Chapter 15) can result in the selection of the best marketing mix to adopt for both the trade and the consumer. Simulation models, on the other hand, can start from a different point and attempt to evaluate the effect of alternative marketing mix combinations on the company's sales and profits, as shown in Figure 14.3.

Company profit equation:
$Z = (P − c)Q − F − A − D$

Company sales equation:
$Q = sQi$

Industry sales equation:
$Qi = mKN$

Market share equation:
$s = R(aA + dD)/\Sigma [R(aA + dD)]$

where:

Z	= Company profit in Year T
P	= Average price of the company's product in Year T
c	= Average variable manufacturing cost of the company's product in Year T
Q	= Number of units of product sold by the company in Year T
F	= Fixed manufacturing costs of company in Year T
A	= Advertising and promotion costs of the company in Year T
D	= Distribution and sales force costs of the company in Year T
s	= Average market share of company in Year T
Qi	= Industry sales in Year T
m	= Convenience food share of total food market
K	= Consumption of food per head in Year T
N	= Population of market in Year T
R	= Preference rating for company's product in Year T
a	= Advertising effectiveness index
d	= Distribution effectiveness index

Figure 14.3 Company sales and profit model

There can be little doubt that models can assist considerably in marketing planning and control, but this will only happen if models are developed and used properly.

Models must be designed on a systematic basis to ensure that they are geared to the decision-maker's objectives and requirements. In addition, models must function as part of the management process, which means that they should not be developed in isolation of an appreciation of the changes in the balance of power that they can produce: political implications are a significant feature of management science applications.

Once developed, the risk exists that models will be incorrectly used. This does not mean that the decision-maker must become a specialist in the development of models, but he or she should understand the essential features of model building and how to apply a model that has been built.

14.3 Cost–volume–profit analysis

In deciding on future courses of action, management pays a great deal of attention to the alternatives that are available. However, in the case of alternatives that involve changes in the level of business activity with no changes in scale itself, it is generally found that profit does not vary in direct proportion to changes in the level of activity. This is due to the interactions of costs, volume and profits.

For short-run decision-making purposes, costs can be classified as fixed, variable and mixed. In a marketing context, the costs that are typically fixed in relation to the level of activity (within a specified time span) are:

➡ Salaries
➡ Sales administration costs
➡ Advertising appropriations
➡ Market research allocations
➡ Establishment costs of premises.

Many costs depend very much on the level of activity (e.g. volume of business) and are often computed on a per unit basis. Such variable costs include:

➡ Commissions, which may vary with sales revenue
➡ Delivery costs, which may vary with weight shipped
➡ After-sales service costs, which may vary with units sold
➡ Cost of credit, which may vary with debtors' balances
➡ Order processing/invoicing costs, which may vary with number of orders received.

Mixed costs are those that are neither constant over a period nor directly variable on a per unit basis. An example could be the cost of additional sales staff: a particular level of business may require thirty sales staff to service the relevant outlets, but a rise in business of, say, 10 per cent that involves new outlets will probably require additional sales staff. The patterns that emerge are shown in Figure 14.4.

Sales revenue is an increasing function of the level of activity and therefore has the behavioural characteristics of the variable cost curve (see Figure 14.4(b)). Profit is a residual that depends on the interaction of sales volume, selling prices and costs. The non-uniform response of certain costs to changes in the level of activity can have
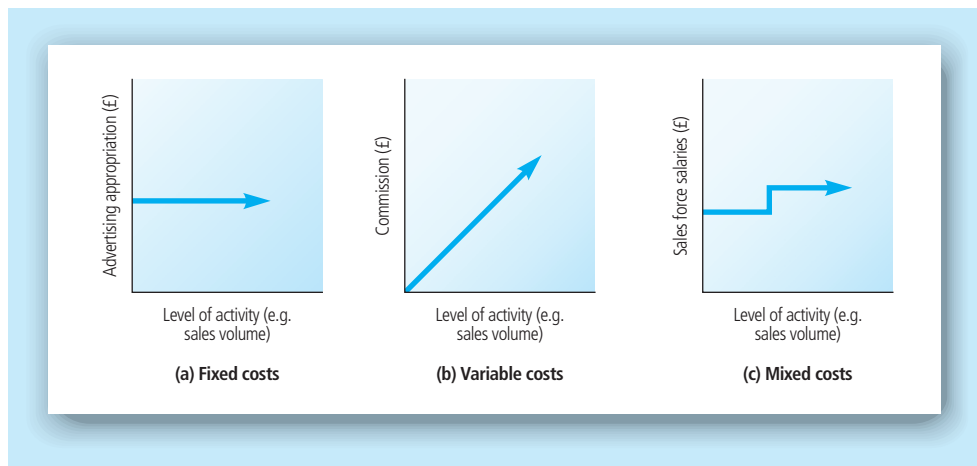

Figure 14.4 Cost behaviour patterns

a serious impact on profit in companies having a high proportion of fixed costs, with the result that a seemingly insignificant decline in sales volume from the expected level may be accompanied by a major drop in expected profit. (This is particularly prevalent in capital-intensive companies producing expensive but specialized industrial equipment.)

On account of the difficulties involved in many industries in accurately predicting the volume of business that may be expected during a forthcoming planning period, it is a wise policy to consider the cost–volume–profit picture for each likely level of activity. This can be done by means of a profitgraph (or break-even chart), which illustrates the profit emerging from different cost/revenue combinations.

The simple profitgraph in Figure 14.5 is compiled by combining the cost and revenue curves. The total revenue curve is simply the expected unit sales multiplied by price for each level of activity, whereas the total cost curve is made up by splitting mixed costs into their fixed and variable costs elements, and superimposing the total fixed cost curve on to the variable cost curve, as shown in Figure 14.6.

It is characteristic of this modelling technique that significant simplifying assumptions underlie its application. For example:

1 It is assumed that fixed costs are constant and that variable costs vary at a constant rate
2 It is assumed that all costs can be broken into either fixed or variable categories
3 It is assumed that only one selling price applies

Any of these (and other) assumptions underlying cost–volume–profit analysis can be modified in order to produce a more realistic model that is better suited to specific
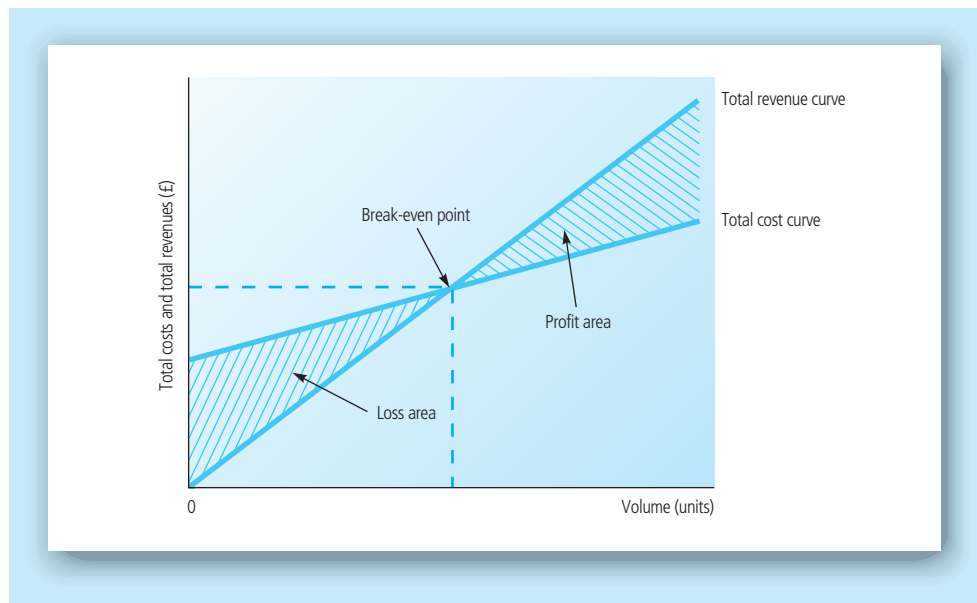
Figure 14.5   Profitgraph
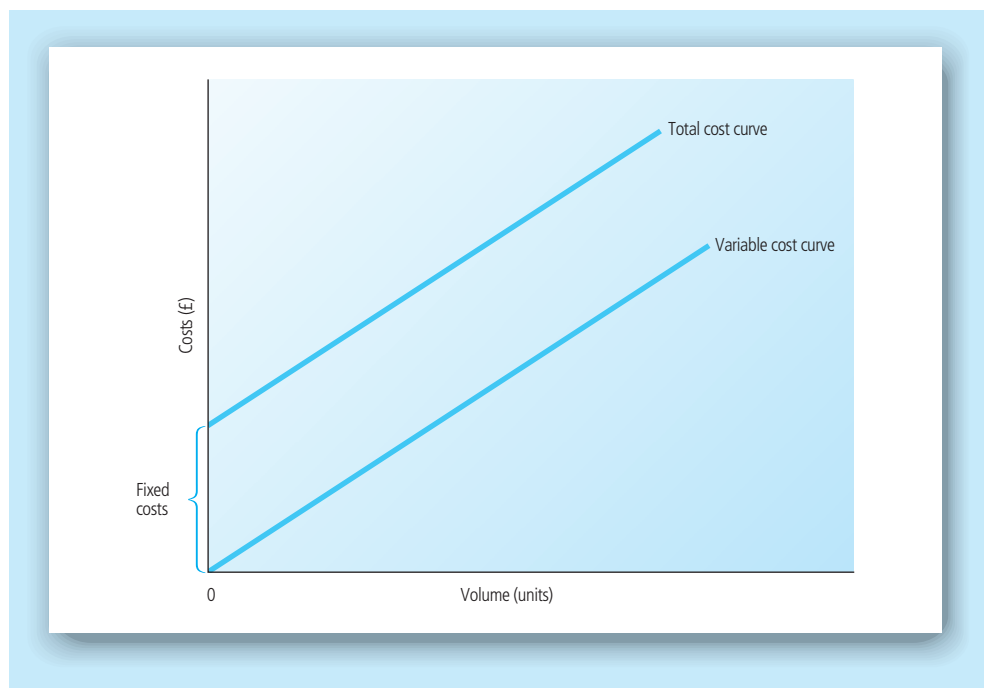
Figure 14.6 Total cost curve

circumstances. This can be demonstrated by reference to Figure 14.7, in which assumption 3 above is relaxed.

Fixed costs are given at £200,000, the unit variable cost is £2.50, and demand forecasts are shown for a number of different prices: £5, £10, £15 and £20. The greatest profit is generated by the £15 price and can be confirmed by the following calculation:

Sales Revenue (SR) (45,000 units at £15.00)	£675,000
Variable Costs (VC) (45,000 units at £2.50)	£112,500
Contribution	£562,500
Fixed costs	£200,000
Profit	£362,500

The break-even volume is derived from the formula:

$$\frac{\text{Fixed costs}}{\text{Unit contribution (i.e. SR/unit} - \text{VC/unit)}}$$

$$= \frac{£200,000}{£15.00 - £2.50} = 16,000 \text{ units}$$

At £15.00 per unit, the break-even point (i.e. the point at which Total Revenue (TR) = Total Costs (TC), hence Profit (P) = 0), expressed in terms of revenue, is:

$16,000 \times £15 = £240,000$

Unit price (£)	Market demand (units)	Total revenue (£)	Total costs (£)	Break-even point (units)	Profit (£)
5	65,000	325,000 (a¹)	362,500	80,000 (a)	(37,500)
10	55,000	550,000 (b¹)	337,500	26,667 (b)	212,500
15	45,000	675,000 (c¹)	312,500	16,000 (c)	362,500
20	30,000	600,000 (d¹)	275,000	11,429 (d)	325,000
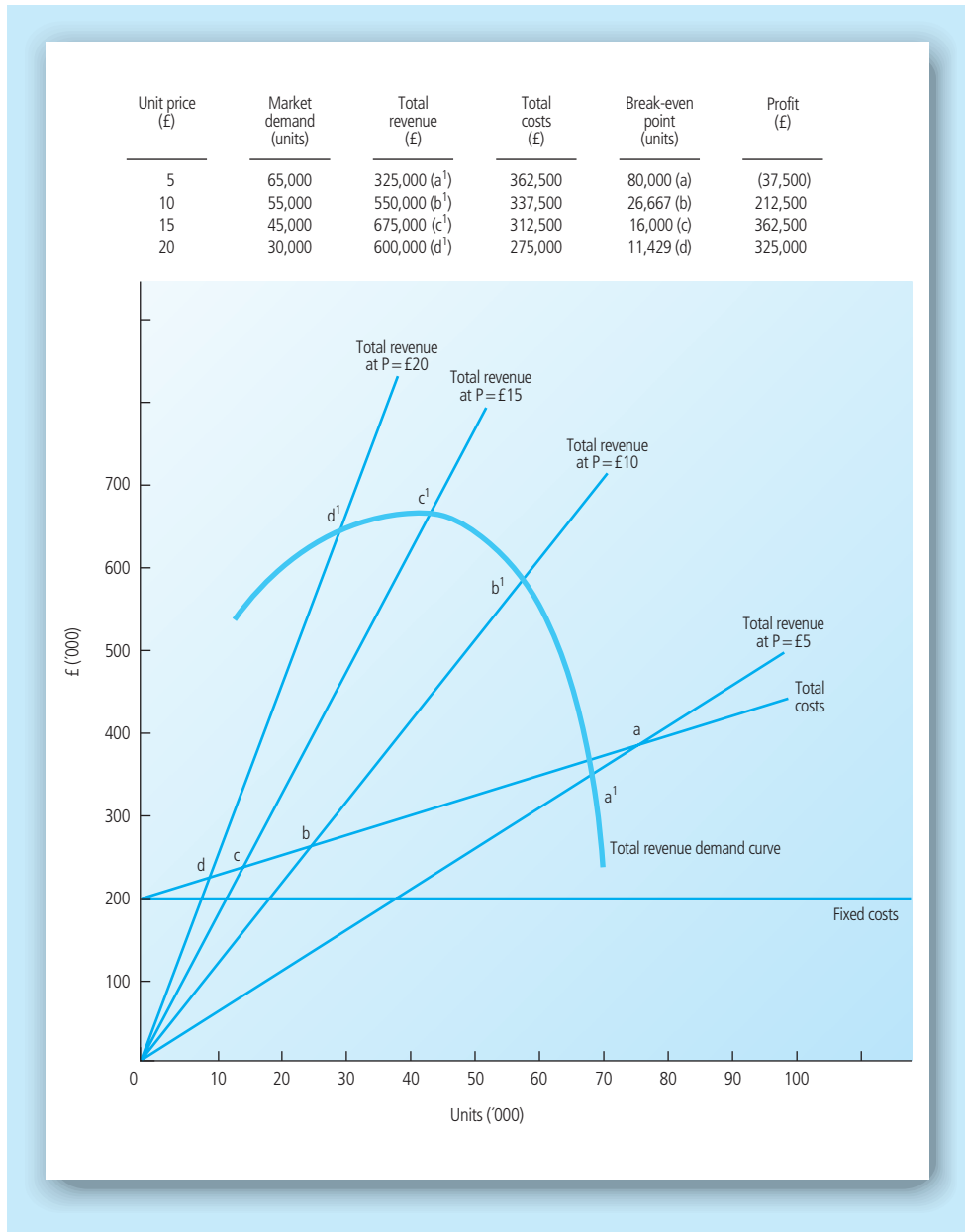
Figure 14.7   CVP analysis with a market demand schedule (adapted from Cravens and Lamb, 1986, p. 31)

This gives a margin of safety of:

$$\frac{£675,000 - £240,000}{£675,000} \times 100 = 64\%$$

In other words, sales could fall by 64 per cent before a loss would be incurred.

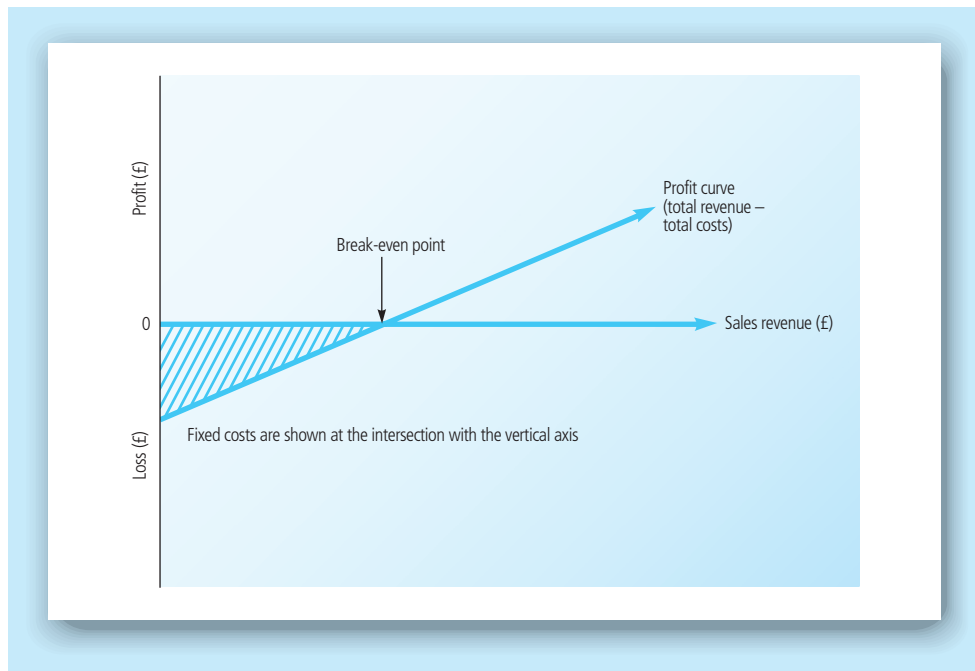In Figure 14.7, the line connecting the points a¹, b¹, c¹ and d¹ constitutes the market demand curve for the product in question.

Figure 14.8   Profit–volume chart

An alternative form of presentation to the profitgraph is the profit–volume chart. This shows the same relationships, but simplifies the picture by netting costs and revenues to show the profit for each level of activity. Figure 14.8 shows such a chart.

The reason why the total cost curve of Figures 14.5 and 14.6 does not pass through the origin is the same as the reason why the profit curve of Figure 14.8 cuts the vertical axis below the point of zero profit: even when there are no sales, the fixed costs must still be paid, and consequently the area below the break-even sales volume represents one of loss, being at its greatest at zero sales.

When constructed, the profitgraph represents, in essence, a wide range of profit statements for various levels of activity. As such, it can be used as a benchmark for judging the adequacy of actual performance or it can be used in the planning phase to portray alternative courses of action. The graphical analysis described above is a simple means of illustrating cost–volume–profit interrelationships, but the managerial applications can also be facilitated by algebraic analysis.

The basic equation is simple once mixed costs have been split into their fixed and variable elements and shown as such:

Sales revenue = variable costs + fixed costs + profit

The break-even (BE) equation is even simpler since, at the break-even point, there is no profit:

BE sales revenue = variable costs + fixed costs

In physical volume terms, the break-even point can be calculated as follows:

$$\text{BE volume} = \frac{\text{Fixed costs}}{(\text{Sales revenue} - \text{variable costs})/(\text{units sold})}$$

Thus if a firm has fixed costs of £10 000, variable costs of £15 000, and sells 5000 units for £30,000, the break-even volume is:

$$\frac{10,000}{(30,000 - 15,000)/5000} = 3333 \text{ units}$$

In monetary terms, the break-even volume can be derived by applying the formula:

$$\frac{\text{Fixed costs}}{1 - (\text{Variable costs/sales revenue})} = \frac{\text{Fixed costs}}{\text{Contribution margin ratio}}$$

Using the data referred to above, the break-even volume is equal to:

$$\frac{10,000}{1 - (15,000/30,000)} = \frac{10,000}{0.5} = £20,000$$

The proof is simple: unit price is £6.00 (i.e. £30 000/5000) and the unit variable cost is £3.00 (i.e. £15 000/5000). The unit contribution towards fixed costs and profit is therefore £6.00 − £3.00 = £3.00, and sufficient units must be sold to cover the fixed costs of £10 000. The solution is thus 3333 units, and at a unit price of £6.00 the break-even revenue is £20 000.

Reference was made in the above example to the contribution margin ratio. This is an important concept that expresses the percentage of a volume change that is composed of contribution to profit. In the example, the revenue from an additional sale is £6.00 and the additional variable cost is £3.00. The contribution margin ratio is therefore $1-[3/6] = 0.5$ or 50 per cent. In other words, half the revenue from a change in volume is sufficient to cover the variable costs and the other half contributes to fixed costs and profits. (The slope of the curve in Figure 14.8 is given by the contribution margin ratio.)

The application of this ratio is based on the assumption that other factors remain constant and it should be evident that this is a somewhat unrealistic assumption. Nevertheless, to continue the above example, if a change in sales of £10 000 takes place, the change in profits will be as shown in Figure 14.9.

Figure 14.9 shows that with a contribution margin (or profit–volume) ratio of 50 per cent, the profit variation for an upward move is the same as that for a downward move, with the former being positive and the latter negative, and with both being equal to one-half of the change in sales revenue.

A further equation can be devised to measure the excess of actual (or budgeted) sales over the break-even volume. This is known as the *margin of safety* and is given by the equation:

(Actual sales − sales at break-even point)/actual sales

	Original volume	Increase in volume	Decrease in volume
Sales	(£) 30,000	(£) +10,000	(£) −10,000
Variable costs	15,000	+5,000	−5,000
Fixed costs	10,000	Unchanged	Unchanged
Total costs	25,000	+5,000	−5,000
Profits	5,000	+5,000	−5,000

Figure 14.9 Profit–volume variations

Again, taking data from the earlier example, in monetary terms the margin of safety is:

$$(£30,000 − £20,000)/£30,000 = 1/3 \text{ or } 33\tfrac{1}{3}\%$$

In physical terms it is:

$$(5,000 − 3,333)/5,000 = 1/3 \text{ or } 33\tfrac{1}{3}\%$$

This ratio means that sales can fall by one-third before operations cease being profitable – assuming that the other relationships are accurately measured and remain constant.

The combination of cost–volume–profit analysis with budgeting enables alternative budget figures to serve as the basis for profit graphs. If a particular budget is shown to be unsatisfactory, then the parameters can be recast until a more suitable budget results. It is not surprising that cost–volume–profit analysis has been compared to flexible budgeting in being able to show what the cost and profit picture should be at different levels of sales, but flexible budgets are essentially concerned with cost control whereas cost–volume–profit analysis is more concerned with the predictions of profit.

As with other techniques, cost–volume–profit analysis has its strengths and weaknesses. In its favour is its value as a background information device for important decisions – such as selecting distribution channels, make or buy, and pricing decisions. In this role it offers an overall view of costs and sales in relation to profit requirements.

If simplicity is a virtue, then cost–volume–profit analysis has this virtue, since it is easily understood. However, this very simplicity points the way to the weaknesses and limitations of cost–volume–profit analysis. As suggested earlier in this section, the major weakness is in the underlying assumptions: profit varies not only in relation to changes in volume, but also with changes in production methods, marketing techniques and other factors. Cost–volume–profit analysis is unable to allow for these possibilities, and at best indicates the profit that may be expected under a single set of assumed conditions regarding external factors as well as managerial policies. Thus, it is a static representation of the

situation it purports to illustrate: a different set of circumstances would obviously result in a different series of cost–volume–profit relationships.

Furthermore, cost–volume–profit analysis can only accommodate objectives that relate to profits, costs and sales levels/revenues, and it tends to treat costs, volume and profit as if they were independent of each other.

These limitations do not outweigh the value of cost–volume–profit analysis provided that the user is aware of the assumptions and limitations. It is necessary, of course, to supplement the assistance given by any technique with managerial judgement, and cost–volume–profit analysis is no exception to this principle.

The roles of budgeting and cost–volume–profit analysis are illustrated below in further examples.

Examples

1 ABC Ltd

This is a single-product company with a profit objective that is expressed as 10 per cent of net sales revenue.

For the next planning period the total market potential is estimated to be 500 units. Figure 14.10 indicates the cost and profit outlook at each level of sales that ABC Ltd can expect to achieve.

The behaviour of marketing costs is shown in Figures 14.11 and 14.12 for fixed and variable costs respectively.

The unit costs from Figure 14.12 can be extended to show the variable marketing costs of each anticipated sales level:

Market share	10%	12%	14%	16%
Variable marketing cost	£5,000	£6,000	£7,000	£8,000

The combination of Figures 14.10–14.12 gives the total cost–volume–profit situation shown in Figure 14.13.

Forecast percentage share of market	10%	12%	14%	16%
Unit sales	50	60	70	80
Average net price per unit	£1,500	£1,500	£1,450	£1,400
Forecast net sales revenue	£75,000	£90,000	£101,500	£112,000
Variable manufacturing costs at £300 per unit	£15,000	£18,000	£21,000	£24,000
Contribution	£60,000	£72,000	£80,500	£88,000
Fixed manufacturing costs	£20,000	£20,000	£20,000	£20,000
Gross profit	£40,000	£52,000	£60,500	£68,000

Figure 14.10 Manufacturing costs and revenues

Fixed costs	10%	12%	14%	16%
Sales force (excluding commission)	£6,000	£6,000	£9,000	£9,000
Sales administration	£10,000	£10,000	£12,000	£12,000
Advertising appropriation	£5,000	£5,500	£8,000	£12,000
Establishment costs	£10,000	£10,000	£12,000	£12,000
Marketing research costs	£2,000	£2,000	£2,000	£2,000
Office services	£3,000	£3,100	£3,200	£3,300
Totals	£36,000	£36,600	£46,200	£50,300

Figure 14.11   Fixed costs

Delivery	£10
Order processing/invoicing	£2
Commission	£10
Average cost of credit	£30
After-sales service	£48
	£100

Figure 14.12   Variable cost per unit

Net profit statement	10%	12%	14%	16%
Gross margin (Figure 14.10)	£40,000	£52,000	£60,500	£68,000
Marketing costs (Figures 14.11 and 14.12)	£41,000	£42,600	£53,200	£58,300
Net profit (loss)	£(1,000)	£9,400	£7,300	£9,700
Net profit as percentage sales revenue	−1.33%	10.44%	7.19%	8.66%

Figure 14.13   Net profits

The profit objective of 10 per cent of net sales revenue is only achieved if ABC Ltd secures a 12 per cent market share, but control effort must be rigorously applied because the margin for error is very small.

This gives the basic budget for the forthcoming period, and this can be illustrated in a profitgraph (Figure 14.14).
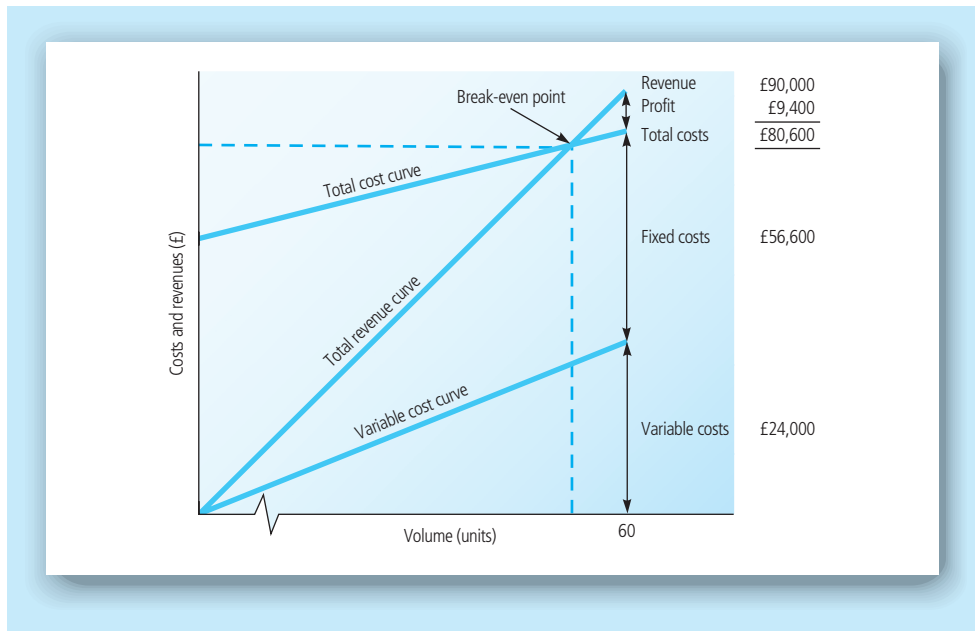
Figure 14.14 Cost–volume–profit relationships

For the selected course of action (i.e. that aiming for a 12 per cent market share), the total cost make-up is:

Variable manufacturing costs	£18,000	
Variable marketing costs	£6,000	
		£24,000
Fixed manufacturing costs	£20,000	
Fixed marketing costs	£36,600	
		£56,600
Total costs		£80,600

The break-even point is computed by applying the formula given earlier in this section:

$$\frac{£56,000}{(£90,000 - £24,000)/60} = 51 \text{ units}$$

This gives a margin of safety of only 15 per cent, calculated thus:

$$(60 - 51)/60 = 15\%$$

A clear and concise summary is given in this way of one particular course of action that provides a standard for management purposes. Separate charts and analyses can easily be drawn up for other alternative courses of action prior to making a choice.

Cost–volume–profit analysis can be used to aid the decision-maker faced with such choices as:

➡ Leasing or buying premises
➡ Leasing or owning vehicles
➡ Using agents or setting up branch offices.

In the case of warehousing, Figure 14.15 summarizes the situation, showing the storage space at which ownership costs are identical with leasing charges (B). At greater volume requirements ownership is cheaper, and at lesser volumes leasing is to be preferred.

2 Product line

The product mix is a major part of the overall marketing plan, and the relationship between the mix and the level of profit can be seen to be one of the basic areas against which alternatives can be reviewed in developing the marketing plan. Not only does it involve the consideration of the roles of single products and product groups, but it also involves considerations of the related effects of decisions bearing on, for example, the choice and emphasis of alternative sales areas.

However, very few companies appear to be aware of the actual gross profit contributions of either individual products or product groups. Furthermore, large variations would probably be found in gross contributions in most cases, and this could suggest different courses of marketing action if only the gross margins were properly computed. Figure 14.16 gives the example of a six-product mix analysed to show how each product contributes to sales and to profit. Product F has a negative contribution of 5 per cent of profit and would thus appear to be a candidate for deletion, while Product C especially,
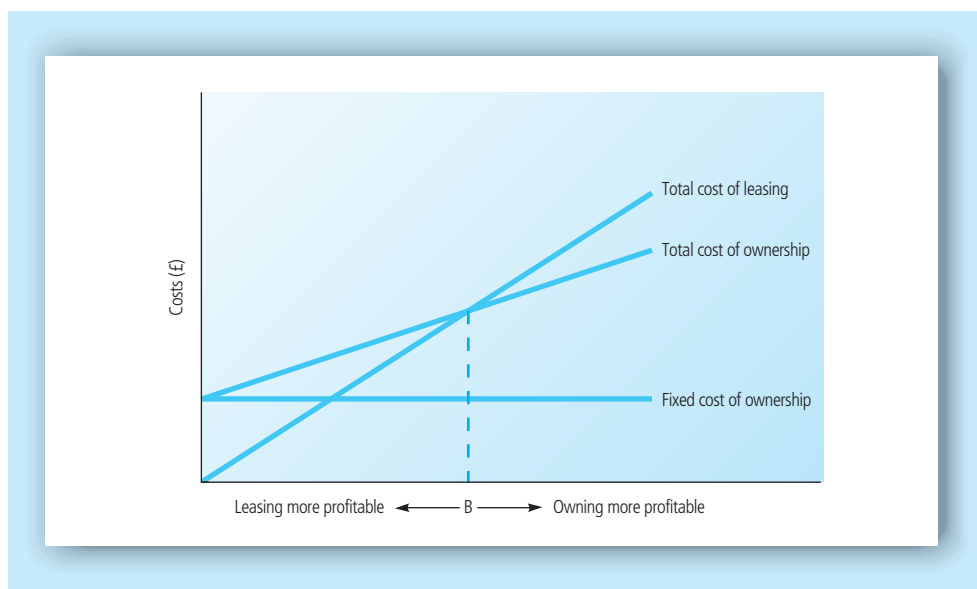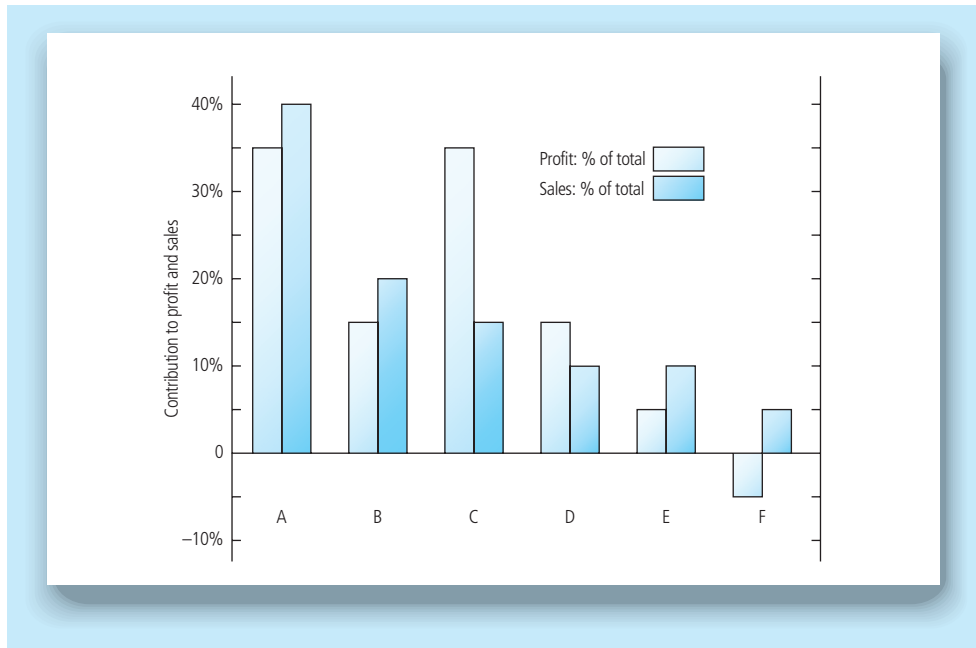

Figure 14.15   Break-even chart for warehousing

Figure 14.16   Product mix analysis

and to a lesser extent Product D, appear to deserve special marketing emphasis because they both have a proportionately greater profit than their relative volume.

When management adopts direct product costing and distribution cost analysis, it can compute the gross contribution of each item in the product range so that the tactical significance of the mix in relation to profit objectives becomes apparent. This can reveal cases of under-recovery of direct costs (as for Product F in Figure 14.16) that could possibly be corrected by modifications in price or cost reduction if it is decided that the product should be retained to fill out the product line. Direct costing requires the separation of fixed and variable costs, with the latter being treated as 'period costs' (i.e. they are charged to the profit and loss account on a periodic basis rather than being apportioned to units of output). An example should make the picture clear. LMN Ltd markets four products, the most recent financial data for which is shown in Figure 14.17. For each £1 of sales of the existing product mix, therefore, 24.8p is profit contribution. If the fixed costs of LMN Ltd amount to £50 000 and total sales are £250 000, then profit (P) is equal to:

(Sales × 24.8/100) − fixed costs
∴ P = £62,000 − £50,000 = £12,000

If it is decided to vary this mix it will be necessary to forecast the costs and sales for the modified mix. For instance, Product E may be launched to replace Product B, having the following characteristics:

Selling price per unit	£7
Variable cost per unit	£5.6
Percentage contribution	20%
Increase in fixed costs	£1000

The effects on the product mix are, for a new total sales level of £275 000:

Product	Former % of sales	Forecast % of sales
A	10%	25%
C	30%	30%
D	40%	30%
E	–	15%
		100%

The total contribution picture then becomes:

A: $20 \times 25/100 = 5\%$

C: $25 \times 30/100 = 7.5\%$

D: $30 \times 30/100 = 9\%$

E: $20 \times 15/100 = 3\%$

24.5%

$\therefore P = (275,000 \times 24.5/100) - (50,000 + 1,000)$

$ P = £67,375 - £51,000 = £16,375$

The profit improvement is thus £4357 (i.e. £16,375 − £12,000) on additional sales of £25 000 and this gives ROS of 17.6 per cent.

This example emphasizes the fact that product decisions should be made on the basis of their contribution to fixed costs and profit, and on the basis of their percentage share of total sales, rather than being considered in isolation.

Future planning and control are both aided by studying the progress of each product over its life cycle, since no product can hold its market position indefinitely in the face of changing conditions. The typical curves of Figure 14.18 show the lagged profit curve and the sales revenue curve for a product over the phases of its life. Rates of technological change, market acceptance, and ease of competitive entry will collectively determine the lifespan of the product. However, it may be possible to extend the

Product	Selling price (SP)	Variable cost (VC)	% contribution (SP − VC)/SP × 100	% of total sales	Contribution as % of total sales
A	£5	£4	20%	10%	2.0%
B	£6	£5	16.6%	20%	3.3%
C	£8	£6	25%	30%	7.5%
D	£10	£7	30%	40%	12.0%
				100%	24.8%

Figure 14.17   Product costs and contributions
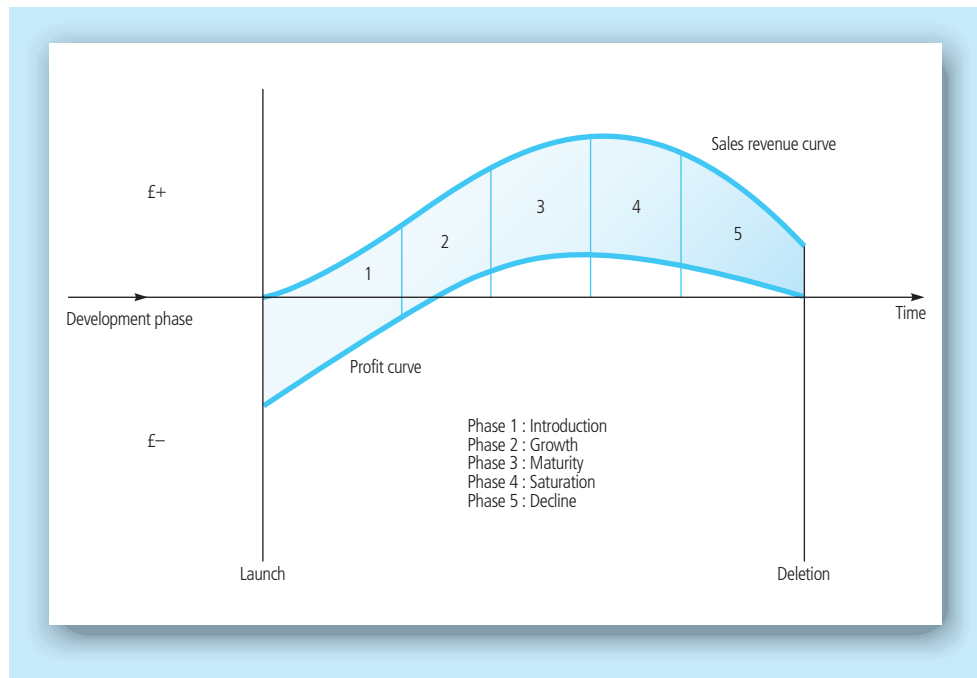
Figure 14.18   The product life cycle

lifespan by either modifying the product, changing its image to appeal to new market segments, or finding new uses for it. Generally, it will be necessary to adapt the marketing effort in each phase, and the ideal situation is one in which new products are introduced at such a rate that optimum profits can be maintained by some products reaching maturity at the time when others are beginning to decline, and so on.

In Figure 14.18 the product in question is deleted at the time when it ceases to be profitable, even though it is still generating sales revenue. But any deletion decision should be preceded by serious consideration of the areas in which it may be possible to improve the product's performance. In particular, areas to consider are selling methods, channels, the advertising message, promotions, the brand image, the pack, the quality and design of the product, and the adequacy of the service offered.

Under no circumstances should a declining product be allowed to continue in decline without evaluation, because it may be consuming resources that could more fruitfully be employed elsewhere. A declining product will tend to take up a disproportionate amount of management time, may require frequent price adjustments, will involve short – hence expensive – production runs, and may damage the company's image. Pareto's law will often apply in that 80 per cent of sales will come from 20 per cent of products and the weakest 20 per cent of products may absorb 80 per cent of management's attention.

Reviewing the product line should not be a rare action but should rather be undertaken in a regular and planned manner. For example, all products could be reviewed every three months and any that are less profitable than, say, the average for the range should be the subject of revised plans to improve their performance.

3 SRD example

Heskett (1976, pp. 410–18) gives the example of a marketing proposal from the Safety Razor Division (SRD) of the Gillette Company for a line of blank audio cassettes. The market penetration of the SRD's razors and blades was such that no further increase was likely; thus, growth would have to come via diversification. Estimates of the size and rate of growth of the market for blank audio cassettes made it particularly attractive.

In the USA the most popular tape was the 60-minute version, available as follows:

Type	Price ($)
Budget quality	1.00
Standard quality	1.75–2.00
Professional quality	2.98

Competition was fierce and price-oriented: some 50 per cent (by value) of tape sales were of budget quality, typically unbranded, with well-known companies supplying standard and professional quality tapes under such brand names as Sony, 3M and Memorex.

If SRD used 10 per cent of its existing sales force's effort to sell cassettes via existing outlets with the 50 per cent discount off retail price that was customary for cassettes, and if an advertising budget for Year 1 was set at $2 million (and $1.2 million per annum thereafter), and if unit costs were as follows:

Cassette case (bought out)	$0.159
Standard quality tape (60 minutes)	$0.214
Professional quality tape (60 minutes)	$0.322
Assembly labour	$0.200

and if the fixed annual costs of an assembly plant with capacity to handle 1 million cassettes per month were $500 000, there is the basis for an economic appraisal of alternative marketing programmes.

Figure 14.19 shows an outline programme offering standard quality cassettes at a price that is a little higher than that applicable to budget cassettes. The break-even volume is almost 40 million units per annum, which is greatly in excess of the capacity of the assembly plant. It also represents 85 per cent of the total retail market of budget-priced cassettes (totalling $65 million). On grounds of feasibility this does not appear to be a viable proposition.

Alternative marketing programmes to allow SRD to enter the cassette market might entail:

➡ Raising list price (with or without an increase in quality)
➡ Reducing trade margins
➡ Using a small sales team and only selling via wholesalers
➡ Reducing the proposed advertising budget
➡ Investing in manufacturing facilities (rather than just assembly).

Item		Computation
Price to final consumer		$1.30 per tape
Price to retailer or wholesaler (50% of list price)		$0.650
Variable costs per tape:		
cassette case	$0.159	
standard quality tape	$0.214	
assembly labour	$0.200	
Total		$0.573
Contribution		$0.077
Fixed costs per annum:		
assembly plant	$500,000	
sales force costs (10%)	$550,000	
advertising	$2,000,000	
Total		$3,050,000

Break-even sales volume: $\dfrac{\$3,050,000}{\$0.077}$

$$= 39,600,000 \text{ tapes}$$

$$39,600,000 \times \$1.30 = \$51.5 \text{ million retail value}$$

Figure 14.19   Economic appraisal of marketing strategy – standard quality at budget prices (adapted from Heskett, 1976)

These alternatives might be considered individually (on a *ceteris paribus* basis) or interactively (on a *mutatis mutandis* basis) and there would also be knock-on effects for other elements of the marketing mix.

Significant effort would need to be applied (via market research) to define the market, its segments, growth rates, etc., in order to determine the viability of alternative marketing programmes. Relevant factors would include:

➡ The quality of forecasts
➡ The rate at which market conditions favourable to entry might change
➡ Alternatives to blank cassette tapes as vehicles for SRD's growth
➡ Assumed buyer behaviour patterns within the cassette market
➡ Assumptions about other elements of the marketing mix.

Three alternative marketing programmes have been developed by SRD. The steps through which they were developed are shown in Figure 14.20 and the evaluated alternatives are shown in Figure 14.21. These alternatives are the marketing of budget cassettes, the marketing of standard cassettes at a low price, and the marketing of professional cassettes. Only the last two would use the Gillette brand name, although all three would have to generate an equivalent profit to Gillette's overall level (at 20 per cent of sales revenue). It is clear from Figure 14.21 that alternative 3 is non-viable and that alternative 1, while viable, is more challenging than alternative 2.
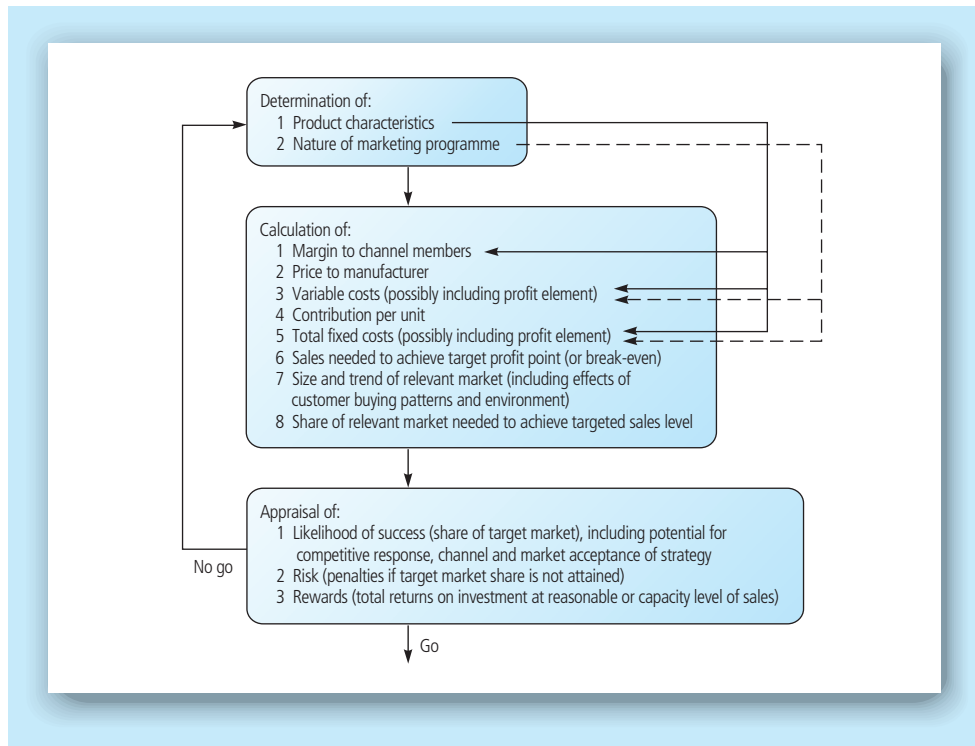
Figure 14.20 A conceptual scheme for the economic appraisal of a marketing programme (source: Heskett, 1976, p. 415)

14.4 Investment appraisal

Any investment involves the outlay of resources at one point in time in anticipation of receiving a larger return at some time in the future. This return must repay the original outlay as well as providing a minimum annual rate of return (or interest) on that outlay. If an individual invests £100 in a building society he will expect to receive that £100 back at some future time, along with compound interest. This is a typical investment situation. The aim will usually be to secure the maximum net cash flow (after tax) from the investment, and this will be achieved only from investments having the highest rate of return of those available.

Characteristically, an investment decision involves a largely irreversible commitment of resources and is generally subject to a significant degree of risk. Such decisions have far-reaching effects on an enterprise's profitability and flexibility over the long term, thus requiring that they be part of a carefully developed strategy that is based on reliable forecasting procedures.

Typical examples of investment projects are:

1 Expansion projects
2 Replacement projects
3 Buy or lease decisions.

	Alternative 1	Alternative 2	Alternative 3
Determination of product characteristics	Budget cassette, sold under a name other than Gillette	Standard cassette, sold under Gillette name	Professional cassette, sold under Gillette name
Elements of marketing programme			
Price (list) to ultimate buyer	$1.20/cassette	$1.50/cassette	$2.50/cassette
Channels	Current Gillette retail outlets, wholesalers; total margin = 25%	Current Gillette retail outlets, wholesalers; total margin = 30%	Audio shops, wholesalers; total margin = 60%
Promotion	Advertising = $2.0 million per year; personal selling = $0.5 million per year	Advertising = $2.0 million per year; personal selling = $0.5 million per year	Advertising = $1.0 million per year; personal selling = $0.2 million per year
Relevant target market	Teenagers for pop music; 50% of total dollar value	Young adults, business people for dictation, letter writing; 40% of total dollar value	Serious audiophiles for convenient high-fidelity recording of music; 10% of total dollar value
Calculation of			
Price to ultimate buyer	$1.20/cassette	$1.50/cassette	$2.50/cassette
Price to SRD	$0.90	$1.05	$1.00
Variable costs and profit per tape			
Unloaded cassette	$0.159	$0.159	$0.159
Tape of each quality	0.214	0.214	0.322
Assembly	0.200	0.200	0.200
Profit (20% of sales)	0.180	0.210	0.200
Total	$0.753	$0.783	$0.881
Contribution to fixed costs	$0.147/cassette	$0.267/cassette	$0.119/cassette
Fixed costs for			
Assembly plant (per year)	$500,000	$500,000	$500,000
Sales force salaries	500,000	500,000	200,000
Advertising	2,000,000	2,000,000	1,000,000
Total	$3,000,000	$3,000,000	$1,700,000
Target sales level (units)	$3,000,000/0.147 = 20,408,163	$3,000,000/0.267 = 11,235,955	$1,700,000/0.119 = 14,300,000
Value to ultimate customers of target sales level	$24,489,795	$16,853,932	$35,800,000
Estimated 1970 target market size ($ and % of $130 million)	$38,000,000 (50%)	$32,000,000 (40%)	$13,000,000 (10%)
Appraisal of			
Likelihood of success (share of target market), including potential for competitive response, channel, and market acceptance of strategy	38% share of target market required to break even	32% share of target market required to break even	275% share of target market required to break even
Potential risk	High fixed investment	High fixed investment	Moderate fixed investment
Potential return on investment of capacity operations	Would require expanded investment in manu-facturing facilities	Would require expanded investment in manu-facturing facilities	Would require expanded investment in manu-facturing facilities

No go

Figure 14.21 An economic analysis of three alternative strategies for designing and marketing SRD cassettes (adapted from Heskett, 1976, pp. 416–17)

Projects for analysis and appraisal do not just appear – a continuing stream of good investment opportunities results from hard thinking, careful planning, and often from large outlays on R&D. Replacement decisions are ordinarily the simplest to make, as the enterprise will have a very good idea of the cost savings to be obtained by replacing an old asset along with the consequences of non-replacement. (A central problem is that of accurately predicting the revenues and costs associated with particular projects for many years into the future.)

Over-investment in capital projects will result in heavy fixed costs, whereas under-investment may mean:

➡ An enterprise's activities are not sufficiently modern to enable it to operate competitively, or
➡ It has inadequate capacity to maintain its share of a growing market.

Investment is one of the main sources of economic growth. The application of reliable means of appraising investment proposals brings out more systematically and reliably the advantages of investing where it will improve performance and thus help to secure faster growth.

Various criticisms have been put forward in relation to the methods of appraisal that many companies employ. Among the most important are:

➡ Although most companies only make investment decisions after careful consideration of the likely costs and benefits as they see them, these decisions are often reached in ways that are unlikely to produce the pattern or level of investment that is most favourable to economic growth – or even most profitable to the company
➡ Many companies apply criteria for assessing investment projects that have little relevance to the measurement of the expected *rate of return on investment* (ROI) by which subsequent performance will be gauged
➡ Even when a calculation of the anticipated ROI of each project is made, the methods used vary widely and are sometimes so arbitrary as to give almost meaningless results – for instance, a failure to assess returns *after* tax is a frequent weakness of many widely used methods, since alternative opportunities can only be effectively compared and appraised on an after-tax basis.

This faulty use of (or use of faulty) means of investment appraisal may result in over-cautious investment decisions in which too high a rate of return is demanded before a proposal is accepted. This will cause delay in economic growth. Alternatively, faulty methods may mean that investment decisions are made that result in the selection of projects that yield an unduly low return. This causes a waste of scarce capital resources, which is also unfavourable to economic growth.

From an information flow point of view, the use of inadequate means of investment appraisal results in a damaging restriction in the flow of information to top management, since these methods are incapable of fully exploiting relevant data. Because a

company's future is inextricably linked to its investments, poor appraisal methods that give poor information that leads to poor decisions are likely to result in many mistakes.

Realistic investment appraisal requires the financial evaluation of many factors, such as the choice of size, type, location, and timing of investments, giving due consideration to the effects of taxation and alternative forms of financing the outlays. This shows that project decisions are difficult on account of their complexity and their strategic significance.

No matter which technique is adopted for investment appraisal the same steps will need to be followed. These steps are:

1 Determine the profitability of each proposal
2 Rank the proposals in accordance with their profitability
3 Determine the cut-off rate (e.g. minimum acceptable rate of return)
4 Determine which projects are acceptable and which unacceptable in relation to the cut-off rate
5 Select the most profitable proposals in accordance with the constraints of the company's available funds.

Cash flows

In considering investment decisions, it does not matter whether outlays are termed 'capital' or 'operating', nor whether inflows are termed 'revenue', 'tax allowance' or whatever. All outlays and inflows must be taken into account in cash flow terms.

Cash flow in this context is not the same as the cash flow through a bank account, nor is it identical to accounting profit, since changes in the latter can occur without any change taking place in the cash flow. For purposes of investment appraisal, the cash flow is the incremental cash receipts less the incremental cash expenditures solely attributable to the investment in question.

The future costs and revenues associated with each investment alternative are:

1 *Capital costs*. These cover the long-term capital outlays necessary to finance a project, and working capital. (Since residual working capital is recoverable at the termination of a project's life, this leads to the investment having a terminal value that should be taken into account.) Typically, additional working capital will be required to cover a higher inventory, or a larger number of debtors, and to be worthwhile the project must earn a return on this capital as well as on the long-term capital.
2 *Operating costs*.
3 *Revenue*.
4 *Depreciation*. In the case of the discounting methods of appraisal (discussed below), the recovery of capital (i.e. depreciation) is automatically allowed for from the net cash flow, so depreciation need not be included as an accounting provision. This has the important advantage that the discounted profitability assessment is not affected by the pattern of accounting depreciation chosen.

5 *Residual value*. As with working capital, the residual assets of the project may have a value (as either scrap or in an alternative use or location). This residual value (net of handling costs and tax allowances or charges) should be included within the net cash flow.

An investment decision implies the choice of an objective, a technique of appraisal, and a length of service – the project's life. The objective and technique must be related to a definite period of time. In a static world that period would quite naturally be taken as being equal to the commercial life of the plan that is the purpose of the investment, which may be known with a good deal of certainty on the basis of past experience. However, in a dynamic world the life of the project may be determined by:

➡ Technological obsolescence, or
➡ Physical deterioration, or
➡ A decline in demand for the output of the project – such as a change in taste away from the market offering.

No matter how good a company's maintenance policy, its technological forecasting ability or its demand forecasting ability, uncertainty will always be present because of the difficulty of predicting the length of a project's life.

Time value of money

To permit realistic appraisal, the value of a cash payment or receipt must be related to the time when the transfer takes place. In particular, it must be recognized that £1 received today is worth more than £1 receivable at some future date, because £1 received today could be earning interest in the intervening period. This is the concept of the *time value of money*.

To illustrate this, if £100 was invested today at 5 per cent per annum compound interest, it would accumulate to £105 at the end of one year (i.e. £100 $\times$ 1.05), to £110.25 at the end of two years (i.e. £100 $\times$ 1.05 $\times$ 1.05, or £105 $\times$ 1.05), and so on. In other words, £110.25 receivable in two years' time is only worth £100 today if 5 per cent per annum can be earned in the meantime (i.e. £110.25/(1.05 $\times$ 1.05) = £100).

The process of converting future sums into their present equivalents is known as *discounting*, which is simply the opposite of *compounding* (see Figure 14.22). Compounding is used to determine the *future value* of present cash flows.

Another example will clarify this further. An investor who can normally obtain 8 per cent on his investments is considering whether or not to invest in a project that gives rise to £388 at the end of each of the next three years. The present value of these sums is:

$$\frac{£388}{1.08} + \frac{£388}{1.08 \times 1.08} + \frac{£388}{1.08 \times 1.08 \times 1.08} = £1000$$
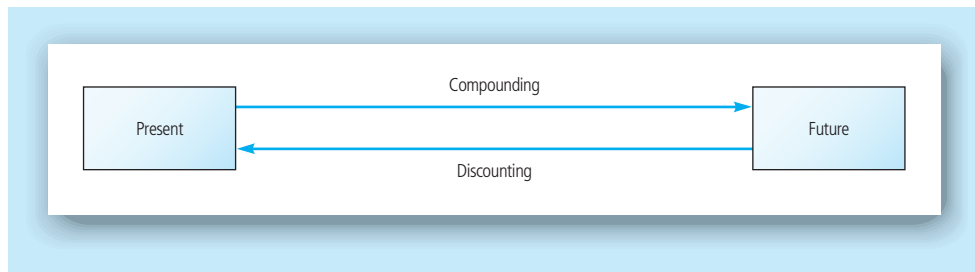
Figure 14.22 Discounting and compounding

If the investment's capital cost is less than the present value of its returns (say £800), then it should be accepted, since the present value of the return on this outlay is a larger amount (i.e. £1000 − £800 = £200 gain from the investment). The gain is the *net present value* of the investment.

The interest rate does not always relate to an outlay of borrowed cash, as the concept of interest applies equally to the use of internal funds. The reason why interest must be considered on *all* funds in use, regardless of their source, is that the selection of one alternative necessarily commits funds that could otherwise be invested in some other alternative. The measure of interest in such cases is the return foregone by rejecting the alternative use (i.e. the opportunity cost).

Financial evaluation

The techniques of financial evaluation fall into two categories, as shown below.

Traditional methods of evaluation

The payback period is the most widely used technique and can be defined as the number of years' net cash flow required to recover the initial cash outlay on the investment. By definition, the payback period ignores cash flows beyond this period and it can thus be seen to be more a measure of liquidity than of profitability. In addition, it fails to take account of the time value of money, and these limitations make it seriously defective in the aim of reflecting the relative financial attractiveness of projects.

Projects with long payback periods are characteristically those involved in strategic planning and that determine an enterprise's future. However, they may not yield their highest returns for a number of years and the result is that the payback method is biased against the very investments that are likely to be most important to long-term success.

The accounting rate of return is defined as the average profit from the project (after allowing for accounting depreciation but before tax) as a percentage of the average required investment. This method is fundamentally unsound. While it does take

account of the anticipated profits (rather than cash flows) over the entire economic life of a project, it fails to take account of the time value of money. This weakness is made worse by the failure to specify adequately the relative attractiveness of alternative proposals. It is biased against short-term projects in the same way that payback is biased against longer-term ones.

These traditional methods of investment appraisal can be misleading to a dangerous extent. A means of measuring *cash* against *cash* that allows for the importance of time is needed. This is provided by the discounting methods of appraisal, of which there are basically two, both of which meet the objections to the payback period and accounting rate of return methods.

Discounting methods of evaluation

Both the main discounting methods relate the estimates of the initial cash outlays on the investment to the annual net after-tax cash flows generated by the investment. As a general rule, the net after-tax cash flows will be composed of profit less taxes (when paid), plus depreciation. Since discounting techniques automatically allow for the recoupment of the capital outlay (i.e. depreciation) in computing time-adjusted rates of return, it follows that depreciation implicitly forms part of the discounting computation and so must be added back to profit in specifying cash flow.

The *internal rate of return* (IRR; or discounted cash flow) method consists of finding that rate of discount that reduces the cash flows (both inflows and outflows) attributable to an investment project to zero – this being, in principle, the true rate of return. (In other words, this 'true' rate is that which exactly equalizes the discounted net cash proceeds over a project's life with the initial investment outlay.)

If the IRR exceeds the minimum required rate (or *cost of capital*) then the project is prima facie acceptable.

Instead of being computed on the basis of the average investment, the IRR is based on the funds in use from period to period.

The actual calculation of the rate is a hit-and-miss exercise because the rate is unknown at the outset, but tables of present values are available to aid the analyst. These tables show the present value of future sums at various rates of discount, and are prepared for both single sums and recurring annual payments (i.e. annuities).

The *net present value* (NPV) method discounts the net cash flows from the investment by the minimum required rate of return, and deducts the initial investment to give the yield from the funds invested. If this yield is positive, then the project is prima facie worthwhile, but if it is negative the project is unable to pay for itself and is thus unacceptable. An index can be developed for comparative purposes by relating the yield to the investment to give the yield per £1 invested. This is the *present value index* and facilitates the ranking of competing proposals in order of acceptability. (It is not important in their evaluation in terms of present value that competing proposals require widely different outlays, since the index reduces alternatives to a common base.)

Comparison of discounting methods

In ordinary circumstances the two discounting approaches will result in identical investment decisions. However, there are differences between them that can result in conflicting answers in terms of ranking projects according to their NPV or IRR.

In formal accept/reject decisions both methods lead to the same decision, since all projects having a yield in excess of the minimum required rate will also have a positive net present value. Figure 14.23 shows that this is so.

Example: Projects A and B both require an outlay of £1000 now to obtain a return of £1150 at the end of Year 1 in the case of A, and £1405 at the end of Year 3 in the case of B. The minimum required rate of return is 8 per cent.

Both projects have rates of return in excess of 8 per cent *and* positive net present values, but on the basis of the IRR method Project A is superior, while on the basis of the NPV method Project B is superior.

Confusion arises because the projects have different lengths of life and if only one of the projects is to be undertaken (i.e. they are mutually exclusive), the IRR can be seen to be unable to discriminate satisfactorily between them. As with any rate of return, there is no indication of either the *amount* of capital involved or the *duration* of the investment. The choice must be made either on the basis of net present values or on the return on the *incremental investment* between projects. (In the above example, of course, the same amount of investment is required for each; thus, Project B is to be preferred on the strength of its higher net present value.)

The two methods make different implicit assumptions about the reinvesting of funds received from projects – particularly during the 'gaps' between the end of one and the end of another.

Considering the example further, if it is explicitly assumed that the funds received from Project A can be reinvested at 10 per cent per annum between the end of Years 1 and 3, the situation will be as shown in Figure 14.24.

All three formulations clearly show Project B to be superior, illustrating the importance of project characteristics when only one can be undertaken.

The NPV approach assumes that cash receipts can be reinvested at the company's minimum acceptable rate of return, thereby giving a bias in favour of long-lived projects.

Internal rate of return:	A = 15%
	B = 12%
Net present value	A = (1,150 × 0.926) − 1,000 = £65
	B = (1,405 × 0.794) − 1,000 = £115

Note: 0.926 is the factor that reduces a sum receivable one year hence, at a discount rate of 8 per cent, to its present value; and 0.794 is the discount factor that reduces a sum due three years hence to its present value. These discount factors are derived easily from published tables.

Figure 14.23   Ranking comparisons – 1

IRR	A = (15 + 10 + 10) ÷ 3	= 11.667%
	B (as Fig. 14.23)	= 12%
NPV	A = [(150 × 0.926) + (115 × 0.857) + (1126 × 0.794)] − 1,000 =	£32
	B (as Fig. 14.23)	= £115
Terminal value:	A = (1,150 × 110% × 110%)	= £1,391
	B (as given)	= £1,405

Figure 14.24 Ranking comparisons – 2

In contrast, the IRR approach assumes that cash receipts are reinvested at the same rate (i.e. a constant renewal of the project), giving a bias in favour of short-lived projects.

It follows that the comparison of alternatives by either method must be made over a common time period, with explicit assumptions being made about what happens to funds between their receipt and the common terminal date.

Aspects of application

Alternative proposals

The selection of a particular proposal should follow a careful appraisal of both alternative uses for funds and alternative means of performing a particular project. For instance, a company may wish to double the capacity of its production line and determine three means of accomplishing this, namely:

1 Introduce double-shift working
2 Install a second production line
3 Scrap the existing production line and build a new line with double the initial capacity.

The choice of a particular alternative will depend on how it accords with the enterprise's established investment objectives, and the choice of projects will depend on both corporate objectives and the availability of funds. But the fact remains that if the most advantageous alternative has been overlooked, no amount of technical evaluation and appraisal can overcome this basic omission.

Capital rationing

In terms of financing investment projects, three essential questions must be asked:

1 What funds are needed for capital expenditure in the forthcoming planning period?
2 What funds are available for investment?
3 How are funds to be assigned when the acceptable proposals require more than are currently available?

The first and third questions are resolved by reference to the discounted return on the various proposals, since it will be known which are acceptable and in which order of preference.

The second question is answered by a reference to the *capital budget*. The level of this budget will tend to depend on the quality of the investment proposals submitted to top management. In addition, it will also tend to depend on:

➡ Top management's philosophy towards capital spending (e.g. is it growth-minded or cautious?)
➡ The outlook for future investment opportunities that may be unavailable if extensive current commitments are undertaken
➡ The funds provided by current operations
➡ The feasibility of acquiring additional capital through borrowing or share issues.

It is not always necessary, of course, to limit the spending on projects to internally generated funds. Theoretically, projects should be undertaken to the point where the return is just equal to the cost of financing these projects.

If safety and the maintaining of, say, family control are considered to be more important than additional profits, there may be a marked unwillingness to engage in external financing, and hence a limit will be placed on the amounts available for investment.

Even though the enterprise may wish to raise external finance for its investment programme, there are many reasons why it may be unable to do this. For example:

➡ The enterprise's past record and its present capital structure may make it impossible, or extremely costly, to raise additional debt capital
➡ Its record may make it impossible to raise new equity capital because of low yields – or even no yield
➡ Covenants in existing loan agreements may restrict future borrowing.

Furthermore, in the typical company, one would expect capital rationing to be largely self-imposed.

Post-audit

Each major project should be followed up to ensure that it conforms to the conditions on which it was accepted, as well as being subject to cost control procedures.

An example

The following example illustrates the importance of accurate forecasts of cash flows (representing sales value, cost of sales, operating costs, and initial investment). Taxation is deliberately ignored. (The example is adapted from Winer, 1966.)

A proposal has been put forward in the form of a marketing plan to launch a new line of toys. Cash flow forecasts are shown in Figure 14.25. Note that depreciation is not, in fact, a cash cost. It is shown here simply as a footnote to indicate that there will be no cash inflow at the end of Year 5 from the sale of the equipment, since that equipment is not expected to have any residual value at that point in time.

The evaluation of the plan is shown in Figure 14.26, which is largely self-explanatory. Cost of capital is shown as being 18 per cent. This can be taken to be the minimum required rate of return from the plan (thus reflecting equivalent returns from alternative plans of comparable risk). The plan's net present value is £447 000,

Proposal	Add a new line of toys
Cash investment (£'000s)	
Production equipment	1,000
Recruiting and training salesmen	100
Promotional material	10
Inventory and debtors	190
	1,300
Projected sales volume (£'000s)	
Year 1	600
Year 2	1,000
Year 3	1,200
Year 4	1,000
Year 5 (final year)	800
Cost of sales	30% of sales value
Direct operating costs	£100,000 per annum
Depreciation of equipment	£200,000 per annum. No salvage value.

Figure 14.25   Cash flow projections (adapted from Winer, 1966)

(£'000s)	Year 0	1	2	3	4	5
1 Cash investment	(1,300)					
2 Sales revenue		600	1,000	1,200	1,000	800
3 Cost of sales		(180)	(300)	(360)	(300)	(240)
4 Operating costs		(100)	(100)	(100)	(100)	(100)
5 Recovery of investment in inventory and debtors						190
6 Cash flows	(1,300)	320	600	740	600	650
7 Discount factor at 18%	1.00	0.847	0.718	0.609	0.516	0.437
8 Discounted cash flow	(1,300)	271	431	451	310	284
9 NPV	447					

Figure 14.26   Cash flow analysis and evaluation (adapted from Winer, 1966)

which results when the discounted inflows and outflows are summed and the initial investment deducted from the total:

Total discounted value of inflows and outflows from Year 1 to year 5	£1,747,000
Initial investment	£1,300,000
Net present value	£447,000

From these figures it is also possible to calculate the PV index:

$$\frac{£1,747,000}{£1,300,000} = 1.34$$

In other words, the plan promises to generate £1.34 for every £1.00 invested in it, expressed in terms of current £s. Since the PV index exceeds unity (hence the NPV is positive), the plan appears to be economically viable. However, various additional questions need to be raised, such as:

➡ Is there sufficient funding available to meet the initial investment requirements of £1 300 000?

➡ Can the plan be modified to earn even more than £1.34 per £1.00 of investment?

➡ Are there alternatives available that may be more attractive?

➡ How sensitive is the plan's NPV to changes in flow estimates, including their timing?

From the data given in Figure 14.26, it is possible to calculate the payback period of the plan and the accounting rate of return, as outlined below.

Payback period is the length of time it takes to recover the initial investment.

		£'000s
	Year 1	320
	Year 2	600
380/740	Year 3	380
		1,300

It will be two years and 187 days (assuming an even pattern of inflows). The investment is exposed, therefore, over half of the anticipated life of the plan.

The accounting rate of return is an accounting (rather than cash flow) measure of the average profitability of the plan.

➡ Average profits will be (in £'000s):

$$\frac{£(320 + 600 + 740 + 600 + 460)}{5} - £200$$

$$\frac{£2,720}{5} - £200 = £344$$

It is necessary to deduct depreciation as an expense in calculating the average accounting profit.

➡ Average investment will be (in £'000s)

$$\frac{£1{,}300 - £190}{2} = £555$$

➡ The ARR will be:

$$\frac{£344}{£555} \times 100 = 62\%$$

Valuing market strategies

Mention was made in Chapter 13 of the criterion of enhanced shareholder value. This has been adopted by Day and Fahey (1988) in their approach to strategy evaluation. Since the basic premise of this approach is that shareholders' interests should be maximized, it will be apparent that it is a partial approach that ignores other stakeholders' interests. Moreover, since maximizing the current market value of shareholders' interests presumes that the shares themselves are listed, this restricts Day and Fahey's approach to a little over 2200 of the total of more than 1 million limited companies incorporated within the UK.

Value is created whenever the financial gains from a strategy exceed its costs. The use of discounting methods allows for both the timing of cash flows and the inherent riskiness of marketing strategies in measuring the value of the latter. A potential shareholder will only invest in an enterprise if it is his or her expectation that the management of that enterprise will generate a better return than he could obtain himself, at a given level of risk. The minimum expected return is the cost of capital (i.e that rate used in discounting); hence, shareholder value is only created when activities are undertaken that generate a return in excess of the cost of capital.

The usual approach adopted in assessing the shareholder value of an enterprise is to discount the anticipated cash flows by the risk-adjusted cost of capital. If a new strategy is in prospect then the shareholder value will be the sum of the value to be derived from the new strategy plus the 'baseline' value, reflecting the value that is expected to result from continuing the existing strategy. This gives a basis for comparing strategic alternatives in a way that highlights their respective contributions to value. Thus:

Estimated shareholder value if strategy X is selected	=	Estimated value contributed by strategy X	+	Baseline shareholder value
∴ Estimated value of strategy X	=	Estimated shareholder value if strategy X is selected	−	Baseline shareholder value

When several competing strategies are being evaluated in a situation where there are insufficient resources to undertake all available strategies that meet the specified economic criterion (e.g. offer a positive net present value when discounted at the risk-adjusted cost of capital), the recommended basis for ranking acceptable strategies is by use of the PV index. This shows how much value is created per £1 of investment:

$$\text{PV index} = \frac{\text{Present value of strategy}}{\text{Investment required}}$$

In using this approach to evaluating strategies, there needs to be available:

➡ Cash inflow and outflow forecasts relating to each alternative strategy
➡ Cash flow forecasts relating to the baseline strategy
➡ A suitable discount factor (i.e. the risk-adjusted cost of capital)
➡ Alternative scenarios to allow the sensitivity of the outcomes to changes in the inputs to be tested.

Even if all these information requirements can be met, there is inevitably a large element of subjectivity involved; in part this will be included within the estimates of cash flows, etc., and in part it will reflect both the specification of the strategy and the interpretation of results from the analysis. It is suggested that all assumptions involving judgements be specified explicitly in order that their appropriateness can be gauged by others.

The steps to follow in carrying out a strategic evaluation to enhance shareholder value are:

1 Derive cash flow forecasts from the managerial judgements relating to competitive and market responses to each strategic alternative
2 Adjust the forecasts from point 1 for risk and timing prior to calculating the NPV of each strategy and relating these NPVs to baseline expectations in order to gauge the increase in shareholder value from each alternative
3 Select the strategy that offers the greatest increase in shareholder value and implement it.

It is implicit in this sequence of steps that:

➡ The value creation potential of each strategic alternative relative to the baseline strategy can be accurately predicted
➡ The shareholder value criterion is applicable to all strategic alternatives having cash flow implications
➡ The stock market will recognize and reward strategies that enhance shareholder value.

Each of these matters raises fundamental questions. For example, our ability to predict accurately is limited for reasons of uncertainty as well as personal bias, and the stock market is not a perfect market (and so does not have perfect information on which to

base its reactions). Nevertheless, by focusing on cash flows rather than accounting data, and by taking a long-term perspective rather than a short-term one, the approach advocated by Day and Fahey has distinct benefits as well as limitations.

Support for variations on this 'economic value' approach has come from a range of sources. Buzzell and Chussil (1985), for example, have argued that it is rare for managers to evaluate strategies in terms of their effects on future value. This suggests that many enterprises are failing to achieve their full potential by using inappropriate methods for strategic evaluation, and by emphasizing short-run financial results at the expense of long-term competitive strength.

14.5 Summary

Given the specification of marketing programmes in Chapters 11 and 12, and the specification of choice criteria in Chapter 13, this chapter has sought to show some of the ways in which marketing programmes might be evaluated by using financial modelling approaches embodying the appropriate criteria.

The principles of modelling were reviewed and developed via a consideration of short-run financial modelling (using cost–volume–profit analysis) and long-run financial modelling (using investment appraisal methods).

A model is, in essence, a simplified representation of a situation or process that needs to be analysed, evaluated or controlled. The representation can be symbolic, mathematical or physical. In using financial models such as those dealt with in this chapter, it is necessary to bear in mind the limitations of such models. In particular, financial systems measure those things that can be measured by financial systems, and in a marketing context there are typically many additional issues that cannot be adequately reflected in financial models.