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# Cost Accounting

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**Stage 2**

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Second edition



HEINEMANN PROFESSIONAL PUBLISHING

*To Pud, D.D. and Poj*

Heinemann Professional Publishing Ltd  
Halley Court, Jordan Hill, Oxford OX2 8EJ

OXFORD LONDON MELBOURNE AUCKLAND SINGAPORE  
IBADAN NAIROBI GABORONE KINGSTON

First published 1988  
Second edition 1989

© Mark Lee Inman 1988, 1989

**British Library Cataloguing in Publication Data**

Inman, Mark Lee

Cost accounting.

1. Cost accounting

I. Title

657'.42      HF5686.C8

ISBN 0 434 90832 0

Printed in Great Britain by  
Redwood Burn Ltd, Trowbridge

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# Preface

It was with a sense of honour and pride that I accepted the commission to write the cost accounting text for the Chartered Institute of Management Accountants' series of textbooks for the 1987 syllabus.

In the almost seventy years of its existence, cost accounting has been the very essence of the CIMA and any such text would have to follow a tradition of excellence forged by very illustrious predecessors indeed. In approaching the task, therefore, I have been mindful of the traditions of the CIMA as well as the needs of students in the final years of the twentieth century. Inevitably, there is much that is traditional in the text's approach. It aims to match a syllabus that assumes very little previous knowledge, building where appropriate on Stage 1 and conversion introductory studies, and then prepares the student to tackle a very critical Stage 2 examination. To achieve this, the approach has been to build a definite bridge between the introductory subjects, by laying a very thorough foundation for the Stage 3 management accounting techniques paper and the final management accounting papers. In attempting to achieve this, there has also been cognisance of the need to relate across to the parallel financial accounting and management papers. The student will notice that he/she is introduced to some basic quantitative analysis very early on. There are two reasons for this. First, to keep the student's 'hand in' on basic quantitative analysis learned from Stage 1, and secondly to ease the inevitable trauma that many non-mathematical students perceive associated with Stage 3 management accounting techniques. I should, however, emphasize that this book in no way prepares the student adequately for Stage 3. There is, however, a by-product to this approach. Students preparing for the final Level of the Accounting Technicians examinations, and the Level 1 Cost Accounting paper for the Chartered Association of Certified Accountants will find this book covers most of their syllabus. It will also provide graduates, exempt from CACA Level 1 with a useful introduction to the Level 2 Management Accounting paper.

Essentially, the approach has been a traditional discourse through

the basic elements of cost and cost collection, moving into cost accounting techniques and methods. New to cost accounting textbooks is a chapter on the presentation of information to the users of cost accounting information. Aware of developments in cost accounting mechanics, some introductory coverage has been given to quantitative models, such as inventory models and linear programming, to the impact of the SSAPs where they affect the cost accountant, and where there is controversy, space has been given over to a discussion on the research as it stands to date. This has been done, not purely to give academic respectability, but to help the student prepare for discursive written questions, and to maintain a healthy interest in his/her subject and its relevance to everyday tasks.

At the end of each chapter, there is a selection of questions, and I am grateful to the CIMA and the CACA for permission to use questions from recent papers.

I must, however, include an apology to the students. After many years of lecturing to various groups of students, I have always endeavoured to show where a figure has come from. This has meant that lecture boards have usually been covered with a maze of vivid green lines! I apologize for their absence in the text, but every effort has been made to ensure that worked examples are clearly described and annotated.

Additionally, a book is many people. My debt must be to the staff of the excellent CIMA library for providing much of the background material, searching the literature, and unearthing obscure but vital articles, and often despatching them to me at very short notice. Soot and her excellent team have been wonderful, and without their efforts this text would have been lacking indeed. My thanks must also go to John Hilary and to John Frew for permission to use material hitherto published in *Management Accounting* and the *Students Newsletter*. To the BTEC (Higher) management accounting class of 1987 at the Central London Polytechnic who were guinea pigs for many of my teaching ideas and suffered handouts made of experimental portions of text, as well as having to work out many of the examples. It says much for the critical and analytical ability of these students that twelve of the twenty-eight attained distinctions in their final examinations. The 1987 CACA2.4 class of the Polytechnic of North London have also been guinea pigs and have made useful contributions. To friends and colleagues Anne Chan MSc FCCA, (Member of Council CACA), John K. Cunningham MA FCA, John Lane MBIM MIIM MIMS FInstD, Carolyn Malinowski BSc. ACMA, Denise J. Donovan BSc. ACA FInstD and W. Stuart Cole MSc., FInstT who read portions of the text, and/or gave valuable specialist advice and comment. However, any mistakes must be my own!

And finally, to my wife, Christine, and two sons, David Duncan and Malcolm, who tolerated endless hours of me locked away with an IBM word processor!

*Mark Lee Inman*  
*Brentwood, Essex*  
*May 1989*

# 1 Introduction

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## Definitions

The current (January 1986) edition of the *CIMA Terminology* defines cost as:

**noun** 'The amount of expenditure (actual or notional) incurred on, or attributable to, a specific thing or activity.'

**verb** 'To ascertain the cost of a specified thing or activity.'

To these definitions, the CIMA adds the footnote that 'the word *'cost'* can rarely stand alone and should be qualified as to its nature and limitations.'

Not surprisingly, the *CIMA Terminology* immediately follows up with a definition of Cost Accounting, which is 'that part of management accounting which establishes budgets and standard costs and actual costs of operations, processes departments or products and the analysis of variances, profitability or social use of funds'. The traditional term 'costing' is not recommended.

Since this book is a basic preparation for future advanced management accounting studies, and since the CIMA definition above refers to 'management accounting' we reproduce the *Terminology* definition viz., The provision of information required by management for such purposes as:

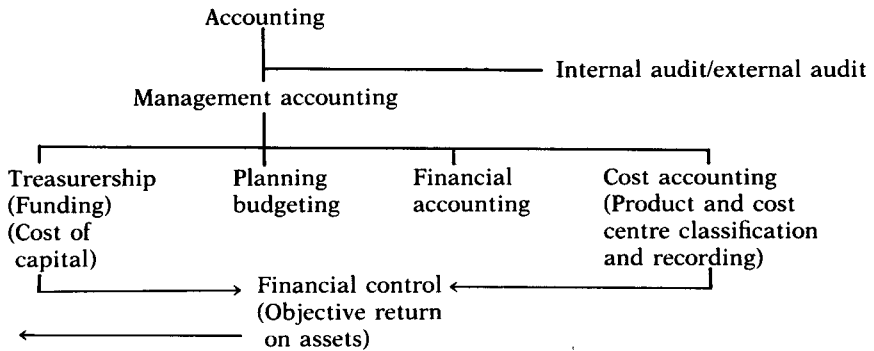
- 1 Formulation of policies.
- 2 Planning and controlling the activities of the enterprise.
- 3 Decision taking on alternative courses of action.
- 4 Disclosure to employees.
- 5 Disclosure to those external to the entity.
- 6 Safeguarding the assets.

To that end, the above involves participation in management to ensure that there is effective:

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- (a) Formulation of plans to meet objectives (long-term planning).
- (b) Formulation of short-term operation plans (budget/profit planning).
- (c) Recording of actual transactions (financial accounting and cost accounting).
- (d) Corrective action to bring future actual transactions into line (financial control).
- (e) Obtaining and controlling finance (treasurership).
- (f) Reviewing and reporting on systems and operations (internal audit/management audit).

For the reader to see the vital importance of the cost accounting function within the operations management team, we now reproduce a combination of two organizational charts in the *Terminology*.



In the context of SSAP9 (see page 9), cost is defined as being that expenditure which has been incurred in the normal course of business in bringing the product or service to its present location and condition. This expenditure should include, in addition to the cost of purchase, such costs of conversion as are appropriate to that location and condition. (SSAP9 paragraph 17.)

These definitions contrast markedly from the economist approach such as those cited by Armand Layne. For example, Alchian's 1972 definition of cost is 'the highest valued opportunity necessary forsaken'. The reader will observe a blatant flavour of pure economics here, but since we will need to consider opportunity costs, choice and implications for decision making below, the economists' approach should not be dismissed entirely.

Armand Layne's (1984) own definition of cost accounting is, however, close in concept to that of the CIMA. He defines cost accounting as 'a conscious and rational procedure by accountants for accumulating cost (however defined) and relating such costs to specific products or departments for effective management action. Such costs are used in balance sheets and income statements for the purposes of stock valuation and income determining'.

As we progress through the book, we shall effectively explore and

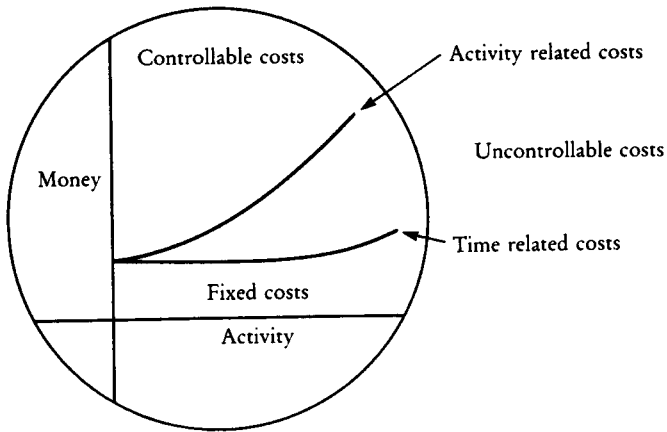


Figure 1.1 *The costing accounting environment*

expand on these two definitions. We shall consider costs, cost collection, cost analysis and techniques as they relate to goods and services. Likewise, we shall look at standards, budgets, analysis of variances or deviations from standard, and effective utilization of funds.

### **The environment of cost accounting**

Figure 1.1 is designed to illustrate the environment of cost, and the components of cost. The circle can represent any organization. Costs within the organization can be controlled and contained. The familiar x and y axes depict time/activity level and money. It is a basic concept of accounting that money is always used as a means of measuring. On the graph are two basic types of cost, *fixed or time related* and *variable or activity related*. An earlier edition of the *CIMA Terminology* defined fixed costs as 'a cost which accrues in relation to the passage of time and which, *within certain output and turnover limits*, tends to be unaffected by fluctuations in the level of output or turnover. Examples of such costs are rent, rates, insurance and staff costs.

The constraint *within certain output and turnover limits* is vital. From Figure 1.1 it will be evident that a point can be envisaged where output, turnover or activity can accelerate away and require not just a similar acceleration in activity related costs, but an increase in fixed or time related costs. The most obvious example of this would be a thriving business where activity expands and reaches a point where additional premises or equipment are required. By contrast, *variable costs* are defined as 'a cost which tends to follow (in the short term) the level of activity'. Traditionally, examples of such costs have been materials used, direct labour and selected overheads such as power exclusively

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used to drive machines. Reality nowadays is however, somewhat different. Materials are only used if there is activity, something is being made or sold. However, as a result of legislation, guaranteed wages and union agreements, labour costs have become virtually fixed in many western countries, although this trend is likely to be reversed as the century draws to a close. (Chalos and Bader 1986.) By the same token, many of the overheads for practical purposes cannot be readily activity related, or the activity related portion is so relatively small in proportion to the total to be immaterial.

From Figure 1.1, therefore, we can envisage costs as having a relationship with activity, either as the direct cost of operating the activity, or as a result of maintaining the level of activity in terms of available facilities. However, there is a third factor that needs to be considered. Beyond the circle in Figure 1.1 is the external environment. No organization can operate independently of its environment. It is the environment that will dictate the demand for its goods or services, the prices that can be commanded, the share of the market that can be obtained. Obviously, the environment, that creates an inelastic demand for the organization's goods or services will create a different internal environment from that where competition is tough and prices keenly competed for. The internal priorities will be very different. Likewise, the environment can, and will, influence costs, material and labour prices and availability, as well as the cost of the overheads, many of which will be very difficult to control or respond to in the short time. All these factors will have a bearing on the cost accounting procedures and the use of cost accounting information.

#### The uses of cost accounting

Effective management needs *information*. Cost accounting is a set of procedures which takes raw data, and refines it into usable information. Some of this information is for what Charles Horngren calls *scorekeeping*, i.e. ascertaining the cost of any ongoing activity, or even computing the net revenues. Another type of information is *attention directing*; that which is designed to draw management's attention to a situation, and motivate it into doing something about it. A third category can be identified as statistics and valuations – the correct valuation of stocks, the use of cost information and data banks.

Another approach, put forward by Mearns (1981) is that cost accounting is needed in the exercising of the management functions of *planning, decision making and control*. Combining the two concepts will help us to perceive the role of the cost accounting function. (See Figure 1.2.)

The reader, as a potential cost accountant will be comforted and gratified by the fact that cost accounting procedures will be required at almost every stage of the diagram. Going through the Figure 1.2 we will find that the cost accountant will be in on the planning process, costing every aspect of the original plan. Where the alternatives are



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of the cost accountant's role that has been hitherto avoided. From basic financial accounting, the reader will recall that the gross profit was computed as follows:

$$\text{Gross profit} = \text{Sales} - (\text{Cost of sales})$$

By the same token:

$$\text{Cost of sales} = \text{Opening stock} + \text{Purchases} - \text{Closing stock}$$

The evaluation of the closing stock, essential to the computation of profit, is yet another important, albeit statistical, role within the function and use of cost accounting.

A final aspect of the uses of cost accounting refers back to Figure 1.1. Economists emphasize that price is a function of demand. Demand is part of the environmental influences upon costs and prices. Prices are formulated to be based on two essential factors:

- 1 What the market will pay.
- 2 What it costs to provide the good or service.

Thus in the pricing decision process, cost accounting produces the costs, and indicates the areas where savings may be made if there is a problem where costs appear to be greater than the price the market will bear.

### **A review of terms associated with costing**

Despite the efforts over the years of the CIMA in formulating a terminology for cost accounting a number of traditional and synonymous terms and ideas still pervade both the accounting literature and the board room. To help readers clarify their own ideas, it will be helpful to review these terms, and point out where they are no longer used or felt appropriate.

#### ***Direct costs***

The *Terminology* identifies direct cost of sales, labour rate, expenses and materials cost. Clearly the key word here is 'direct' and this means costs which can be *directly related to a specific product or saleable service*. For example, an interior decorator has a contract to paint and wallpaper a room. Before starting, he will buy paint and paper specifically for the job. The cost of the paint and wallpaper is directly attributed to the job.

#### ***Indirect costs***

Inevitably, these are costs that *cannot be specifically attributed to a good or service*. Staying with the interior decorator, while the paint and paper will be specific to the job in hand, the cost of cleaning materials for his brushes will be an indirect material cost.



**Fixed costs**

We have already encountered fixed or time related costs, and the constraints related to them. It is worth emphasizing that there is a viewpoint that argues that ultimately no cost is fixed, since eventually the circumstances influencing it will change. Rent is a fixed cost over the period under review. However, it is subject to review, changing the cost, while the demands of the environment over time may require larger or smaller premises, causing a change in the rent cost.

**Variable costs**

Variable costs are all activity related. What is important at this juncture however is the consideration that the variable costs are not always linear in their relationship with activity. Indeed, this is why the lines are drawn with curves in them in Figure 1.1. As the reader progresses with his or her knowledge of cost and management accounting, this point will come more to the fore. For example, as activity increases, there is likely to be the opportunity to bulk buy, or to exert greater purchasing power, which will reduce the costs of materials or services. Similarly, operatives will become more familiar with the job(s) they are doing, and tend to work faster and make fewer mistakes.

**Prime cost**

This is a term that has been around almost since the advent of cost accounting. The *Terminology* defines it as 'the total cost of direct materials, direct labour and direct expenses'. As a result of the influences of SSAP9 on cost accounting, prime cost is a term now restricted to *direct production (i.e. manufacturing) costs only*, and therefore would exclude any direct costs of marketing or developing a product.

**Conversion cost**

This was a term introduced by SSAP9 and is defined in the *Terminology* as the 'costs of converting material input into semi-finished or finished products, i.e. additional direct materials, direct wages, direct expenses and absorbed production overhead'. The reader will readily see that prime cost and conversion cost overlap in the area of direct labour and expenses. To avoid confusion therefore, we will ignore the term 'prime cost' and refer to material and conversion cost.

**Cost behaviour**

The reader will appreciate from Figure 1.1 that costs respond to the environment both within and outside the organization. This is described as *cost behaviour*, and defined as 'the way in which costs per unit of output are affected by fluctuations in the level of activity'. The

## 8 Cost Accounting

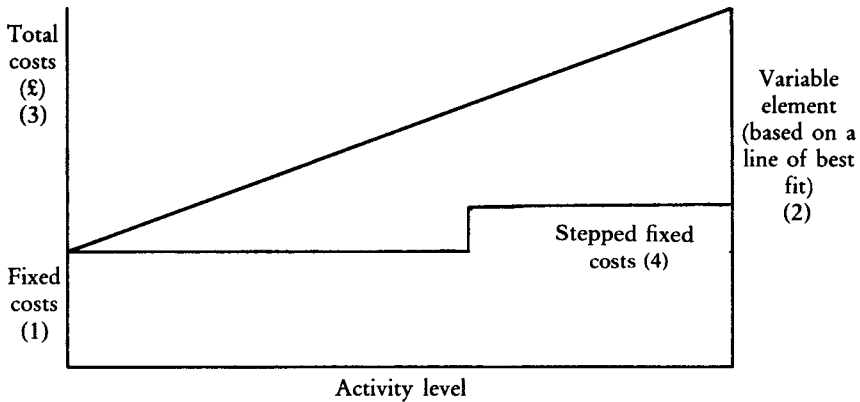


Figure 1.3 Cost behaviour analysis (after the terminology)

*Terminology* identifies both behaviour of costs in aggregate, and behaviour of costs per unit. (See Figure 1.3.)

From Figure 1.3 we can identify:

- 1 Fixed (or time related) costs remaining unchanged irrespective of activity levels.
- 2 Variable costs which change, although not always with a linear relationship, with activity.
- 3 Total costs which are made up of both fixed and variable costs.
- 4 Stepped fixed costs, where a fixed cost increases dramatically as a result of increased activity. It has been already suggested that fixed costs will change because of environmental influences. We have suggested that rent is a fixed cost. If, however, activity demands more premises, then the rent will increase sharply, although there will be no change of activity, and then continue at this new level until further or perhaps different premises are acquired.

In addition we should identify semi-fixed or semi-variable costs. These are costs that have a mixture of variable and fixed components in them. The telephone has a fixed cost element, the rental of the equipment, and a variable element, the unit charge per call. However, the variable element illustrates another point, it is variable only on the basis of usage, and the amount it is used may have no relationship to activity level at all. Indeed, it may well be quite the reverse, poor sales may require greater usage of the telephone to attract further business and orders, or poor production may mean using the telephone more to contact maintenance engineers and/or suppliers.

Under the heading *cost per unit* it will be apparent that fixed costs decrease per unit as activity increases, while variable costs will either remain unchanged or decrease as a result of bulk discounts and learn-

ing curves. In general, total unit costs, made up of fixed and variable elements, will decrease as activity increases.

### **Note on SSAP9**

The reader will have already seen several references to SSAPs (Statements of Standard Accounting Practice) which are issued by the Accounting Standards Committee and have approval of the councils of all the accountancy bodies in England, Scotland and Ireland. Essentially, they describe approved methods of accounting. In the context of cost accounting SSAP9, (Stock Valuation) is very important, and likely to be referred to frequently. To assist in the studying of cost accounting in the context of SSAP9, the attention of the reader is drawn at the outset to the following paragraphs and definitions.

#### **Paragraph 18**

The cost of purchase comprises purchase price (of direct materials) including import duties, transport and handling costs and any other directly attributable costs, less trade discounts, rebates and subsidies.

#### **Paragraph 19**

Cost of conversion comprises:

- 1 Costs which are specifically attributable to units of production, i.e. direct labour, direct expenses and subcontracted work.
- 2 Production overheads.
- 3 Other overheads, if any, attributable in the particular circumstances of the business to bringing the product or service to its present location and condition.

#### **Paragraph 20**

Production overheads: overheads incurred in respect of materials, labour and services, based on the *normal* level of activity, taking one year with another. For this purpose, each overhead should be classified according to function (e.g. production, selling or administration) to ensure the inclusion in the cost of conversion of those overheads (including depreciation) which relate to production, notwithstanding that these may accrue wholly or partly on a time basis.

In addition, the following quote from Paragraph 40 should be noted: 'Only those costs of the accounts department that can reasonably be allocated to the production function should be included in the cost of conversion.'

It is beyond the scope of this text to enter into detailed debates about the merits or failings of any SSAP, but the implication should be clear,

## 10 Cost Accounting

that only production expenses should be included in the carry forward value of stock and work-in-progress and that other expenses such as selling, distribution and administration, are to be excluded.

### Questions

- 1 'Decisions made about the future of products on the basis of production costs when production overhead has been allocated and apportioned can be misleading' said the accountant to the managing director.

You are required, as the assistant accountant, to write a short report to the managing director in which you should comment on the reasons for the validity of the above statement and also include in your report an explanation of the following terms:

- (a) Production cost
- (b) Production overhead
- (c) Cost allocation
- (d) Cost apportionment (15 marks)

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- 2 It is common cost accounting practice to treat direct wages as an item of variable cost. In certain circumstances however, such as when production plants are highly mechanized or automated, operators' wages are regarded as a fixed cost.

Discuss the factors which should be considered in the cost accounting treatment of operators' wages in different circumstances. (15 marks)

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- 3 A company manufactures and retails clothing.
- (a) You are required to group the costs which are listed below and numbered 1 to 20 into the following classifications (each cost is intended to belong to only one classification):
- (i) Direct materials
  - (ii) Direct labour
  - (iii) Direct expenses
  - (iv) Indirect production overhead
  - (v) Research and development costs
  - (vi) Selling and distribution costs
  - (vii) Administration costs
  - (viii) Finance costs
- 1 Lubricant for sewing machines
  - 2 Floppy disks for general office computer
  - 3 Maintenance contract for general office photocopying machine

- 4 Telephone rental plus metered calls
  - 5 Interest on bank overdraft
  - 6 Performing Rights Society charge for music broadcast throughout the factory
  - 7 Market research undertaken prior to a new product launch
  - 8 Wages of security guards for factory
  - 9 Carriage on purchases of basic raw material
  - 10 Royalty payable on number of units of product XY produced
  - 11 Road fund licences for delivery vehicles
  - 12 Parcels sent to customers
  - 13 Cost of advertising products on television
  - 14 Audit fees
  - 15 Chief accountant's salary
  - 16 Wages of operatives in the cutting department
  - 17 Cost of painting advertising slogans on delivery vans
  - 18 Wages of storekeepers in materials store
  - 19 Wages of fork lift truck drivers who handle raw materials
  - 20 Developing a new product in the laboratory (10 marks)
- (b) During the last twelve months, the stock control and recording system of the retailing division has been computerized. Each garment is coded and, when sold, the code number, quantity and sales value is keyed on the cash till which is linked with the computer.

'Surely', a clothing store manager said to the accountant, 'there is no need for you to organize a physical stocktaking this year-end. After all, we can now press a few keys on the computer terminal and see on the visual display unit what stock is held of each item, so I am sure you can obtain a computer print-out showing the quantities we have in stock.'

You are required, as the accountant to whom the above remark was made, to write a reply addressed to the manager.

(10 marks)

(Total: 20 marks)

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## References and further reading

- 1 All references to the *Terminology* will be to the January 1986 reprint of the 1982 edition. Readers of this book who are students of the CIMA should remember that the *Terminology* is examinable, and the definitions included in the *Terminology* are the ones expected.
- 2 Layne, W. Armand, *Cost Accounting Analysis and Control*, Macmillan, 1984, p. 1.
- 3 Horngren, C. T., *Cost Accounting a Managerial Emphasis*, Prentice Hall, Englewood Cliffs (NJ), 1977.

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- 4 Mearns, I. J., *Fundamentals of Cost and Management Accounting*, Longman, 1981, pp. 1–5.
- 5 A useful discussion on the changing mix of product costs is to be found in Chalos, P., and Bader A. H., 'High Production The Impact on Cost Reporting Systems', *Journal of Accountancy*, March 1986, pp. 106–12.
- 6 References to SSAPs: In addition to the comments made above, readers who are students of the CIMA should remember that they are required to know the SSAPs related to each level of their course. As such, these SSAPs are quoted in the official student reading list. By implication, the reference to money as a measure and hence as a basic concept leads the reader to SSAP2, while the references to cost accounting and inventory valuation, refer to SSAP9.

## 2 Cost ascertainment – materials

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In this and the following chapter we will identify the basic elements of cost accounting, and how some of the elements are drawn into the procedures. This will require consideration of a number of small topics that are relevant to both chapters, beginning with a cost centre.

### **Cost centre**

As we have already seen, (in Chapter 1) costing procedures work towards ascertaining the cost of any activity. To do this effectively requires identifying the costs, and then collecting them together. The point to which costs are collected is identified as a cost centre. The *Terminology* defines a cost centre as 'a location, function or items of equipment in respect of which costs may be ascertained and related to cost units for control purposes'. Note particularly the broadening out of the definition to 'functions or items of equipment'. Typically, a cost centre is indeed thought of as a department, and costs collected to it. However, it is just as likely that a product or an order could become a cost centre. For example, a firm in the electronics industry may have an order to manufacture a type of equipment. To that order will be charged the material and components purchased, the work done by operatives in manufacture and assembly, and an allocation of production overhead. Likewise a particularly large and highly specialized piece of equipment will lend itself to becoming a cost centre. Examples of this might be specialist testing equipment, specialist production equipment such as a blast furnace or heat treatment equipment, or even vehicles like trucks, merry-go-round trains and even ships. Whatever the nature of the cost centre, it provides a platform on which costs can be collected, recognized and compared for control purposes against any previously agreed estimates.

### The elements of cost

Irrespective of any headings already discussed, costs can be divided into three essential headings. To help relate to the headings already mentioned, we will tabulate the elements accordingly. (See Table 2.1.)

Table 2.1 *The elements of cost*

| <i>Element</i>     | <i>Traditional category</i>           | <i>SSAP9</i>    |
|--------------------|---------------------------------------|-----------------|
| Direct material    | (Prime cost)                          |                 |
| Direct labour      | (Prime cost)                          | Conversion cost |
| Expenses/overheads | (Direct expenses would be prime cost) | Conversion cost |

Direct materials need little explanation. An earlier than 1982 edition of the *Terminology* defined them as 'the cost of materials entering into and becoming constituent elements of a good or service'. Copper wire is a direct material in the manufacture of power cable, food is a direct material in the provision of meals in a restaurant. We have already made reference to indirect materials. These would become part of the overheads.

Direct labour is the labour that can be identified directly with the production of the good or service. The operative on the line in a cable making factory, the chef in a restaurant, or the lecturer in a college.

Expenses can be divided into direct and indirect. For example, the power required for the smelting of aluminium in an electric furnace is enormous, and can be readily related to the production of aluminium. As such, therefore, it becomes a direct expense. Likewise, if a special order requires the hiring of a specialist piece of equipment, this can be treated as a direct expense. Indirect expenses, or in the context of production, conversion overheads, will embrace such things as those shown in Table 2.2.

Table 2.2 *Indirect expenses/conversion overheads*

| <i>Material</i>                                       | <i>Labour</i>   | <i>Overheads</i>   |
|---|---|--|
| Lubricants, consumable tools, stationery, heating oil | Salaries of supervisors, storekeepers, test engineers | Factory rent, rates, plant insurance, light, power, telecommunications |

At this juncture, it must be emphasized that the examples in Table 2.2 are just a few of the many that could be quoted. In addition, the categories are by no means hard and fast. For example, we have quoted stationery and telecommunications as examples of different types of overhead or indirect expense. However, for a computer bureau, stationery is an essential part of the operating process, and would become a direct material, while if data were being transmitted down telephone



lines, or by satellite, then much of the telecommunications expense would become a direct expense. Conversely, some organizations, recognizing the reality of all labour as a fixed cost, have dispensed with the notion of direct labour and combine all labour costs into the one category of conversion cost.

To illustrate how a cost report for a cost centre would appear at this stage, we will now work through a simple example.

*Example 2.1*

Alison plc is a small manufacturing company. For the period ending 30 June 19X6, the costs were as follows:

|                                   | £k     |
|-----------------------------------|--------|
| Direct material purchased         | 218 dm |
| Direct labour                     | 60 dl  |
| Indirect labour and supervision   | 22 oe  |
| Administrative expenses           | 80     |
| Factory rent, rates and insurance | 47 oe  |
| Depreciation of factory equipment | 35 oe  |
| Factory power, heat and light     | 10 oe  |
| Sundry factory expenses           | 6 oe   |

You are required to prepare a manufacturing cost statement clearly identifying direct costs and conversion costs.

*Approach:*

For the purpose of this illustration, we shall show direct material and direct labour separately, and then compile the overhead cost schedule. To assist in the analysis, we have put dm after the direct material(s) figure, dl after the direct labour figure(s), and oe for the overhead expense. The reader will immediately recognize that this categorization exercise will exclude one of the figures listed above. This is because *administration expense* is not considered a conversion expense under SSAP9 and as such, will be excluded from the required statement.

*Answer:*

*Alison plc manufacturing cost statement to 30 June 19X6*

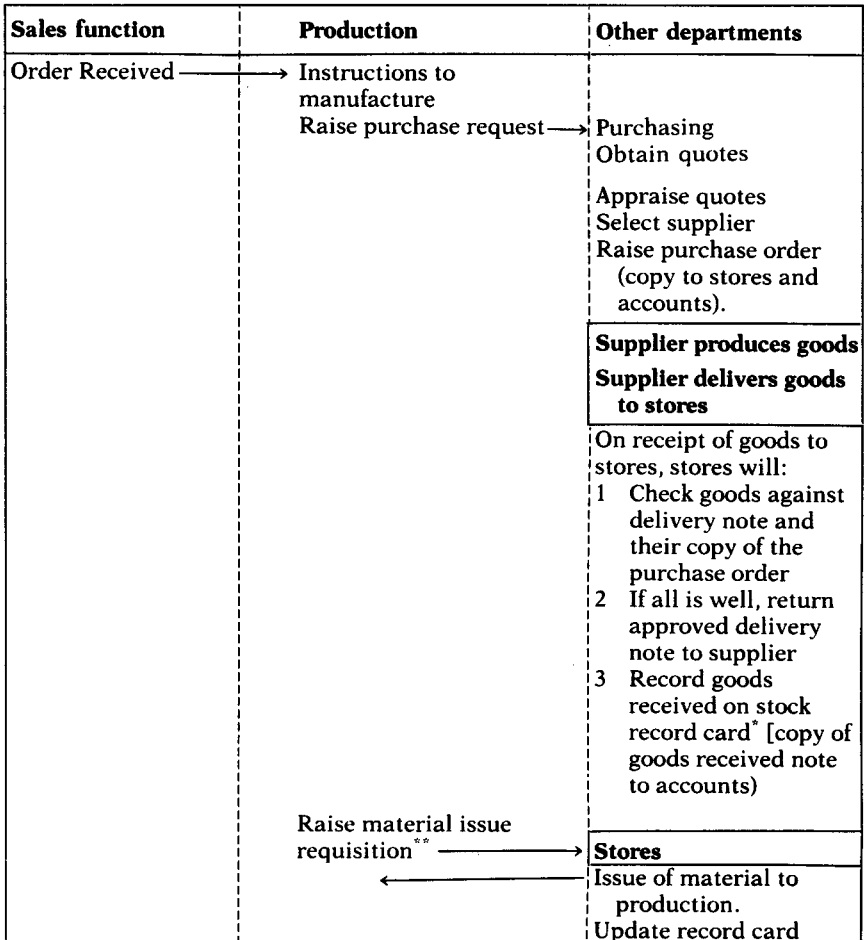
|                                   |              |
|-----------------------------------|--------------|
| Direct materials                  | £218k        |
| Conversion cost                   |              |
| Direct labour                     | 60           |
| Overhead expense                  |              |
| Indirect labour and supervision   | 22           |
| Factory rent, rates and insurance | 47           |
| Depreciation of factory equipment | 35           |
| Factory power, heat and light     | 10           |
| Sundry factory overheads          | 6            |
| Total manufacturing cost          | <u>£398k</u> |

Additional non-conversion cost  
Administration  
Total cost of operations

80  
£478k

**Material costs**

Before considering material costing problems in detail, it is worth revising the normal process of purchasing and issue procedures for the control of material stocks or inventories. This is best achieved by means of a diagram. (Figure 2.1.) In Figure 2.1 it will be assumed that an order has been received by the company requiring the purchase of materials from a supplier specifically for the use in fulfilling the order.



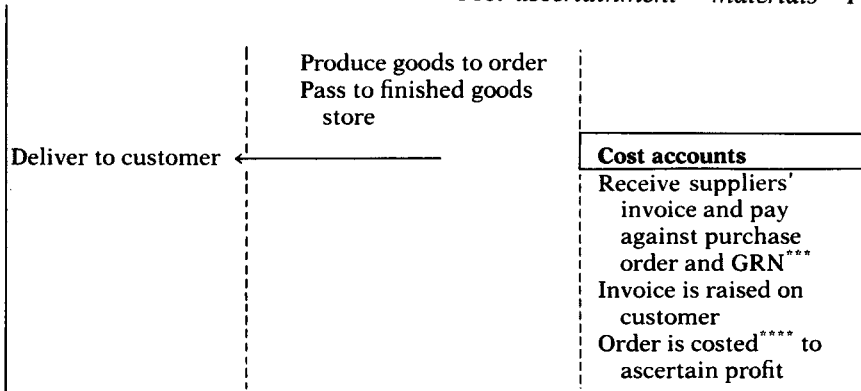


Figure 2.1 The purchasing and material issue procedure

*Additional explanatory notes*

It is felt that one or two terms in Figure 2.1 may be unfamiliar, and are therefore explained below.

- \* Stores record cards – these are the cards or computer file on which the physical amount of individual stock items are recorded. Each item of stock is described in detail and the movements in and out are logged. In theory, when a physical stockcheck is undertaken, the physical count should agree with the figure on the card or computer print-out.
- \*\* A stores/materials requisition is defined as ‘a document which requests, and when approved, authorizes the issue of a specific quantity of materials’. (It may initiate entry in materials/stores ledgers.) It will most certainly be used to update stock record cards.
- \*\*\* A goods received note (GRN) is a ‘document prepared by a recipient to record receipt (acceptance and approval) of goods into the stores (or of services supplied) to create a common format for use (and control) within the recipient’s system’. (*Terminology definition modified.*)
- \*\*\*\* It should be added that the cost of converting the materials into the required finished goods will be added to the costings at this stage.

Going through the sequence of events, the problem that will become apparent is at what value is the material issued from stores to the production area? Ostensibly, the answer is obvious, at the price paid for it, but in the words of the famous opera ‘it ain’t necessarily so’!

Almost inevitably, the problem is most acute in times of changing or fluctuating prices. Figure 2.1 assumed for the purposes of the illustration, that the purchase was a one-off exercise, for a one-off order. However, more often than not, orders are fulfilled from a combination of specifically bought in materials and standard, frequently used, items. Obviously, specific materials would be costed at the price paid to the supplier, but should standard parts, that have to be replaced, be charged at the price paid, or the price currently ruling, or the price that is likely to be paid? There are various options available and these will be dealt with in turn.

To illustrate the methods we will assume the following data:

## 18 Cost Accounting

| Date        | Units purchased | Price (£) | Units issued | Market price (£) |
|-------------|-----------------|-----------|--------------|------------------|
| 1 July      | 200             | 10.25     |              | 10.25            |
| 23 July     | 150             | 12.00     |              | 12.00            |
| 4 August    |                 |           | 100          | 12.25            |
| 16 August   |                 |           | 130          | 12.50            |
| 25 August   | 80              | 12.50     |              | 12.50            |
| 4 September |                 |           | 100          | 13.00            |

Standard price for the period is assumed to be £12.00, and the price likely to be ruling at the time of the next order is £14.00.

### First in first out

In this method, the assumption is that the materials are issued in the same order in which they were received into stores. Consequently, the valuation of the remaining stock is therefore on the basis that the quantities in hand represent the latest purchases.

| Date        | Receipts |           |           | Issues   |           |           | Balance  |           |
|-------------|----------|-----------|-----------|----------|-----------|-----------|----------|-----------|
|             | Quantity | Price (£) | Value (£) | Quantity | Price (£) | Value (£) | Quantity | Value (£) |
| 1 July      | 200      | 10.25     | 2,050     |          |           |           | 200      | 2,050     |
| 23 July     | 150      | 12.00     | 1,800     |          |           |           | 350      | 3,850     |
| 4 August    |          |           |           | 100      | 10.25     | 1,025     | 250      | 2,825     |
| 16 August   |          |           |           | 100      | 10.25     | 1,025     |          |           |
|             |          |           |           | 30       | 12.00     | 360       | 120      | 1,440     |
| 25 August   | 80       | 12.50     | 1,000     |          |           |           | 200      | 2,440     |
| 4 September |          |           |           | 100      | 12.00     | 1,200     | 100      |           |
| Total       |          |           | £4,850    |          |           | £3,610    |          | £1,240    |

\* The 130 units issued on 16 August are valued on the basis of  
 100 received first in on 1 July @ £10.25 = £1,025  
 30 received on July 23 @ £12.00 = £ 360 → £1,385

### Advantages

- 1 Obviously it is a realistic method of pricing as it conforms to the normal method of issuing stock i.e. the oldest items are usually issued first.
- 2 As the quantities in stock represent the latest purchases, stock is valued using the most recent market prices i.e. the closing stock represents the current value of stock.
- 3 It is acceptable to the Inland Revenue.

### Disadvantages

- 1 It is argued, although not very convincingly, that the comparison of one job against another is difficult because the costs will depend on

when material was drawn from the stores. This can be answered by comparing latest prices quoted rather than the issue prices.

- 2 More realistically, issue price may not reflect current economic values.
- 3 The method is cumbersome since continual updating of the stock values is required. This should be no problem in an environment of computer controlled inventory.

**Last in first out**

This method assumes that although the stocks are physically still issued in the order of receipt, the latest prices paid are the prices used.

| Date         | Receipts |           |               | Issues   |           |               | Balance  |               |
|--------------|----------|-----------|---------------|----------|-----------|---------------|----------|---------------|
|              | Quantity | Price (£) | Value (£)     | Quantity | Price (£) | Value (£)     | Quantity | Value (£)     |
| 1 July       | 200      | 10.25     | 2,050         |          |           |               | 200      | 2,050         |
| 23 July      | 150      | 12.00     | 1,800         |          |           |               | 350      | 3,850         |
| 4 August     |          |           |               | 100      | 12.00     | 1,200         | 250      | 2,650         |
| 16 August    |          |           |               | 50       | 12.00     | 600           |          |               |
|              |          |           |               | 80       | 10.25     | 820           | 120      | 1,230         |
| 25 August    | 80       | 12.50     | 1,000         |          |           |               | 200      | 2,230         |
| 4 September  |          |           |               | 80       | 12.50     | 1,000         |          |               |
|              |          |           |               | 20       | 10.25     | 205           | 100      |               |
| <b>Total</b> |          |           | <b>£4,850</b> |          |           | <b>£3,825</b> |          | <b>£1,025</b> |

\* Here, the 130 issued on 16 August is valued on the basis of: The remaining 50 of the order received on July 23,  
 50 @ £12.00 = £600  
 80 at the earlier (July 1) value @ £10.25 = £820 → £1,420

It will be immediately apparent that the value charged into the profit and loss account when costing up work done on this method is considerably higher than that with the FIFO method. By the same token, the value of the closing stock is much lower.

**Advantages**

- 1 The issue prices are closer to current economic values (c/f SSAP16 'current cost of material consumed').
- 2 During a period of rising prices, stock values are conservative, thus reducing the risk of profits being overstated through the inclusion of holding gains. (Profits arising because material held in stock has gone up in price from that which was originally paid.) However, the valuation will lag behind current values.
- 3 Costs are reasonably accurate.

**Disadvantages**

- 1 Like FIFO, it is likely to be cumbersome, although this problem can be resolved with computerized inventory control.

- 2 In the event of 'old stock' being issued, i.e. stock being issued at the July price shown in the example above, this will be at a very much outdated price.
- 3 The most important disadvantage is that the method is unacceptable in the United Kingdom to the Inland Revenue. Under the *Anaconda Brass* case, the Inland Revenue rejected this method of inventory valuation as a route to computing profits. The logical, yet slightly cynical, reader will easily appreciate the reason why. This method depresses profits.

LIFO is, however, acceptable in the United States and curiously, under Sch 4 of the Companies Act 1985. However, the revised SSAP9 (September 1988), while accepting LIFO as a valid method under CA1985 and IAS2, (International Accounting Standard 2) gives the following instructions:

Paragraph 37 stresses that any method (such as FIFO, LIFO or average) may be used to value stock provided that it is one 'which appears to the directors to be appropriate to the circumstances of the company.'

More important is perhaps Paragraph 39. The use of LIFO is likely to produce values to the inventory that are substantially different from current valuations. As such, therefore, they are likely to detract from the true and fair valuations required on a balance sheet, and distort both current and future results. Directors may still use LIFO if they wish, subject to the Inland Revenue accepting it, but they must be able to convince auditors and other users of accounting information that such a method is most appropriate.

It is worth adding that LIFO (and indeed NIFO and Base Stock [*vide infra*]) are permitted under IAS2, but may only be used in conjunction with a statement showing the difference between LIFO or net realizable value or the lower of current cost and net realizable value (Paragraphs 24/26).

Irish students should note that the Companies (Amendment) Act 1986 contains no provision for the use of LIFO in Ireland.

#### ***Use of average valuations***

Clearly, the problem is a conflict between current value of stocks issued, and hence a realistic cost of sales value, and a current value of closing inventory, giving a realistic (true and fair) value of the affairs of the organization. Almost inevitably, this leads to the traditional compromise, and most of the methods described below aim to achieve that.

*Simple average:* This is based on averaging out the prices paid for the goods in stock. While this may provide a solution where quantities bought are unlikely to fluctuate, where quantities do vary, then distortions are inevitable. In the example, the simple average price at 4 August is:

$$\frac{(10.25 + 12.00)}{2} = \underline{\underline{\pounds 11.125}}$$

which would give a closing stock value at that date of £2,781.25 of £1,158, but a charge to the cost of sales of £1112.50. The latter figure is close to the LIFO figure, but the valuation is clearly between FIFO and LIFO.

Obviously, there is the advantage of simplicity, but the disadvantages of distorted and misleading figures would produce misleading information.

*Weighted average:* Here the prices are multiplied by the quantities to eliminate the distortions created by the simple average method.

| Date        | Receipts |           |           | Issues   |           |           | Balance  |           |
|-------------|----------|-----------|-----------|----------|-----------|-----------|----------|-----------|
|             | Quantity | Price (£) | Value (£) | Quantity | Price (£) | Value (£) | Quantity | Value (£) |
| 1 July      | 200      | 10.25     | 2,050     |          |           |           | 200      | 2,050     |
| 23 July     | 150      | 12.00     | 1,800     |          |           |           | 350      | 3,850     |
| 4 August    |          |           |           | 100*     | 11.00     | 1,100     | 250      | 2,750     |
| 16 August   |          |           |           | 130      | 11.00     | 1,430     | 120      | 1,320     |
| 25 August   | 80       | 12.50     | 1,000     |          |           |           | 200      | 2,320     |
| 4 September |          |           |           | 100*     | 11.60     | 1,160     | 100      | 1,160     |
| Total value |          |           | £4,850    |          |           | £3,690    |          | £1,160    |

\* Note: the issue prices are calculated as follows:

$$\frac{2050 + 1800}{350} = \text{£}11.00 \quad \frac{2320}{200} = \text{£}11.60$$

It should be noted that issue prices need only be computed on the receipt of new deliveries, not at the time of each issue as with both LIFO and FIFO.

Stocks are credited out of the 'pool of stock' i.e. at the computed value based on the weighted average, but the balances do cross check. (See grid above.)

*Advantages*

- 1 It is logical in that it assumes values of identical items will be equal.
- 2 Since receipts are much less frequent than issues, it is less cumbersome when operated manually.
- 3 Price fluctuations are smoothed out.
- 4 Costs are somewhere between LIFO and FIFO. Stock valuation will be satisfactory, although likely to be behind i.e. slightly out of date when compared to FIFO.

*Disadvantages*

- 1 Issues could still be adrift of current economic values or prices.
- 2 The issue price is a fiction. It can, however, be readily identified and verified since the auditors will have access to computations which must be properly recorded and retained.
- 3 Theoretically, the issue price could run to a number of decimal places, but this is unlikely to present a problem in practice!

**Replacement price**

The crux of the problem in inflationary conditions is that whatever the cost of sales computed, the cost of replacing the stocks used will be higher. Essentially, more money is required just to keep the business standing still.

Replacement prices, popular with large Dutch multinationals such as Philips, offer one possible solution. In principle, this involves valuing issues and remaining stock at the cost of replacing it.

| Date         | Receipts |           |               | Issues   |           |               | Balance  |           |
|--------------|----------|-----------|---------------|----------|-----------|---------------|----------|-----------|
|              | Quantity | Price (£) | Value (£)     | Quantity | Price (£) | Value (£)     | Quantity | Value (£) |
| 1 July       | 200      | 10.25     | 2,050         |          |           |               | 200      |           |
| 23 July      | 150      | 12.00     | 1,800         |          |           |               | 350      |           |
| 4 August     |          |           |               | 100      | 12.25     | 1,225*        | 250      |           |
| 16 August    |          |           |               | 130      | 12.50     | 1,625*        | 120      |           |
| 23 August    | 80       | 12.50     | 1,000         |          |           |               | 200      |           |
| 4 September  |          |           |               | 100      | 13.00     | 1,300*        | 100      | 1,300     |
| <b>Total</b> |          |           | <b>£4,850</b> |          |           | <b>£4,150</b> |          |           |

\* Note issue prices based on current market prices ruling at the time. See initial assumptions grid above.

**Advantages**

- 1 Issues are at current economic prices, and hence costs are at current economic values. Stock valuation is true and fair, since it is also based upon current economic values, and indicates clearly the cost to the business of standing still.
- 2 Calculations are simple.

**Disadvantages**

- 1 It can be argued that there will be difficulty in keeping up with current replacement prices. The protagonists will, however, argue that if that is the case, then the purchasing department is not doing its job in keeping abreast of latest prices.
- 2 It is not a traditional 'cost' price. While this is also true, and as such, it may be in conflict with traditional accounting concepts, inflationary conditions call into question the validity of traditional accounting concepts anyway.
- 3 Where there is a long interval between individual deliveries of material, it may be necessary to use estimates. Again, it can be disputed that the job of the purchasing department is to keep abreast of prices, and they should be able to supply a verifiable catalogue price as requested.
- 4 Profit and losses can arise because of material not going out of stock at the price it went in.



**Standard prices**

Although standard costing is a topic on its own, and as such is dealt with in detail later in the text, it is necessary, if only for clarity, to introduce the implications of standards into the problem of issuing and valuing stock.

Under this method, purchases are valued at standard, and any gain or loss between standard and actual is written off, on receipt, to the profit and loss account. All issues are at the same price, eliminating the need to maintain the stores at a value as well as a quantity, reducing the clerical burden.

| Date                            | Receipts |           |           | Issues   |           |           | Balance  |           |
|---------------------------------|----------|-----------|-----------|----------|-----------|-----------|----------|-----------|
|                                 | Quantity | Price (£) | Value (£) | Quantity | Price (£) | Value (£) | Quantity | Value (£) |
| 1 July                          | 200      | 12.00     | 2,400     |          |           |           | 200      |           |
| 23 July                         | 150      | 12.00     | 1,800     |          |           |           | 350      |           |
| 4 August                        |          |           |           | 100      | 12.00     | 1,200     | 250      |           |
| 16 August                       |          |           |           | 130      | 12.00     | 1,560     | 120      |           |
| 25 August                       | 80       | 12.00     | 960       |          |           |           | 200      |           |
| 4 September                     |          |           |           | 100      | 12.00     | 1,200     | 100      | £1,200    |
| Standard value of stores issued |          |           |           |          |           | £3,960    |          |           |

*Advantages*

- 1 Given that the standards do not get out of step with actuals by too large a margin, the method is very simple to apply.
- 2 It provides a very useful check on the standard setting process, but more especially on the purchasing department.
- 3 By eliminating fluctuations, realistic comparisons can be made if relevant.
- 4 Costs are unlikely to change over an accounting period. (But note carefully the rider in 1 above.)

*Disadvantages*

- 1 It can be costly to set up and effectively maintain, although it can be argued that there are some useful trade-offs from the standard establishing exercise. Reality is that it requires very careful initial determination, and often attempts at establishing any form of control by standards have foundered because the initial exercise was badly carried out.
- 2 Profits and losses can arise for the same reason as with replacement cost methods.
- 3 Issues may not be at current economic values. This is a particularly weak argument. The standard is going to be established either from a range of observed prices, or from a known contracted figure. Unless the figures fluctuate widely, in which case standards may not be appropriate, by definition the selected standard issue price will

be the mean and hence, actuals will be subject to the laws of standard deviation.

- 4 In the short term, standards do disregard price trends. Again, however, reality is that price trends must be monitored to ensure that the standard is relevant, and it is usual to review standards periodically, frequently on an annual basis.

In the light of the shortcomings of the methods outlined above, other methods of valuing issues and stock have been considered.

#### ***Next in First out (NIFO)***

This method is based on the notion that the price of the materials to be delivered next is the most relevant and likely to be more up to date, than even the LIFO price. This means that the latest quotes and purchase order data must be available to the cost accounting function. This method has some support, and has been documented by Bishop (1981) in *Certified Accountant*.

#### ***Inflated price methods***

There are two reasons for using these methods. The first is as an ancillary to whatever main method is in use to allow for evaporation, deterioration or recognized normal losses. For example, if a material is subject to a 10 per cent loss as a result of evaporation, then it is normal to uplift the issue price to compensate for this.

The second reason is to do with replacement costs and inflation accounting. Although the debate about inflation accounting has subsided with the return to single figure inflation in the United Kingdom, and the SSAP now largely ignored, the cost of sales adjustment required a computation of the value to the business of the stock consumed, i.e. issued to production and incorporated in the cost of sales. While little of what was advocated by SSAP16 was likely to be incorporated in the cost accounts, there were, and still are, those who would support the view that for effective control through cost accounts, cognisance should be given to the value to the business of the stocks consumed.

#### ***Base stock method***

This is essentially a method of valuing stock, rather than actually valuing issues. It presupposes that there is a working buffer stock that never moves and always appears in the stocktake at its original purchase cost. It provides a useful indication of how prices are moving over a longer period of time than the normal accounting periods would allow.

Some organizations use a basic standard cost for the same reason. This standard is kept in force for a period longer than the normal accounting period to provide a bench mark for monitoring material price movements.

***Using costs that include freight***

Since SSAP<sup>9</sup> defines the purchase price to include the costs of getting material into the store, then it is not unreasonable to add any transport, duty or rebates into the issue price, or to compute standards (if used) on such a basis.

**Additional points to be considered under the heading of material costs**

***Accounting treatment for profits in stock***

Under the heading of average and standard cost stock valuations above, the comment was made about the problem of profits being generated in the stock because issue price was higher/lower than receipt price. In principle, this variation must be treated through the manufacturing profit and loss account. In essence, the mechanics are pure double entry, and the procedure is as follows:

***Average stock methods***

Receipt of materials: Debit stock account at cost  
(opposite entry credit purchase ledger)

Issue of materials: Credit stock at calculated average  
(opposite entry debit work-in-progress)  
Credit/debit differences to profit and loss (if any)

***Standard Cost***

Receipt of materials: Debit stock account at standard  
(opposite entry credit purchase ledger at cost)  
Debit/credit difference (called a variance) to  
manufacturing profit and loss

Issue of materials: Credit stock account at standard  
(opposite entry debit work-in-progress at  
standard)

***Inventory control – physical losses***

This is an important area. In many manufacturing companies, the level of finance tied up in inventory can run into millions of pounds/dollars and comprise a significant portion of the working capital employed. (See Table 2.3 for quantitative examples.)

The examples in Table 2.3, chosen at random, show that the percentage of gross working capital devoted to inventory in manufacturing can be over 30 per cent and as much as 50 per cent. Effective control is therefore vital.

Table 2.3 *Level of finance tied up in inventory in manufacturing companies*

| <i>Company</i>   | <i>Inventory</i> | <i>Working capital</i> | <i>Total gross assets</i> |
|------------------|------------------|------------------------|---------------------------|
| Cray Electronics | 9.96             | 20.96                  | 32.41                     |
| Gestetner plc    | 80.4             | 193.30                 | 242.59                    |
| IMI plc          | 179.00           | 383.60                 | 543.80                    |
| Plessey Group    | 282.00           | 987.00                 | 1283.70                   |
| ICI plc          | 1750.00          | 4497.00                | 8317.00                   |

*Note:* Data relates to latest end figures either late 1985 or early 1986

*Source:* *Hambro Company Guide*

The main concern in this text centres firstly on operational losses and secondly on inventory shortages.

- 1 Operational losses arise when too much stock has to be issued to manufacture the product. Irrespective of whether standard costing is being used or not, the quantities of material required to be used in a production operation are known and actual use can be accordingly measured. If it is different, then it could be because:
  - (a) Quality of material is not up to specification causing more to be required.
  - (b) Quality of labour is causing more rejects, or more wastage in the production process.
  - (c) Poor storage will also cause deterioration of stores, or damage to containers causing deterioration.
  - (d) Careless moving of stores can cause accidents which lead to wastage.
- 2 At the year end, (or in many organizations, more frequently) a physical check of the inventory is taken. At such times, differences between the book figure and the physical count will be highlighted. The reason for any major differences will need to be investigated. Common causes of such differences are:
  - (a) Incorrect posting of the category of stock.
  - (b) Incorrect location of stock especially where items are prone to be missed, or are of the same type.
  - (c) Arithmetical errors in the book figure be it on a manual or computer system.
  - (d) Abnormal losses of stock that have not been recorded. This could include theft or destruction.

Control of stock is vital to the efficient running and profitability of any business, and failure in this area can have serious consequences.

### ***Location of stores***

By implication from above, the loss of stock items can easily arise in the movement from receiving area to stores, and from stores to usage area. This has led to considerable discussion about the merits of either cen-

tralized or decentralized locations of stores. The following rules should be considered in the general arrangement and location of stores:

- 1 Heavy goods should be kept near the floor.
- 2 Goods most regularly required should be easily accessible.
- 3 Goods susceptible to dampness or any other risk of deterioration should be properly protected. Equally, goods should not be allowed to contaminate each other.
- 4 Valuable or fragile goods should receive special protection.
- 5 Stores should be located convenient to receiving bay and the location of use.

**Receiving Bay** -----> **Stores** -----> **Point of use**

### *Centralized stores*

The advantages of centralized stores are:

- 1 Specialized facilities are not duplicated, especially if they are costly to install.
- 2 Smaller levels of inventory can be carried, reducing the risks of deterioration, obsolescence, reducing working capital, and storage costs. In addition, delivery to only one location eliminates the costly problems of breaking bulk and delivery to more than one location.
- 3 Physical stock control is easier and can be done with fewer people.

### *Decentralized stores*

- 1 By contrast, decentralized stores are closer to the point of manufacture.
- 2 Elimination of the high cost of internal distribution.

### *Inventory levels*

Under this heading, control of correct levels, comes the very important problem of the actual level of inventory to hold. In essence, the problem is one of finely balancing the level of inventory with the level of production. Two control ratios are vital:

$$\text{Stock turnover} = \frac{\text{Inventory}}{\text{cost of sales}} \times 365$$

$$\frac{\text{Inventory}}{\text{Total Sales}} \times 100$$

These ratios form useful guidelines as to the effectiveness of inventory management.

Several definitions are also important. These are:

- 1 *Lead time*: An interval of time which elapses between the placing of an order for a good and its actual delivery.
- 2 *Reorder level*: The stock level at which the storekeeper advises the purchasing department to order more stock.
- 3 *Safety stock*: Additional inventory sometimes held to cater for fluctuations in demand and to avoid 'stock-outs'.
- 4 *Stock-out*: Where a business runs out of an item of stock.

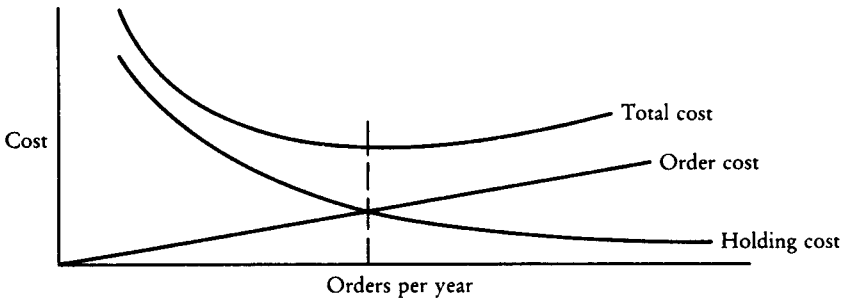


Figure 2.2 *Optimizing stock levels*

We have already stressed that inventory management is walking a very fine line indeed, dictated to by a number of variables. Already the discerning reader should be able to appreciate what might happen if too much or too little inventory is held, and the consequent costs to an organization.

### ***Cost associated with holding inventory***

The cost of holding inventory (or stocks) is an important aspect of the efficient management of any organization. The amount to invest in inventory is not a problem that is peculiar to traditional manufacturing. Indeed, it can be just as important a problem to health authorities, local government and retail operations.

To manage inventories successfully, requires optimizing the amount to hold in stock to ensure that users or customers are supplied when required, and that there is never an excessive amount of inventory held. Into this equation must be introduced:

- 1 The cost of ordering inventories (the purchasing department and its clerical procedures to which must be added delivery costs).
- 2 The cost of carrying inventories (the stores department, its head-count and overheads such as insurance, storage space cost, risk of obsolescence and interest on capital tied up in inventory).
- 3 The cost, already intimated above, of not carrying sufficient inventories. This is difficult to quantify, but it could involve a combination of added transport charges to rush in urgent supplies, lost goodwill and orders, loss of quantity discounts, small order surcharges, and inefficient production runs.

In an attempt to optimize the level of stock that should be ordered to minimize all the risks and costs a model has been formulated. (See Figure 2.2.)

### ***Derivation of the economic order quantity (EOQ)***

Consider the situation where the yearly known demand for a particular product is  $R$  units. The ordering cost is  $S$  and the annual holding cost is  $K$ . Let  $Q$  be the size of the order, and  $q$  the buffer or additional stock

desired to allow for fluctuations in demand and avoid stock outs. From that we can write:

$$\begin{aligned} \text{Number of orders required per year} &= R/Q \\ \text{Yearly set up cost for each individual run} &= S(R)/Q \end{aligned}$$

If the buffer stock is added, then we can recognize a reduction in set ups so that we can write:

$$(R/Q + q) \text{ and hence } S(R/Q + q)$$

From that we can see that the cost of having  $q$  will save the organization:

$$\frac{(S[R])}{Q} - \frac{S R}{(Q + q)}$$

This decision will, however, incur a cost. If one assumes that the average buffer stock is  $q/2$ , then the cost of holding it is  $Kq/2$ . Thus, it only becomes justifiable to hold the buffer stock, if the costs of not having it are greater than the holding costs.

If we equate the costs, i.e. assume that they are equal this can be written mathematically as:

$$S(R/Q) - S[R/(Q + q)] = K(q/2)$$

This can be simplified by simple factorizing we get:

$$\frac{SR(Q + q) - SR(Q)}{Q(Q + q)} = K(q/2)$$

The student will readily see that the expression can be simplified further by subtracting the like terms ( $SR(Q)$ ) in the numerator. This will give us:

$$SR \left( \frac{q}{Q(Q + q)} \right) = K[q/2]$$

We can now further simplify the equation by dividing both sides by  $q$ . This gives:

$$SR \left( \frac{1}{Q(Q + q)} \right) = K/2$$

Through the mechanics of simple cross multiplying, this clumsy looking equation can be re-arranged to become:

$$Q^2 + Qq = 2RS/K$$

Now, as  $q$  approaches 0, then so will  $Qq$ , so if  $q = 0$  then  $Q$  must be the optimal size, i.e. that low point in Figure 2.2. We can thus write:

$$Q = \sqrt{\frac{2RS}{K}} \text{ where:}$$

$Q$  = order size in units

$R$  = yearly quantity used in units

$S$  = cost of placing an order

$K$  = annual cost of carrying one unit in stock

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*Impact for optimum production run*

In an operating environment, the length of the production run might be important. Clearly, production will want long runs to minimize set up time and reduce unit costs. By the same token, marketing will want to be able to satisfy every customer by delivering off the shelf. However, the cost accountant will be anxious about the costs of holding the stock and financing the additional and possibly excessive capital employed. This leads to an important variation on the EOQ theme, the optimal size of production run.

*Derivation*

- Let D = demand
- Hc = holding cost
- PR = production rate
- Q = amount produced
- s = cost of setting up equipment
- t = time
- u = unit variable cost

At a production rate of PR the time taken to produce Q units will be:

$$t = Q/PR$$

At demand D this becomes:

$$tD = QD/PR$$

Now, maximum inventory can be stated as the total amount produced less the demand during the production run.

Expressed mathematically, this becomes:

$$Q - (QD/PR) = Q (1 - (D/PR))$$

If we then assume that the average inventory is half the maximum inventory, we can rewrite the right hand side of the expression above as:

$$\frac{1}{2}Q (1 - D/PR) \dots\dots\dots 1$$

To this we must eventually introduce the annual holding costs.

Now the replenishment costs will be given by S + uQ which for a total year will be:

$$(s + uQ)D/Q \dots\dots\dots 2$$

Adding 1 and 2 we get:

$$TK = \frac{1}{2}QHc(1 - D/PR) + (s + uQ)D/Q$$

This can then be simplified down by factorization to:

$$TK = \frac{1}{2}QHc(1 - D/PR) + Ds/Q + Du$$

By then introducing elementary calculus into the equation, we can differentiate and obtain:



$$dTK/dQ = \frac{1}{2}Hc(1 - D/PR) - Ds/Q(\text{squared})$$

Solving for Q gives:

$$0 = \frac{1}{2}Hc(1 - D/PR) - Ds/Q(\text{squared})$$

$$2PRS = Hc(PR - D)Q(\text{squared})$$

$$Q = \sqrt{\frac{2PRDS}{Hc(PR - D)}}$$

*Example 2.2 (EOQ)*

The annual demand for product L is 3750 units, the holding cost is £1.50 per unit, and the order cost is £200.

Using the formula:

$$Q = \sqrt{\frac{2RS}{K}} \text{ we get:}$$

$$Q = \sqrt{\frac{2 \times 3750 \times 200}{1.5}}$$

$$Q = \sqrt{\frac{1,500,000}{1.5}} = 1,000,000 = \underline{1000 \text{ units}}$$

If the cost of ordering went up by 25 per cent, and annual usage to 4500, then we would have:

$$Q = \sqrt{\frac{2 \times 4000 \times 250}{1.50}} = \underline{1155 \text{ units}}$$

*Example 2.3 (Production run)*

The following data relates to product V:

Set up cost = £700

Holding cost = £4 per item per year

Production run i.e. capacity that the production department would like to run at = 28,000

Demand = 18,000

The optimum run is determined by the equation:

$$Q = \sqrt{\frac{2PRDS}{Hc(PR - D)}}$$

Substituting we get:

$$Q = \sqrt{\frac{2 \times 28,000 \times 18,000 \times 700}{4(28,000 - 18,000)}}$$

$$Q = \sqrt{176,400} = \underline{4200 \text{ units}}$$

Given that demand is 18,000 units per annum, then the optimum is 18,000/4200 i.e. 4.3 runs per annum.

Suppose demand goes up to 25,000 units, set up cost comes down to £500, and the holding cost goes up to £6. Then we get:

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$$Q = \sqrt{\frac{2 \times 28,000 \times 25,000 \times 500}{6(28,000 - 25,000)}}$$

that gives us  $\sqrt{38888888.89} = \underline{6236 \text{ units}}$

This means the number of optimum runs is (25000/6236) i.e. 4.01 per annum.

### Questions

Questions relating to Chapter 2 and Chapter 3 are combined in a section at the end of Chapter 3.

### References and further reading

- 1 Layne, W. Armand, *Cost Accounting Analysis and Control*, Macmillan, 1984, Chapter 6. (This cites many other very useful references.)
- 2 Morrison, A., *Storage and Control of Stock*, Pitman, 1981, Chapter 7. (A very descriptive text.)
- 3 Wild, R., *Production and Operations Management*, Holt Reinhart 1984, Chapter 17.
- 4 Wild R., *Essentials of Production and Operations Management*, Holt Reinhart, 1985, Chapter 17.
- 5 Replacement prices (page 22) are sometimes referred to as current entrance prices.
- 6 SSAP16 'Current Cost Accounting' was an attempt at accounting for the effects of inflation. It was introduced in 1980 and withdrawn in 1988. Only IAS15 remains as an inflation accounting standard.

# 3 Conversion costs

---

From the Terminology definition, we have learned that conversion costs include direct wages (labour costs), direct expenses and absorbed production overhead.

## **Labour cost control**

Labour costs have changed considerably since the establishment of the CIMA and the development of cost control ideas shortly after the First World War. At that time, much of the UK labour force was engaged in manufacturing, and paid on an hourly basis, possibly with an element of performance related remuneration included. Operators were only paid if they worked, so direct labour, and indeed, much of the indirect labour force was a variable element in the cost structure. Rightly or wrongly, much of this has now changed. As a result of legislation, much of the cost of labour is now fixed, so that irrespective of whether or not there is work available for the operator to perform, he/she still gets paid.

Effective control therefore is essential, and the emphasis may well be on the use of labour rather than the simple cost of it. In considering labour cost control, the emphasis will be almost from an auditing standpoint, to enable the reader to appreciate where the controls can still be effectively enforced.

## **Recruitment**

A departmental manager/supervisor/foreman will have an agreed pre-terminated workload and the requisite number of people under him/her to do the work. In a well managed organization, all the work will have been professionally timed and the manning levels agreed. However, let us assume that additional headcount is required.

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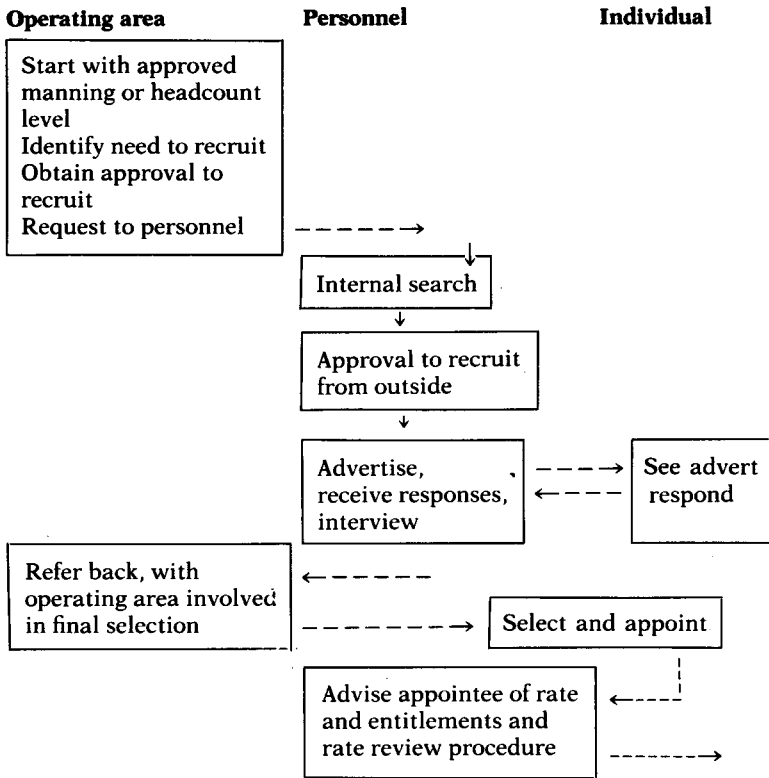


Figure 3.1 Recruitment procedure

Traditionally, in many old industries, the foreman had the power to recruit. This system, while it was simple and rapid, was open to abuse. An unscrupulous foreman could allege that he had hired someone on (say) Tuesday, the man had worked until Thursday morning, but the foreman had fired him at lunchtime. The man was therefore entitled to two days pay. Reality was that the man had never existed, and the foreman, and perhaps those who were required to keep quiet about the situation, collected the pay packet and shared it amongst themselves.

Effective labour cost control must therefore begin with recruitment, and like the material purchase procedure, is best illustrated by a diagram. (See Figure 3.1.) The choice of the term 'operating area' recognizes that labour cost control is not exclusive to hourly paid operators in manufacturing, but to any form of labour in any form of organization.

This rather complicated procedure:

- 1 Controls manning levels in all departments.
- 2 Stops the possibility of overmanning.
- 3 Eliminates the risk of operating areas recruiting 'phantoms' (people who have been allegedly hired and fired in the same week).

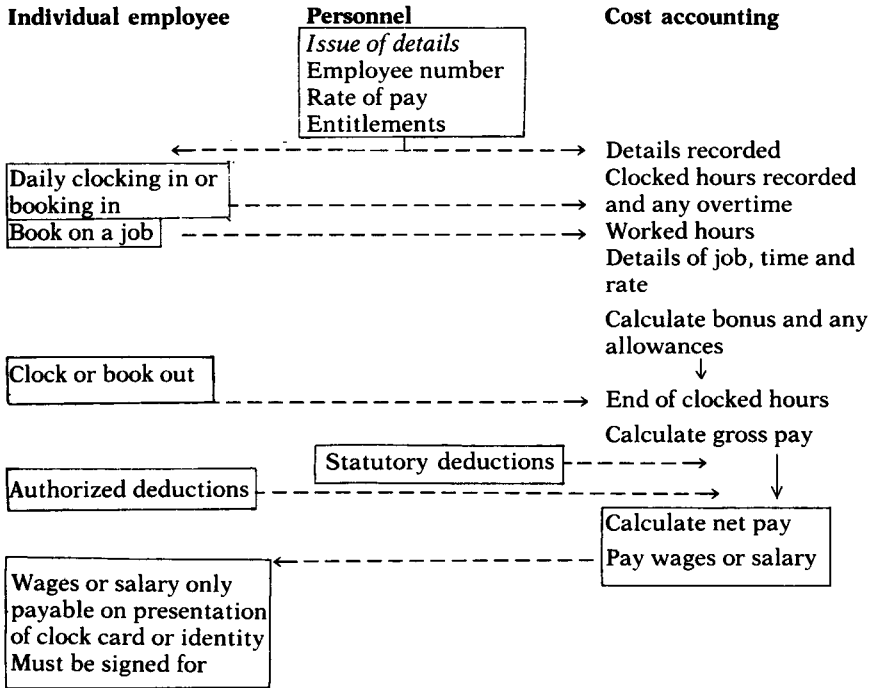


Figure 3.2 *Payment of wages or salaries*

- 4 Eliminates the risk of people being paid who do not exist.
- 5 Introduces controls on how people are paid.

**Payment of wages or salaries**

Having controlled the level of headcount, the next area for control is the actual payment of wages or salaries. Again, the rules outlined can be applied to both hourly paid shop floor operatives in manufacturing, or to salaried staff in a service industry. Indeed, with the increased popularity of flexitime in many service industries, the traditional rules related to operatives clocking in or out have acquired a new significance.

A few points need a little expansion. The hours a person is actually on the organization premises are the 'clocked hours' recorded either on a clock or in a signing in book. 'Worked hours' apply where employees are booked as direct labour on to a job, task or assignment. For example, a computer systems analyst may be assigned to a task for a client. He or she will work on that task, and the time put in is chargeable to the client. The difference between clocked hours and worked hours gives a clear indication of how effectively headcount is being used. A further term, 'produced hours' is used. This is based on the measured hours taken to complete a job. Thus, of the time taken to assemble a piece of

equipment is rated at (say) ten hours. Here each time a piece is completed, that is deemed to be ten produced hours of output. This approach has the obvious merit of providing a common measure of output, and gives an indication of how efficiently the worked hours are being turned into saleable activities.

Bonuses and allowances refer to bonuses arising from working faster than expected. Traditionally, jobs were timed and if the employee worked faster than the time, he or she shared part of the time saved as a bonus. The idea behind this system was to motivate people to work faster. Bonus schemes have been abused, have often been regarded as part of 'labour's chain' and with increased mechanization and less operator control over output, have tended to fall from favour. In many organizations today, bonuses have taken the form of profit sharing schemes. Allowances are something different. Many tasks undertaken by employees are in conditions that are either hot (e.g. a furnace), dangerous (steeplejack), cold (refrigeration plant), dirty (coal mine or ship's hold), or even unsociable (night work) and this may attract a special allowance in addition to any agreed rates or bonuses. For control purposes, it is essential that these allowances are only paid when the operator is entitled to them. In the context of booking on jobs, there may be situations where the hours worked are on recoverable, saleable activities, or on internal work that will be written off to overhead. Again control of such tasks is essential as is the transfer of employees between jobs and departments.

To illustrate how employees might be paid, and how the rates can vary, we will now talk through an illustrative example.

### *Example 3.1*

Based on the data below, you are required to calculate the remuneration of each employee, as determined by each of the following methods:

- 1 Hourly rate
- 2 Basic piece rate
- 3 Individual bonus scheme, where the employee receives a bonus in proportion of the time saved to the time allowed.

#### *Data*

| Name of employee               | Salmon | Roach | Pike |
|--------------------------------|--------|-------|------|
| Units produced                 | 270    | 200   | 220  |
| Unit time allowed<br>(minutes) | 10     | 15    | 12   |
| Time taken (hours)             | 40     | 38    | 36   |
|                                | £      | £     | £    |
| Rate per hour                  | 2.25   | 2.05  | 2.20 |
| Rate per unit                  | 0.40   | 0.45  | 0.44 |

#### *Approach:*

This is a fairly straightforward computational question, requiring simple multiplication of hours or units and rates.

| <i>Answer:</i> | <i>Salmon</i> | <i>Roach</i> | <i>Pike</i> |
|----------------|---------------|--------------|-------------|
| Hourly rate    |               |              |             |
| Hours × rate   | 40 × 2.25     | 38 × 2.05    | 36 × 2.20   |
| Remuneration   | £90.00        | £77.90       | £79.20      |

*Basic piece rate*, i.e. remuneration is based purely on work produced, there being no time related wages payable at all.

|              |            |            |            |
|--------------|------------|------------|------------|
| Units × rate | 270 × 0.40 | 200 × 0.45 | 220 × 0.44 |
| Remuneration | £108.00    | £90.00     | £96.80     |

*Bonus scheme:* Taking Salmon as the first example, we are told that he produced 270 units. Since each unit is timed to take 10 minutes, this represents (270 × 10) minutes or 45 hours. Since Salmon completed his task in 40 hours, he saved 5 hours and this entitles him to a bonus of 5/45 of his basic wage.

$$5/45 \times (40 \times 2.25) = \text{£}10.00$$

|                          |                           |                |
|--------------------------|---------------------------|----------------|
| Thus Salmon's wages are: | Basic hourly rate         | £90.00         |
|                          | Bonus                     | £10.00         |
|                          | Total gross wages payable | <u>£100.00</u> |

Having established the principle, we can now do the same computations for Roach and Pike.

|                           | <i>Roach</i>      | <i>Pike</i>       |
|---------------------------|-------------------|-------------------|
| Hours produced            | 50                | 44                |
| Hours worked              | 38                | 36                |
| Hours saved               | 12                | 8                 |
| Proportion                | 12/50 (i.e. 0.24) | 8/44 (i.e. 0.182) |
| Remuneration payable      |                   |                   |
| Basic wages               | £77.90            | £79.20            |
| Bonus                     | £18.70            | £14.41            |
| Total gross wages payable | <u>£96.60</u>     | <u>£93.61</u>     |

Questions of the type illustrated above, often ask the student to discuss some aspect of the remuneration scheme. Usually, this means where the bonus is in force. Theoretically, bonus schemes provide an incentive for an employee to produce more and increase his/her earnings, while at the same time reducing unit costs. There may be savings in supervision costs, but it may be necessary to increase the inspection, and there may be an increased clerical cost of administering the bonus scheme.

All bonus schemes however operated and based should follow certain basic guidelines if they are to be successful:

- 1 There must be full discussion between employer, employees and

their representatives before the scheme is introduced. Imposed schemes will be likely to cause more harm than good.

- 2 It must be readily understandable by the employees to avoid any suspicion that they are being cheated.
- 3 The bonus must be adequate enough to motivate them to greater effort.
- 4 There must be adequate and credible inspection, again to avoid any perception of operatives being cheated.
- 5 Employees must not be made responsible or penalized for any event that is beyond their control. This avoids disputes arising over non-payment of bonuses. However it could mean the provision of guaranteed bonuses if it is not possible to earn a bonus for certain uncontrollable reasons.
- 6 The bonus should be paid as quickly as possible after the work is done, i.e. perhaps a week in arrears at the most.
- 7 There must be a reduction in unit production costs.
- 8 It should be recognized that no bonus scheme is a ready made solution to the problems of badly managed or poorly equipped production areas.
- 9 However sophisticated the work study methods that establish the original rates, the actual rate fixing still retains an element of judgement, with the result that the final setting up will involve negotiation and consultation with the unions. This could be protracted, and if not satisfactorily resolved, could cause a serious sequence of disputes and stoppages.
- 10 The sham deal, often set up as an attempt to alleviate other problems, such as wage control or to placate the unions should be avoided (see Williamson, 1989).

### ***The debate about incentive schemes***

Incentive schemes are far from being a panacea. Indeed, there is considerable debate surrounding them. Essentially, the debate centres on the advantages and disadvantages of incentive schemes per se, and the advantages and disadvantages of group schemes.

#### *Advantages*

- 1 Increases production and thereby increases wages but also reduces unit overheads especially where there are high fixed overheads.
- 2 By improved productivity and reduced unit costs, the organization retains its competitive edge.
- 3 Operator morale is improved by rewards directly related to extra effort.
- 4 More efficient workers are attracted to the lure of high wages.

#### *Disadvantages*

- 1 Frequently there are problems in establishing performance levels and rates with the result that there are continual disputes. Often, if



too much bonus is being earned, the job is retimed and the potential for earning bonuses is lost. As a result, bonus schemes tend to be self destructive.

- 2 Some incentive schemes are highly complex and costly to operate and maintain.
- 3 Some groups of workers, although unskilled, may be able to earn high bonuses, and as a result differentials may be eroded causing further unrest.

Where schemes do operate, they appear to be more successful when they relate to individual performance, rather than the group scheme.

The group scheme operates where it is not always possible to use an individual scheme. Such situations might be where there are gangs working, such as in coal mining, where there is a machine based production line, such as a machine shop or in automobile manufacture. In such situations, it becomes impossible to measure individual performance.

*Advantages of group schemes*

- 1 A greater team spirit is generated amongst the participating operatives.
- 2 Administration is simpler and cheaper because individual performances are not required to be recorded.
- 3 Support workers can be included whereas they might be left out of an individual scheme.
- 4 The number of rates required to be negotiated may be reduced.
- 5 It is possible that more flexible working arrangements can be introduced.

*Disadvantages of group schemes*

- 1 Less direct than individual schemes with the result that there is not the same incentive.
- 2 Less industrious operatives can fail to 'pull their weight' and yet still collect a bonus. Eventually, this will cause friction, especially where there are well motivated and industrious operatives.
- 3 It is not always easy to apportion the amount of the bonus between grades of operatives. Frequently, such schemes result in a 'broad brush' rate being paid to all operatives which can exacerbate the effects of the situation described in 2 above.

We have implied above that there are frequent situations where the labour cost is not chargeable to produced work, but likely to be written off to overhead. To expand on this, but at the same time help the reader relate to the problem, we will talk through a typical problem in example 3.2.

*Example 3.2*

**Situation**

Idle time caused by an explosion in factory.

**Possible treatment**

Not charged as an overhead, but collected to a separate account for

|  |   |
|--|---|
|  | costing out a possible insurance claim.   |
| Idle time in the finishing department because of production delays.  | Here the blame is in another department. The cost of that idle time should be charged to the production department. This will probably finish up as an under-absorbed item of production overhead and eventually be written off to the profit and loss account. |
| Holiday pay.   | Since paid holidays are a fact of life, this is part of the normal conversion overhead.   |
| Overtime in the lubricating department, caused by general pressure of work.  | Charge cost to the department, which will be absorbed when the cost is charged out to production.   |
| Overtime in the lubricating department due to a mix-up in holiday allocations by the departmental manager.   | This cannot be charged out, and must be taken by the department as an overspend.  |
| Overtime resulting from a customer wanting a job urgently, and consenting to pay accordingly.  | Charge to the job and recover in the invoice to the customer. Conversion overhead.  |
| Supervisor's wages – labour time involved in reworking 5 units out of a batch of 50, on a process where 10 per cent of completed units are expected to be defective. | In the initial costings, there will be an allowance for this eventuality. Thus the rectification cost can be treated as normal conversion direct labour. Had the 10 per cent been exceeded however, the excess would have to have been written off to overhead. |

Two other points need consideration under the heading of labour cost: lateness/absenteeism and turnover.

***Lateness/absenteeism***

Since labour is very often a fixed cost, subject to a contractual daily or weekly rate, the control of lateness and/or absenteeism becomes difficult. Where there is effective control over the arrivals and departures of employees, this can be monitored easily, and control data prepared and circulated to indicate:

1. Number of employees arriving late.
2. Percentage of employees arriving late.
3. Persistent late arrivals.

Likewise absenteeism can be similarly monitored and statistics prepared. Where appropriate investigations can be undertaken to ascertain why employees are late, and whether it is their fault, or the symptom of poor management or of a general discontent. Absenteeism, traditionally rife in some of the older UK industries and in certain UK regions, does not save the employer wages, but rather runs the risk of high cost overtime, poor productivity and the risk of accident.

***Labour turnover (i.e. the number of employees leaving an organization)***

Some years ago, when the CIMA was still the Institute of Cost and Works Accountants, a detailed research study was undertaken in this area. Essentially, five things are important for us to consider:

*1 The labour turnover ratio*

This can be defined as:

$$\frac{\text{Number of employees leaving during a period}}{\text{Average number of employees}} \text{ expressed as a percentage}$$

Like the control over lateness and absenteeism, this can be monitored by frequent regular calculation, comparison with previous figures to ascertain trends, and investigating why the situation is as it is.

*2 Impact of labour turnover*

A high rate of labour turnover will be reflected in a loss of output, a lowering of morale and higher costs. Output losses will arise because of:

- (a) Possible gaps in the ranks while replacements are found.
- (b) The length of time required to train a new recruit and his output compared with that of the experienced employee who has left.
- (c) The inevitable reduced effort put in by the employee who is leaving during the time between giving in notice and the actual date of departure. Some organizations attempt to deal with this problem by terminating such employees (if it is practical to do so) as soon as notice is submitted.

*3 The cost of a high labour turnover*

The research paper highlighted the following cost consequences of a high labour turnover:

- (a) Increased cost for advertising and interview expenses, including extra costs on the personnel and possibly the pension department. Curiously, this latter point has produced the reverse effect in more recent (mid 1980s) times. The reduction in headcount caused by

redundancies, has left many pension funds oversubscribed for the actuarial demands likely to be put upon them, resulting in either 'pension holidays' or the release of funds set aside back into the organization.

- (b) Increased cost of settling in expenses if appropriate, although this will only apply to key senior staff, and many employees are now contributing less and less amounts to this.
- (c) The inevitable cost of training, not just in any direct training costs, but in time taken to help the new employee 'learn the ropes' and the inevitable mistakes generated by his lack of experience within the organization.
- (d) From the problems cited above, the possible cost of defective work, scrap, rectification, machine breakdown because of operation by inexperienced operatives.

#### *4 Causes of labour turnover*

Since it is obvious that labour turnover can represent a considerable high cost item, either in lost productivity or in direct cash outlays, the causes need to be investigated thoroughly. In general these causes are:

- (a) Dissatisfaction with the job, wages, hours of work or working conditions.
- (b) Discontent due to the relationship with the employee's supervisor and/or colleagues.
- (c) Lack of promotional opportunities (this is more likely to affect skilled and staff employees rather than the direct labour force as such).
- (d) Personal matters e.g. ill health, the need to relocate.

The reader will be aware that while these are items which should be regularly reviewed, an important factor in the equation is environmental. Clearly, labour turnover is at its highest when jobs are plentiful, and the employees are in a suppliers' market. However, where the situation is one of high levels of unemployment, either regionally or nationally, the labour turnover figure inevitably goes down, since there is not the choice of jobs available.

#### *Reduction in the labour turnover rate*

Cost accountants are not just bean counters preparing cost data and statistics. Rather, they are expected to play their part in the running of an organization. Accepting therefore, that labour turnover is expensive, cost accountants from their position of being able to see how expensive it is, should be able to make some suggestions as to how it might be controlled. Possible suggestions should include:

- (a) Regular statistics on turnover attempting to identify the cause, whether the termination was voluntary or the individual was dismissed, or whether the cause was unavoidable or not. While the figures will be objective, the reasons may well be rather subjective.

What may be more useful will be comparative statistics, to see if the figure may be high (or low) in one particular division or unit and thus provide the attention directing information for investigation and hopefully to find a solution. (Or see if there is something that can be learned from the local experience.)

- (b) Obviously improve the selection procedure.
- (c) Improve the manpower planning facility to avoid costly redundancy exercises at a later date.
- (d) Ensure that the total remuneration package (i.e. including fringe benefits) is realistic, and employees are not leaving because the wage rate is too low. (This can curiously rebound to the unscrupulous employer's advantage. The best reference any employee can have is his/her wages or salary, and low paid people often find it difficult to move because they are judged, albeit wrongly, as being ineffective and unable to command a high wage.)
- (e) Ensure that the working environment is acceptable. This may require consideration of the conditions of work, the facilities provided, and the accessibility of the plant itself and the ease of parking.
- (f) Investigate apparent causes of dissatisfaction to see if they can be resolved without a termination.
- (g) Monitor health and safety to ensure that losses due to ill health and accident are minimized.
- (h) Strive for better working relationships. This follows on from (a) above, i.e. looking to see if it is a personal problem that is causing labour turnover statistics to be unacceptably out of line.

### ***Allocation of labour costs***

There are two essential ways that labour can be incorporated into the cost of an activity.

If the labour is direct, an employee can be allocated directly to a task or job, then the hours worked, or hours produced, multiplied by the labour cost will give the figure.

#### *Example 3.3*

Alun clocks on to his job at 0730 hours and his working day is as follows:

|           |   |
|-----------|---|
| 0730–0830 | Job No. 1234                                  |
| 0830–0845 | Breakfast break                               |
| 0845–1045 | Job No. 1234                                  |
| 1045–1230 | Job No. 8901                                  |
| 1230–1300 | Lunch   |
| 1300–1430 | Assisting in maintenance                      |
| 1430–1500 | Idle time for which he is entitled to be paid |
| 1500–1515 | Tea break                                     |
| 1515–1630 | Job No. 4567                                  |
| 1630      | Clock out                                     |

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You are required to analyse the hours Alun has worked.

*Answer:*

Alun was on site for nine hours. One hour is deleted for breaks. The remaining eight hours can be analysed as follows:

*Hours worked on jobs*

|                        |             |
|------------------------|-------------|
| No. 1234               | 3           |
| No. 8901               | 1.75        |
| No. 4567               | <u>1.25</u> |
| Total                  | <u>6.00</u> |
| Idle time              | 0.50        |
| On loan to maintenance | <u>1.50</u> |
| Total                  | <u>8.00</u> |

From this, the six hours worked on jobs would be charged to the jobs, and there would be two hours written off to overhead, as maintenance and idle time. To take the analysis further, if Alun had produced seven hours, then seven hours would be charged to the jobs. The accounting of this would be as follows:

*Labour cost control account*

---

|  |                              |
|--|------------------------------|
| Debit cost of labour                                   | Credit work-in-progress      |
|  | [Charges to individual jobs] |
| [Wages control]  | Maintenance overhead         |
| Balance [if any] to costing profit<br>and loss account | Idle time                    |

---

If there is a situation where it is not possible to assign labour costs to individual contracts, as in some forms of process industries or mass production, then it is better to charge a value added rate, based on either labour hours or some more realistic method. This will be dealt with under our consideration of overheads, and it is to this we must now turn.

## Overheads

The *Terminology* defines overhead cost as 'the total cost of indirect materials, indirect labour and direct expenses'. The attention of the student reading the *Terminology* is drawn to the synonymous term *burden* which is used in American companies and in American subsidiaries in Europe. The reference to the term 'indirect' indicates that this includes all the costs that are not chargeable directly to a product or service, such as insurance, rent, rates, depreciation, supervision, cleaning materials, maintenance, tools etc.

There are two categories of overhead, conversion overhead which,

under SSAP9, refers to overheads related to production or operations activities, and *non-conversion overheads*, which are those overheads related to selling, distribution and administration.

**Collection of overhead**

This may be best illustrated by means of a diagram. (See Figure 3.3.)

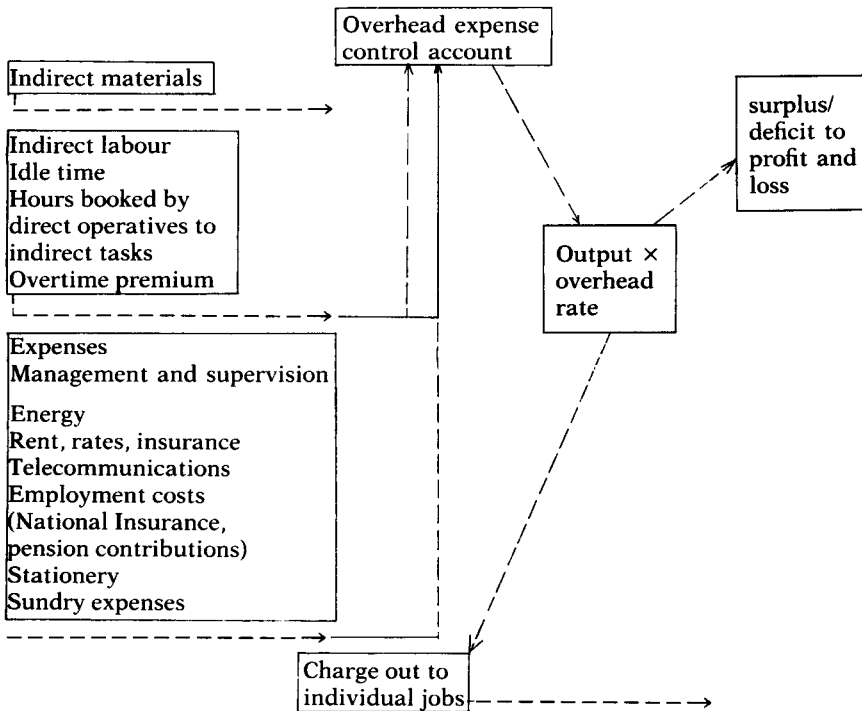


Figure 3.3 Collection of overhead

In terms of a simple 'T' account, the book-keeping would be as follows:

*Overhead expense control account*

|   |  |
|---|--|
| <p>Debit</p> <p>From the cash book</p> <p>Indirect materials</p> <p>Indirect labour costs (cash book and labour analysis)</p> <p>Expenses (Cash book and allocation)</p> <p>Depreciation charge (Not a cash item)</p> | <p>Credit</p> <p>Charge to individual jobs or allocate/absorb to work-in-progress</p> <p>Balance to costing profit profit and loss account</p> |
|---|--|

There are two key words in the above 'T' account pro-forma that are essential to the treatment and understanding of conversion overheads. These are *allocation/apportionment* and *absorption*.

**Cost allocation/apportionment**

This is defined as 'the charging of discrete items of cost to cost centres or cost units.' This definition embraces both direct costs and indirect costs. Clearly any indirect conversion cost is allocated to the conversion overhead control account. However, a problem arises when costs are likely to cover more than one department, or be both conversion and non-conversion. This requires costs to be *apportioned* and this is defined as the 'division of costs amongst two or more cost centres in proportion to the estimated benefit received, (for the purposes of stock valuation) using a proxy, e.g. square metres, headcount, capital value.' Essentially, this is an extension of the accounting concept of matching, whereby the cost is apportioned in such a way as to match the use of the facility that is being costed out.

There are various ways that such shared costs may be charged out, and examples are shown in Table 3.1.

Table 3.1 *Charging of shared costs*

| <i>Basis of apportionment</i>              | <i>Category of expenditure</i>  |
|--|---|
| Headcount                                  | Supervision, welfare and medical costs, employer's liability insurance  |
| Floor space (square feet or square metres) | Rent, rates, building repairs, heating and lighting. (This is a common means of apportioning what are collectively called 'site costs') |
| Book value                                 | Depreciation of fixed assets  |
| Machine power (kW or kN)                   | Insurance of assets<br>Power  |

To clarify this and to help in understanding, we will now work through an example.

*Example 3.4*

Carolyn Cyfyngedig is a retail organization which has three sales departments and an administration department in a large supermarket complex. From the data below, you are required to apportion the various overheads and prepare a schedule of expenses.

| <i>Item</i>    | <i>Amount</i> | <i>Basis of apportionment</i> |
|----------------|---------------|-------------------------------|
| Rates          | 4,000         | Floorspace                    |
| Light and heat | 2,000         | Floorspace                    |
| Advertising    | 35,250        | Sales value                   |
| Transport      | 25,850        |                               |



|                  |       |                      |
|------------------|-------|----------------------|
| Insurance        | 3,525 | } All in sales value |
| Miscellaneous    | 1,175 |                      |
| Staff restaurant | 4,125 |                      |
| Administration   | 2,500 |                      |

Headcount  
Charge direct to administration

Other detailed information for the period was:

|                | Salaries | Depreciation | Headcount | Floorspace |
|----------------|----------|--------------|-----------|------------|
| Department 1   | 11,900   | 500          | 27        | 600 sq. m  |
| Department 2   | 2,000    | 750          | 4         | 200 sq. m  |
| Department 3   | 6,000    | 1,000        | 15        | 500 sq. m  |
| Administration | 5,010    | 1,500        | 9         | 300 sq. m  |
|                | 24,910   | 3,750        | 55        | 1,600      |

In addition you are told that the sales for the period were:

| Department | 1       | 2      | 3       |
|------------|---------|--------|---------|
|            | 220,000 | 66,000 | 231,000 |

Answer:

This answer requires that we format a grid

| Department                        | 1      | 2      | 3      | Administration | Total   |
|-----------------------------------|--------|--------|--------|----------------|---------|
| Salaries                          | 11,900 | 2,000  | 6,000  | 5,010          | 24,910  |
| Depreciation                      | 500    | 750    | 1,000  | 1,500          | 3,750   |
| Rates & Light/Heat*               | 2,250  | 750    | 1,875  | 1,125          | 6,000   |
| Advertising }<br>Transport etc. } | 28,000 | 8,400  | 29,400 |                | 65,800  |
| Staff restaurant                  | 2,025  | 300    | 1,125  | 675            | 4,125   |
| Administration (direct)           |        |        |        | 2,500          | 2,500   |
| Total                             | 44,675 | 12,200 | 39,400 | 10,810         | 107,085 |

\* To calculate the apportionment for this, we divide the combined total cost (£6,000) by the fractions of floorspace shown above. For example for Department 1:

$$(4,000 + 2,000) \times \frac{600}{1,600} = \underline{\underline{\pounds 2,250}}$$

By the same token we can calculate the apportionments of the advertising, transport, insurance and miscellaneous costs. Thus for department 1:

$$(35,250 + 25,850 + 1,175 + 3,525) \times \frac{220,000}{517,000} = \underline{\underline{\pounds 28,000}}$$

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In certain circumstances, service departments such as the administration department illustrated above are charged across to the operating areas. In the example cited above, if this was done, (say) on the basis of gross sales value, we would have the following result:

| <i>Department</i>              | <i>1</i> | <i>2</i> | <i>3</i> | <i>Administration</i> | <i>Total</i> |
|--------------------------------|----------|----------|----------|-----------------------|--------------|
| From grid above                | 44,675   | 12,200   | 39,400   | 10,810                | 107,085      |
| Allocating the administration* | 4,600    | 1,380    | 4,830    | [10,810]              |              |
| Revised totals                 | 49,275   | 13,580   | 57,810   | –                     | 107,085      |

\* For Department 1, the calculation is:

$$10,810 \times (220,000 \div 517,000) = \underline{\underline{\pounds 4,600}}$$

The allocation of service department costs becomes more significant when there are service departments supporting manufacturing activities. Clearly, the service provided is an essential part of the conversion cost, and must be matched with the use of the activity by the production area. This situation can be exacerbated when there are more than one ancillary service areas, mutually using each others' facilities. This again is best illustrated by a worked through example.

*Example 3.5*

Diane plc is a manufacturing organization, with three production departments, and two service areas. The overhead budget for the coming year is as follows:

|                             | <i>Production departments</i> |                  |                 | <i>Service departments</i> |                  |
|-----------------------------|-------------------------------|------------------|-----------------|----------------------------|------------------|
|                             | <i>Cutting</i>                | <i>Machining</i> | <i>Pressing</i> | <i>Engineering</i>         | <i>Personnel</i> |
| Budget overheads            | 154,482                       | 64,316           | 58,452          | 56,000                     | 34,000           |
| Share of service costs [%]: |                               |                  |                 |                            |                  |
| Engineering                 | 20                            | 45               | 25              |                            | 10               |
| Personnel                   | 55                            | 10               | 20              | 15                         |                  |

*Approach:*

There are two methods of dealing with this problem. First, there is a continual mechanical passing of costs backwards and forwards, until the service costs finally are total apportioned. This is a slow, time consuming task, that is costly and at the end of the day, lacks 100 per cent accuracy. The alternative is to use simple algebra.

*The mechanical method*

| <i>Department</i> | <i>Cutting</i> | <i>Machining</i> | <i>Pressing</i> | <i>Engineering</i> | <i>Personnel</i> |
|-------------------|----------------|------------------|-----------------|--------------------|------------------|
| Overhead          | 154,482        | 64,316           | 58,452          | 56,000             | 34,000           |
| Apportionment     | 11,200         | 25,200           | 14,000          | [56,000]           | 5,600            |
| Subtotal          | 165,682        | 89,516           | 72,452          | –                  | 39,600           |
| Apportionment     | 21,780         | 3,960            | 7,920           | 5,940              | [39,600]         |
| Subtotal          | 187,462        | 93,476           | 80,372          | 5,940              | –                |
| Apportionment     | 1,188          | 2,673            | 1,485           | [5,940]            | 594              |
| Subtotal          | 188,650        | 96,149           | 81,857          | –                  | 594              |
| Apportionment     | 327            | 59               | 119             | 89                 | [594]            |
| Apportionment*    | 20             | 45               | 24              | [89]               |                  |
| Final total Cost  | 188,997        | 96,253           | 82,000          |                    |                  |

\* To eliminate the time consuming effort in the last stages, where the totals are immaterial, this apportionment has been cut off, by doing a second apportionment of the engineering service cost between the production departments only.

*The algebraic method*

Let the total cost of the engineering department be  $e$ , and the personnel department be  $p$ . Then we can write:

$$e = 56,000 + 0.15p$$

$$p = 34,000 + 0.10e$$

Solving these two equations simultaneously, we get

$$p = 34,000 + 0.1(56,000 + 0.15p)$$

Collecting terms

$$0.985p = 34,000 + 5,600$$

$$\text{then } p = \underline{40,203}$$

Substituting we get

$$e = 56,000 + (0.15 \times 40,203)$$

$$e = \underline{62,030}$$

We can now apportion the two service departments in one step, avoiding the long winded procedure illustrated above.

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| <i>Department</i> | <i>Cutting</i> | <i>Machining</i> | <i>Pressing</i> | <i>Engineering</i> | <i>Personnel</i> |
|-------------------|----------------|------------------|-----------------|--------------------|------------------|
| Overhead          | 154,482        | 64,316           | 58,452          | 56,000             | 34,000           |
| e                 | 12,406         | 27,914           | 15,507          | (62,030)           | 6,203            |
| p                 | 22,112         | 4,020            | 8,041           | 6,030              | (40,203)         |
| <b>Total</b>      | <b>189,000</b> | <b>96,250</b>    | <b>82,000</b>   |                    |                  |

The reader will notice minor differences in the total figures when comparing the two methods, but the real advantage of the algebraic approach is the shortening of the time taken to perform the allocation.

### *Use of matrices*

A third method involves the use of matrices. The student reader will know from studying basic mathematics the essential workings of a matrix. To avoid the complexities inherent in the example above, we will use a simpler example.

### *Example 3.6*

A manufacturing organization has three production areas, and two service departments. The anticipated costs for the coming period are shown in the grid, along with the allocations of the service department expenses. You are required to formulate and allocate the service departments to the production areas.

| <i>Production</i> | <i>Services</i> |    |    |    |    |
|-------------------|-----------------|----|----|----|----|
| Department        | 1               | 2  | 3  | 1  | 2  |
| Costs [£K]        | 20              | 30 | 50 | 35 | 45 |
| Allocations       |                 |    |    |    |    |
| S1 (%)            | 40              | 20 | 30 |    | 10 |
| S2 (%)            | 55              | 30 |    | 15 |    |

Using the matrix, we can write:

Let A = Coefficient matrix

Let B = Percentage matrix

Let b = Vector of Constants

Let c = Vector which contains the solutions respectively for S<sub>1</sub> and S<sub>2</sub>

Let f = Vector which contains the final charges to the production departments.

Then we can write:

$$As = b$$

where  $s = S_1, S_2$  respectively,

$$(1 - A)s = b$$

i.e.  $s = (1 - A)^{-1}b$

Inserting and annotating the data as we do so, we get:

Coefficient matrix = (vector of constants) (vector of solutions)

Inserting the relevant data

I ----- The mutual allocation of  
I service department costs.

$$A = \begin{bmatrix} 0 & 0.10 \\ 0.15 & 0 \end{bmatrix} \begin{bmatrix} S1 \\ S2 \end{bmatrix} \qquad b = \begin{bmatrix} 35 \\ 45 \end{bmatrix} \qquad \text{The costs in the service areas}$$

from which:

$$(1 - A)^{-1} = \begin{bmatrix} 1.0148 & 0.0985 \\ 0.1478 & 0.9852 \end{bmatrix}$$

and

$$\begin{bmatrix} 35 \\ 45 \end{bmatrix} = \begin{bmatrix} 40 \\ 50 \end{bmatrix}$$

Simple matrix multiplication gives the final apportionment as

$$\begin{matrix} \text{(B)} & \text{c} & = & \text{f} \\ \begin{bmatrix} 0.40 & 0.55 \\ 0.20 & 0.30 \\ 0.30 & 0.00 \end{bmatrix} & \begin{bmatrix} 40 \\ 50 \end{bmatrix} & & \begin{matrix} 45 \\ 23 \\ 12 \end{matrix} \end{matrix}$$

I -----> The agreed percentage allocations

Thus the statement showing the allocations of the service department costs are:

|              | <i>Department</i> |           |           | <i>Total</i> |
|--------------|-------------------|-----------|-----------|--------------|
|              | <i>P1</i>         | <i>P2</i> | <i>P3</i> |              |
| £K           | 20                | 30        | 50        | 100          |
| Services     | 45                | 23        | 12        | 80           |
| <b>Total</b> | <b>65</b>         | <b>53</b> | <b>62</b> | <b>180</b>   |

The cynical, if not pragmatic student reader will note that much of the allocation of service centre costs is done on a very much more simplistic basis, using floorspace and other similar methods. The more curious reader might like to explore the complexities of linear programming and the references cited at the end of this chapter.

**Absorption of conversion overhead**

Having considered the problem of allocating and apportioning overheads to the production operating departments, the next stage is to absorb the overhead expenditure into the work-in-progress or stock valuation, in an equitable manner, that realistically matches the overhead used in converting the materials to finished goods.

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There are various methods available, and we will consider each in turn by taking a simple example.

The methods are:

- 1 Percentage on material cost, labour cost or even the traditional prime cost.
- 2 Labour hours produced.
- 3 Machine hours produced.

Essentially, each works on the basis that the conversion overhead is totalled, and expressed as a percentage of the cost being used to be absorbed, or as a unit rate per hour or unit of production. Before turning in detail to our example, let us assume that target material spend for the year was to be £500,000 and conversion overhead was likewise to be £500,000. The reader will readily appreciate that:

$$\frac{500,000}{500,000} \times 100 = 100\%$$

By the same token, let us assume that target production for the period was to be 200,000 produced hours, again, the reader will readily discern that:

$$\frac{£500,000}{200,000} = £2.50$$

### *Example 3.7*

For our example, we will assume a job that has the following cost details: Material £10.00 Labour £20.00 Labour hours produced 4. Machine hours produced 8. We are required to compute the implications where: Overhead is absorbed as either: 100 per cent on material cost, or 50 per cent on labour cost or 33 per cent on prime cost or £2.50 per labour produced hour or £1.25 per machine hours.

### *Percentage on cost methods*

#### *Percentage material cost method:*

|               |               |
|---------------|---------------|
| Material cost | 10.00         |
| Labour cost   | 20.00         |
| Overhead      | <u>10.00</u>  |
| Total cost    | <u>£40.00</u> |

#### *Percentage labour cost method:*

|               |               |
|---------------|---------------|
| Material cost | 10.00         |
| Labour cost   | 20.00         |
| Overhead      | <u>10.00</u>  |
| Total cost    | <u>£40.00</u> |

#### *Percentage on prime cost method:*

|               |                     |
|---------------|---------------------|
| Material cost | 10.00               |
| Labour cost   | <u>20.00</u>        |
| Prime cost    | <u>30.00</u>        |
| Overhead      | <u>10.00</u>        |
| Total cost    | <u><u>40.00</u></u> |

Ostensibly, these three methods illustrate a very simple approach to the problem. By simply estimating what you anticipate spending upon all overheads, and comparing it as a percentage of expected spends on either material, labour or total prime cost, a mark up for conversion overhead can be computed easily, and be readily understood.

Percentage methods have one big drawback however. Suppose in the example above, there was an overspend on materials, say of 100 per cent and the overhead is being absorbed on the material cost percentage basis. This is what would happen.

|                                      |                      |
|--------------------------------------|----------------------|
| Actual material cost                 | £20.00               |
| Labour cost                          | 20.00                |
| Overhead [100 per cent on materials] | <u>20.00</u>         |
| Total cost                           | <u><u>£60.00</u></u> |

Thus costs have not gone up by just the £10.00 materials, but by an extra £10.00 of overabsorbed overhead. Now while this may be good for profits, in that the overheads get overabsorbed, and overcharged to the customer, what is more likely to happen is that the firm's competitive edge is eroded, and control of overheads, vital for profitability is lost. Costing is as much about control as simple bean counting, and any method that risks removing the control element out of any part of the cost structure is, in the long term, detrimental. If the reader is unconvinced, then he or she should look at the industries in the western economies that have made their money out of cost plus pricing (defined as when conversion costs are added to materials *plus* any other costs plus a percentage on top for profit) on protected government contract work, and how they have had serious problems in adapting to the more competitive value for money approach demanded by governments in the contemporary world. There is a solution to this problem, and that is to establish standards for material costs, and absorb the overhead on the basis of a percentage on standard material costs. In this way, excess material costs are not compounded into the total cost through escalating overhead absorption percentages. This method is used, and is acceptable for inventory valuations under SSAP9.

#### *Labour hours method*

In the example above, it was assumed that the job took four hours, i.e. it created four standard hours. This will give a cost structure as follows:

|                 |                     |
|-----------------|---------------------|
|                 | £                   |
| Material cost   | 10.00               |
| Labour cost     | 20.00               |
| Overhead        |                     |
| 4 hours × £2.50 | 10.00               |
| Total cost      | <u><u>40.00</u></u> |

The reader should note that the emphasis is on *standard hours* defined as 'the quantity of work achievable at standard performance

expressed in terms of a standard produced unit of work in a standard period of time'. This avoids the problem outlined with the material cost above, that of compounding the inefficiencies by using actual hours worked. Such a method of overhead absorption is highly popular, well understood, and lends itself particularly to manufacturing activities that are highly labour intensive.

#### *Machine hour method*

In our example, we were told that there were eight hours of standard machine time. The effect of this is as follows:

|                 |                     |
|-----------------|---------------------|
|                 | £                   |
| Material cost   | 10.00               |
| Labour cost     | 20.00               |
| Overhead        |                     |
| 8 hours × £1.25 | <u>10.00</u>        |
| Total cost      | <u><u>40.00</u></u> |

In a world that is becoming more and more mechanized, with machines doing most of the work, and traditional direct labour relegated to the role of machine minders, this is a method of overhead absorption that is likely to become even more common. Clearly, therefore, it is appropriate in an environment where activity and output is controlled by the performance of a machine, rather than in the hands of a worker(s).

In selecting the method for absorbing conversion overhead, consideration should be given to two vital factors. First, the method should be appropriate. Where there is a high material content, some consideration should be given to percentages on standard material costs, while if the operation is labour intensive, then labour produced hours is appropriate, while, if it is a highly mechanized situation, then clearly, machine hours are appropriate.

The essential point is that the conversion overheads are absorbed into the cost of the inventory, and an effective control and measure of performance is available. Obviously, conversion overheads must be equal to the amount of overhead absorbed (defined by SSAP9 as the normal level of activity taking one year with another), so that there is no surplus at the end of the year. Should there be a surplus (or a deficit), then it is written off to the profit and loss account.

After this rather long winded treatise, the reader, and students in particular are tempted to say, 'Why bother?', there are reasons for not valuing stocks by the prime cost method (especially in the context of the Companies Act, 1985).

First of all, SSAP9 requires that inventories are valued on the total absorption cost basis, i.e. including the time related indirect expenses, or overheads. Since the SSAPs are approved by Council, they are binding on professional accountants. SSAP9 compliance also implies compliance with International Accounting Standards (IAS) which are slowly improving standards of accounting around the world, and there-



fore in case students overseas, or in multinationals thought they were off the proverbial hook, then IAS2 makes the same demands!

For UK students in particular, there is another reason. Under the famous *Ostime v Duple* tax case, prime cost inventory valuations are unacceptable to the Inland Revenue for the computation of taxable profits.

Students will be forgiven for thinking that neither reason is particularly good or relevant to the control of costs in an organization, but those are the rules, and we are stuck with them. However, as we shall see when we come to discuss marginal or direct costing, the exclusion of fixed or time related overheads is valid in the decision making process. It is worth adding out of interest that there is as yet, no Federal Accounting Standard that lays down adherence to total absorption costing for American companies, in quite the same way as SSAPs and IASs do in Europe.

### **Depreciation**

SSAP9 Paragraph 20 includes the phrase 'the inclusion in the cost of conversion of those overheads (including *depreciation*) which relate to production, not withstanding that these may accrue wholly or on a part-time basis'. In the light of this, it is essential that we consider depreciation.

Both the *Terminology* and SSAP12 define depreciation as 'the measure of wearing out, consumption, or other loss of value of a fixed asset whether arising from use, effluxion of time or obsolescence through technology and market changes'. It is well that we dispel a few popular misconceptions about depreciation at the outset.

First of all, depreciation does not set money aside for the future replacement of assets. It is purely the *matching* of the use, consumption and inevitable deterioration of an asset with the income that it generates. Examiners come down hard on students who persist in thinking that depreciation is such an exercise.

Secondly, depreciation is a non-cash item. When accounting for depreciation, the entries are to debit the overhead expense account with the charge for depreciation, and to credit either the fixed asset account or the depreciation provision. Notice that there is *no entry in the cash book*. No cash has moved in or out of the business. Examiners are even harder on students, who when preparing cash budgets and forecasts, bring depreciation into the calculation.

Thirdly, despite the fact that assets, especially buildings appear to increase in value, due to inflation, and it is tempting to exclude the depreciation charge because of this, SSAP12 is quite specific. Paragraph 10 says, 'It is not appropriate to omit charging depreciation of a fixed asset on the grounds that its market value is greater than its net book value. If account is taken of such increased value by writing up the net book value of a fixed asset, then, an increased charge for depreciation will become necessary'. (Greater clarification of this point has been given in ED37.)

From a costing standpoint, our concern is to identify a means of depreciating assets that is realistic, and then pass the charge into the conversion overhead. To that end, depreciation should be allocated to the accounting period, and hence the conversion cost, and absorbed accordingly so as to charge a fair proportion to each accounting period during the expected life of the asset used. This will include assets with a fixed life, such as leases (a leasehold factory building) or a wasting asset such as a mine.

At the outset, depreciation requires you to know: the cost or valuation of an asset; the nature of the asset and the expected length of its useful life with due regard to the possible incidence of obsolescence; estimated residual value.

In addition, useful life is determined by a contract as in a leasehold, directly governed by extraction or consumption dependent on extent of use, reduced by deterioration or physical obsolescence.

In principle we are faced with an equation:

$$\text{Depreciation charge} = \frac{\text{Cost of asset} - \text{any residual value}}{\text{Duration of life or level of use}}$$

SSAP12 concedes that residual value is likely to be small and at best an estimate, and can therefore be excluded from the calculations. The duration of life or level of use will determine the method chosen for depreciation, and as cost accountants, this is our focal point of interest. It is interesting to note that SSAP12 does not prescribe any methods of depreciation, or rates to be charged, but leaves it to SSAP2 (Accounting Policies) to declare what method of depreciation is being used. We will briefly review the four more common methods.

#### *Straight line*

This is where an equal amount of the cost of an asset is written off every year. Thus, where an asset cost £10,000, and has a life of ten years, one tenth, 10 per cent, or £1,000 will be written off each year for ten years. This is a simple method, and is much favoured by organizations.

#### *Reducing balance*

This is where a computed equal percentage of the value of the asset is written off each year. Thus, taking the same asset as quoted above under the straight line illustration, a percentage of the year end balance will be written off each year. However, to alleviate the problem of the asset never being totally written off, a formula is employed to arrive at this percentage. This is:

$$\text{Percentage} = \left(1 - \sqrt[n]{\frac{s}{a}}\right) \times 100$$

where:

n = estimated life in years

s = net scrap value

a = total installed cost

Thus using the data from the straight line illustration above, and adding the assumption that the asset will have a scrap value of £500, we get:

$$\begin{aligned}\text{Percentage} &= \left(1 - 10 \sqrt[10]{\frac{500}{10,000}}\right) \times 100 \\ &= (1 - \sqrt[10]{0.05}) \times 100 \\ &= (1 - 0.8511) \times 100 = \underline{14.89\% \text{ say } 15\%}\end{aligned}$$

Thus applying to the illustration:

| <i>Year</i> | <i>Balance brought forward</i> | <i>Charge</i> | <i>Carried forward</i> |
|-------------|--------------------------------|---------------|------------------------|
| 0           | 10,000                         | (1,500)       | 8,500                  |
| 1           | 8,500                          | (1,275)       | 7,225                  |
| 2           | 7,225                          | (1,084)       | 6,141                  |
| 3           | 6,141                          | ( 921)        | 5,220                  |
| 4           | 5,220                          | ( 783)        | 4,437                  |

This method takes cognisance of the fact that a greater amount of the value of the asset will be lost in the earlier years of its life. It will be noted that the formula used to calculate what rate to use to enable the asset to be written off during a fixed period of time is complicated, and it should perhaps be noted that the only real advantage that this method has, is that it is used by the Inland Revenue, when computing writing down allowance for fixed assets.

#### *Sum of the digits*

This method, sometimes called the rule of 78, sums the total of the years of an asset's life, and then depreciates a fraction. Thus for our asset, with a ten year life span:

$$\Sigma (10 + 9 + 8 + 7 + 6 + 5 + 4 + 3 + 2 + 1) = 55$$

Thus 10/55 of the asset value goes in the first year, 9/55 in the second, 8/55 in the third, and so on.

| <i>Year</i> | <i>Opening balance</i> | <i>Charge</i> | <i>Closing balance</i> |
|-------------|------------------------|---------------|------------------------|
| 0           | 10,000                 | (1,818)       | 8,182                  |
| 1           | 8,182                  | (1,637)       | 6,545                  |
| 2           | 6,545                  | (1,455)       | 5,090                  |
| 3           | 5,090                  | (1,272)       | 3,818                  |
| 4           | 3,818                  | (1,090)       | 2,728                  |

This method has the obvious advantage of loading the depreciation charge towards the beginning of the life of the asset, when value loss is at its greatest. This disadvantage of both this method and the reducing balance method, is that both show different figures for the charge each year, making comparisons and indeed, computation of overhead absorption rates difficult, inconsistent and meaningless.

*Units*

SSAP12 paragraph 3(c) recognizes that useful life is dependent upon the extent of use. It therefore seems appropriate to compute depreciation based on use. Theoretically, this is fine, providing the use is close to 'normal' as defined by SSAP9, Reality can give problems however, as our example will illustrate.

*Output from the asset described above:*

| <i>Year</i> | <i>Unit</i> |
|-------------|-------------|
| 0           | 1,000       |
| 1           | 1,500       |
| 2           | 500         |
| 3           | 0           |
| 4           | 1,750       |

Life is assumed to be ten years, and 10,000 units produced.

*Annual charge*

| <i>Year</i> | <i>Opening balance</i> | <i>Charge</i> | <i>Closing balance</i> |
|-------------|------------------------|---------------|------------------------|
| 0           | 10,000                 | (1,000)       | 9,000                  |
| 1           | 9,000                  | (1,500)       | 7,500                  |
| 2           | 7,500                  | ( 500)        | 7,000                  |
| 3           | 7,000                  |               | 7,000                  |
| 4           | 7,000                  | (1,750)       | 5,250                  |

This disadvantage is obvious. During the year the machine was not used, it still lost value, even if it did not deteriorate, and as a result the book value at the end of the year, was not true and fair. The obvious problems of comparison remain, as do the problems of forecasting a depreciation charge for inclusion in the overhead absorption rate.

**Final considerations**

Three final points remain for our consideration under the heading cost ascertainment.

***Relevant costs***

The *Terminology* defines these as 'Costs appropriate to aiding the making of specific management decisions'. These can include direct material, direct labour and fixed and variable overheads, and include not just production overheads, but also selling, administration and distribution costs.

For example, suppose an accountant spends part of his leisure time cultivating a smallholding. It is purely a hobby, a chance to get away from the desk, and out in the fresh air. The smallholding, however, has a bad year, and since it is not a trade, enabling the losses to be set against the profits of the accounting practice, the accountant has to

decide whether to abandon the holding. The costs *relevant* to such a decision are:

- 1 Cost of materials; seeds, fertilizers, pesticides.
- 2 Cost of any tools bought specially.
- 3 Cost of any hired equipment.
- 4 Cost of the rent of the smallholding.

*Less* the income generated by growing fresh vegetables, instead of having to buy them.

Notice that there is no labour cost in the equation. This is because the accountant works the holding himself, purely as a leisure interest instead of jogging or playing squash, and thus the cost of his labour is irrelevant.

Another simple example might be whether to drive to work or use the car. The cost of the depreciation of the car is irrelevant, since it is incurred anyway, irrespective of whether the car is out on the road in use, or locked away in the garage. The relevant costs are fares and perhaps a time allowance versus petrol, oil and possible increased service costs.

### **Opportunity costs**

These are defined as 'the value of a benefit sacrificed in favour of an alternative course of action'. To illustrate this, let us go back to our friend the accountant. Suppose he finds it necessary to paint the outside of his house. If he does it himself, it will be a dangerous, exhausting weekend(s), the job will drag on, but he is a competent amateur house painter, and he will be sure of a good quality job, possibly get a suntan and save £200! He is offered a weekend consultancy job, that will pay £1,000. Since he cannot do both, he must sacrifice the £200 saving on painting the house himself, and leave it to a professional. The £200 is the opportunity cost of taking on that special consultancy assignment.

### **Notional costs**

These are defined as 'a hypothetical cost taken into account in a particular situation to represent a benefit enjoyed by an entity in respect of which no actual expense is incurred'.

Traditional cost accountants feel that a notional charge for rent should be brought into the cost accounts, where buildings are freehold, to take into consideration the cost of the buildings. The logic behind this is that there may be manufacturing premises which are freehold, while others are either leasehold, or rented. Such an action would be consistent, and facilitate realistic comparison and performance evaluation.

Since SSAP12 stipulates that freehold buildings should be depreciated, the charge for the depreciation will appear in the cost accounts instead, the use of notional costs in this context is now meaningless.

Since it appears that there are no other notional costs, even in the most recent of textbooks, it would seem that notional costs are no longer a topic for consideration, other than that the student should be aware of the term, but see Chapter 10 for an example of the treatment of notional costs.

### **Summary of Chapters 2 and 3**

We have now come to the end of two rather long and exhausting chapters. However, their contents are fundamental to not just the rest of the subject, but also the development of the essential technical knowledge required to go on to more advanced management accounting studies. Consequently, a brief summary is perhaps desirable. From Chapter 2, the student should now have a thorough grounding in the nature of cost, what a cost centre is, the elements of cost and the mechanics of cost collection. With regard to materials, there must be an awareness of material procurement, issue, valuation, inventory management and control and where there are points of controversy and debate, or different approaches, the arguments and the implications of the respective alternatives.

In Chapter 3 we concentrated first on direct labour. Again, the student must be aware of labour control, from the mechanics of recruitment, remuneration and control through clocked hours, worked hours and produced hours. The implications and debate about allowances and bonuses, as well as the problems of turnover should not be ignored. Turning to overheads, there should be a knowledge of the nature of overheads, the difference between spend, allocation, apportionment, and absorption with a thorough appreciation of the various methods of absorption, and the importance of selecting the most appropriate method. Some of the actual accounting implications were discussed, in preparation for further more detailed treatment in later chapters. Depreciation was introduced, and again, the student should appreciate the requirements of SSAP12, and the implications of the various methods available. Finally, three somewhat esoteric terms were introduced, viz., notional costs, relevant costs, and opportunity costs. Again, these are terms which will be encountered in more detail later on.

### **Questions**

- 1 Describe the essential requirements of an effective material stock control system. (17 marks)

*CACA 1.2*

- 2 SP plc is engaged mainly in retailing fashion and leisure wear, camping equipment and protective clothing. The company's head office and warehouse are located on the east coast and the 50 shops it operates are divided into three divisions as follows:

| <i>Division</i> | <i>No. of shops</i> |
|-----------------|---------------------|
| North-west      | 16                  |
| West            | 13                  |
| South           | 21                  |

Servicing of the shops is undertaken from the head office for:

- personnel and staff training
- window display, sales promotion and advertising
- warehousing and distribution – no goods are delivered direct to the shops from the manufacturers.

Costs for the three service functions are budgeted for the next financial year, as shown below, and it is desired to determine methods of apportioning these costs to the three retailing divisions.

|             | <i>Personnel and<br/>staff training</i> | <i>Window display,<br/>sales promotion<br/>and advertising</i> | <i>Warehousing and<br/>distribution</i> |
|-------------|---|--|---|
|             | <i>£000</i>                             | <i>£000</i>  | <i>£000</i>                             |
| Wages       | 40                                      | 65   | 140                                     |
| Transport   | 9                                       | 30   | 115                                     |
| Other costs | 8                                       | 135  | 30                                      |

Other information available from the budget for the next financial year is as follows:

| <i>Division</i>              | <i>North-west</i> | <i>West</i> | <i>South</i> | <i>Total</i> |
|------------------------------|-------------------|-------------|--------------|--------------|
|                              | <i>£000</i>       | <i>£000</i> | <i>£000</i>  | <i>£000</i>  |
| Sales                        | 2,760             | 2,320       | 4,120        | 9,200        |
| Cost of goods<br>sold        | 1,154             | 978         | 1,668        | 3,800        |
| Branch wages                 | 422               | 358         | 645          | 1,425        |
| Divisional<br>administration | 45                | 45          | 53           | 143          |

You are required to:

- Prepare a statement showing how you would apportion the costs of the service functions to each of the retailing divisions. (8 marks)
  - Explain, in a brief report, why you have selected the bases of apportionment that you have used in (a) above and state any limitations. (7 marks)
- (Total: 15 marks)

### *CIMA CA1*

- A small company classifies all its production overhead of £2,400 per week as fixed. The company currently produces 150 components per week on a subcontracting basis and has been asked by its major customer to increase its output. Management is reluctant to operate for more than the normal forty hours each week but in an attempt to meet its customer's wishes decides to offer an incentive scheme to its four direct operators whose current rates of pay are as follows:

|                             | <i>Hourly rate</i> |
|-----------------------------|--------------------|
|                             | £                  |
| G Ahmed                     | 3.00               |
| A Brown                     | 3.00               |
| D Choudery                  | 4.00               |
| G Spencer (working foreman) | 5.00               |

With the agreement of the employees, who are not members of a trade union, their basic hourly rates are to be reduced for a trial period of four weeks to those shown below but with *each* of them being given a bonus of £0.60 for every unit produced.

|            | <i>Revised hourly rate</i> |
|------------|----------------------------|
|            | £                          |
| G Ahmed    | 1.50                       |
| A Brown    | 1.50                       |
| D Choudery | 2.50                       |
| G Spencer  | 3.50                       |

After the first week of the trial period, production was 180 units. The production manager studied the results and believed the introduction of the bonus was too costly because the increase of 20 per cent in production had increased labour costs by 32 per cent. He is considering recommending changes to the newly-introduced scheme.

You are required to:

- (a) (i) Calculate how the increase in labour cost of 32 per cent was derived.  
(ii) Comment on whether the production manager was correct in assuming that the bonus scheme was too costly, showing your supporting calculations. (12 marks)
- (b) List *eight* of the general principles which should be borne in mind when an incentive scheme for direct labour personnel is being considered. (8 marks)
- (Total: 20 marks)

*CIMA CAI November 1984*

- 4 In the context of a company's stock control, the following information relates to item number 7829:

|  |                |
|--|----------------|
| Stock levels: maximum                      | Units<br>6,000 |
| minimum                                    | 1,000          |
| Re-order level – when free balance reaches | 1,600          |
| Re-order quantity                          | 2,000          |
| Opening balances at 1st August included:   |                |
| Stock in the stores                        | 1,600          |
| Ordered from suppliers awaiting delivery   | 2,200          |
| Allocated                                  | 1,200          |

Transactions for the three months ended 31st October included:



|  | August | September | October |
|--|--------|-----------|---------|
| Received   | 1,200  | 2,400     | 3,600   |
| Issued   | 1,400  | 3,600     | 2,200   |
| Allocated  | 1,800  | 4,600     | 1,400   |
| Returns to supplier (not replaced)                                 | 200    | 800       | 400     |
| Transfers (by transfer notes) from<br>Department X to Department Y | 600    | —         | 800     |
| Returns to stores  | 600    | 400       | 200     |

You are required to:

- (a) Design a stores record card to provide for the above information. (10 marks)
- (b) Enter on the card, for item number 7829, the appropriate transactions for the three months. The balances at the end of each month should be shown for:
  - (i) allocated stock
  - (ii) stock on order
  - (iii) stock in stores
  - (iv) free balance

(15 marks)

(Total: 25 marks)

*CIMA CA1 November 1985*

- 5 Cost classifications used in costing include:
  - (a) Period or time related costs
  - (b) Product costs
  - (c) Variable costs
  - (d) Opportunity costs

Required:

Explain each of these definitions with examples of types of costs that may be included. (17 marks)

*CACA 1.2 June 1987*

### References and further reading

- 1 CIMA (ICWA), *The Cost of Labour Turnover*, 1952.
- 2 Kaplan, R., Thompson, G. L., 'Overhead Allocation via Mathematical Programming Models', *Accounting Review*, April 1971.
- 3 Layne, W. A., *Cost Accounting*, Macmillan, 1984, Chapters 2 and 5. (Chapter 2 is Dr Layne's excellent ancillary chapter that introduces students to the use of matrices.)
- 4 Scapens, R. W., *Management Accounting Recent Developments*, 1985, Chapter 10.
- 5 Weingarter, H. M., *Mathematical Programming and the Analysis of Capital Budgeting Problems*, Kershaw, 1974.
- 6 Williams, T. N., Griffin C. H., 'Matrix Theory and Cost Allocation' in Rosen, L. S., (ed.) *Topics in Managerial Accounting*, McGraw-Hill, 1964.
- 7 Williamson, D. 'Incentive Payment Schemes', *Management Accounting*, March 1989, pp. 40–1.

# 4 Types of costing

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This chapter splits very clearly into two parts. First we will look briefly at the types of costing methods that are likely to be found, and then the second part will describe some typical costing systems that exist.

## Types of costing methods

From studying management, the student reader will already be aware of the different types of organizations that can be found. For almost every type of organization, there is a costing system, but just as many different organizations can be grouped together under one heading, so can many of the types of costing systems.

The *Terminology* identifies seven essential methods. (See Figure 4.1.)

## Product cost accounting

The cost of any product, good or service is defined as 'the cost of a finished product, good or service built up from its cost elements'. The *Terminology* goes on to add an example, and such a product cost will include:

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**Material:** Description of the material(s) used, plus details of any ancillary materials, such as trim and packing. Build in any contingency allowances.

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**Labour cost:** Identification of activities, the machines used and skills required. Allowances for testing and any contingencies should be built in.

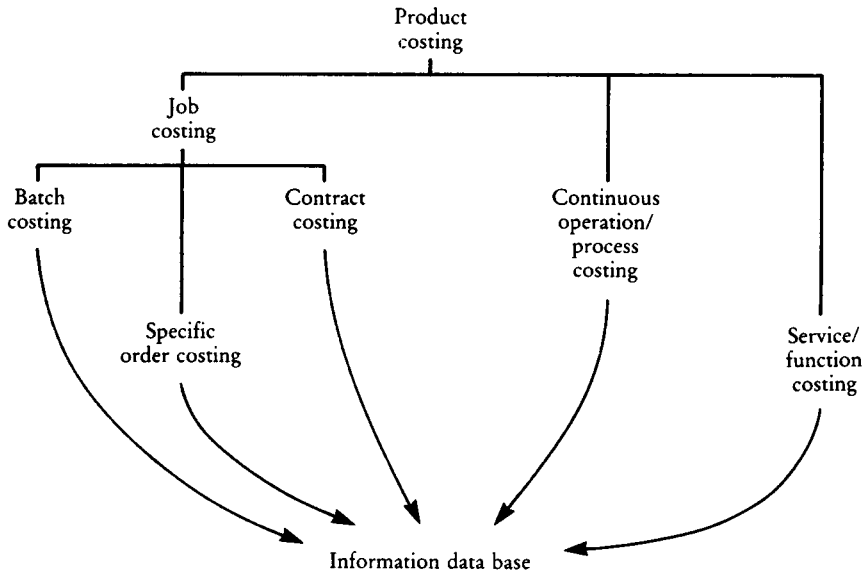


Figure 4.1 Costing systems

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**Overhead allocation:** (However based i.e. material based, labour hours or machine hours.)

---

Any direct costs that arise say special subcontract work.

---

Final reject contingency.

---

Total production cost. (This complies with SSAP9.)

---

To build up to a price, obviously, the allowances for non-conversion overhead (selling, distribution and administration) have to be added on, plus any expected mark up arising from a cost-plus pricing system.

The reference to contingency allowances, recognizes that there may always be spare material, such as that which arises from cutting out shapes from metal, or cutting out cloth from lengths, which cannot be used in the final production. This may become waste, or as in the case of metal, recoverable scrap. Equally, there will always be an element of spoilage, causing items of material to be scrapped, and the need for contingency allowances to be built into the labour times. The student reader might like to consider the implications of more advanced mechanization, in the context of reduced scrap material, and hopefully fewer rejects being generated, because a machine, provided it is properly maintained, can work at a more consistent rate than a human being.

This cost card layout can be used for costing up a product, and hence

for quoting a customer, for control against standards if operating, and for inventory valuation at various stages of manufacture. Such a card would not be exclusively used in manufacturing, the costing out of a banquet, or basic meals in the catering trade would follow very much the same approach, while a garage bill for servicing or repairs follows very much the same pattern.

Product costing leads into three additional types of costing, job costing, batch costing and continuous operation/process costing.

### ***Job costing***

Job costing is 'that form of specific order costing which applies where work is undertaken to customers' special requirements and each order is of comparatively short duration, (compared with those to which contract costing applies).

The work is usually carried out within a factory or workshop and moves through activities and operations as a continuously identifiable unit. The term may also be applied to work such as property repairs and the method may be used in the costing of internal capital expenditure jobs. Job costing is discussed in more detail below.

### ***Batch costing***

Batch costing is 'that form of specific order costing which applies where similar articles are manufactured in batches either for sale or for use within the undertaking'.

Job costing can be characterized by a single product or service. The servicing of a motor car by a garage is the classic example of this. The individual motor car goes in, and the tasks are performed.

By contrast, batch costing is characterized by a run of similar products. A jobbing printer, or any form of printer would operate on a batch costing basis, quoting in his price for a length of run. To that end, batch costing is frequently characterized by a large fixed cost element, embracing the tooling and setting up time, and a much smaller variable cost element, which relates to the length of run. For example, Elizabeth Limited specializes in the printing of handbills and leaflets. Fiona asks her to quote for a leaflet, and asks about the implications for having 500, 1000, and 2500 leaflets printed. Elizabeth's response is to reply by saying that the setting and layout will cost £100, and each leaflet ½p. Thus the costings work out as follows:

|                        | <i>Number of leaflets</i> |             |             |
|------------------------|---------------------------|-------------|-------------|
|                        | <i>500</i>                | <i>1000</i> | <i>2500</i> |
| Setting and layout (£) | 100                       | 100         | 100         |
| Cost of leaflets (£)   | 2.50                      | 5           | 12.50       |
| Total cost (£)         | 102.50                    | 105         | 112.50      |
| Unit cost (p)          | 20.5p                     | 10.5p       | 4.5p        |

It is thus very obvious that as volumes or lengths of runs increase, so the unit costs fall considerably. Batch costing will be further discussed in detail below.

### **Continuous operation/process costing**

Continuous operation/process costing is defined as 'the basic costing method applicable where goods or services result from a sequence of continuous or repetitive operations or processes to which costs are charged before being averaged over the units produced during the period'. Again, process costing is dealt with in detail below, but the significant aspect of process costing compared with job and batch costing is that it is difficult to identify a single unit of product within the process hence the need to utilize averages.

### **Contract costing**

Contract cost is defined as 'aggregated costs relative to a single contract designated a cost unit'. Such an approach usually applies to major long-term contracts as distinct from short-term job costs. The important distinction is long-term since this has important implications for the matching of profit with costs and expenses for major contractors. Contract costing is similar to job costing, only the jobs are usually deemed to be bigger, and longer lasting, as emphasized in the definition: 'that form of specific order costing which applies where work is undertaken to customers' special requirements and each order is of long duration (compared with those to which job costing applies)'. Examples would include civil engineering such as the building of motorways, bridges, building construction, ship building and naval refits, and the development of weapon systems.

### **Service/function costing**

This is 'the costing of specific services or functions, e.g. canteens, maintenance, personnel'. These may be referred to as service centres, departments or functions.

Service costing is an area which is largely neglected in the costing literature. The reason may be that culturally and traditionally, costing has thought in terms of manufacturing, and services have been regarded very much as an ancillary function. The reader really needs to fix two things in his mind. Service industries *per se*, such as automobile maintenance, hotel and catering, transport, computer systems and operation tend to operate systems very similar to those of manufacturing. Consequently, it is not difficult to graft the ideas of jobbing, batch and continuous operations on to a service industry. Secondly however, are the ancillary services, found where there are large manufacturing or even service organizations, with their own internal ancillary service activities. For example, an automobile manufacturer may have its own

power plant identified as a separate cost centre, or an electronic equipment manufacturer may have its own transport department, its own computer centre, and need its own site services as a separate cost centre, if only for efficient control purposes.

Having outlined the various types of costing systems that can be found, we now turn our attention to some examples. All the examples quoted have been derived from the accounting literature on the subject and have been selected as being typical of a particular industry or sector. The reader who would like to go further, can study the references at the end of the chapter and then embark on his or her own research.

We have selected:

- 1 High-tech production.
- 2 The oil industry.
- 3 The world of retailing.
- 4 Canteens/restaurants/fast food outlets.
- 5 Maintenance costs.
- 6 Service industries – small hotels.
- 7 The environment of the UK health service.
- 8 Retailing and manufacturing compared – the Fine Fare case study.
- 9 Transport industries.

It must be emphasized that the descriptions cannot be comprehensive, but are included as a basis for the reader to begin further exploration.

### *1 High-tech production*

It would be repetitious to describe a traditional costing system in a conventional manufacturing environment, so attention is turned instead to the implications of high-tech production on cost reporting systems. Chalos and Bader note that traditional methods may lead to a distortion and consequential misallocation of resources. Even in the United States, where direct labour is still largely an activity related cost, the reduction in direct labour due to advanced 'usi-facture' has meant a substitution of more conversion overhead, possibly due to higher depreciation charges and higher technical support charges. The term 'usi-facture', first coined by a Swedish economist describes the type of industrial activity that is highly mechanized and automated. Few operatives in the traditional sense, are required to actually perform tasks with their hands to make the product. 'Usi' comes from the French 'usine' meaning a factory and compares with the traditional word 'manufacturing' which etymologically indicates the use of hands, crafts and human skill. (This derives from the Latin 'manus' meaning hand and 'facere' meaning to make.) To emphasize this change of emphasis, Chalos and Bader show a comparison of the two types of cost structure and suggest the reasons for change, and a new type of cost system. (See Figure 4.2.)

The discerning student reader will notice that price and usage variances will have reduced, perhaps moving closer to the traditional

| Category                                    | Traditional costs                        | High-tech costs        | Cause of change                               |
|---|--|------------------------|---|
| Prime costs                                 | Raw material                             | Raw material (reduced) | No change but less spoilage and fewer defects |
|   | -----> Direct labour                     | Reduced direct labour  |   |
| Conversion costs                            | ←----- Variable manufacturing            | ----->                 | Reduced because of less support staff         |
| Conversion costs                            | ←----- Fixed Manufacturing               | ----->                 | Increased due to greater depreciation         |
| Period costs (not related to manufacturing) | ←----- Variable selling and distribution | ----->                 | Changing distribution costs                   |
|   | ←----- Fixed selling and distribution    | ----->                 | Increased by more indirect labour             |

Figure 4.2 *Changing product cost emphasis*

concept of operational ideal standards. At the same time, overhead absorption must be machine hour based, and the increased fixed costs proportion will raise the traditional break even point and erode the margin of safety. (See Chapter 8 for a full discussion of the terms break even point and margin of safety.) Some of these points come out in Chalos and Bader's second grid (Figure 4.3).

## 2 *A thought from the oil industry*

Costing systems must comply with the essential concepts of accounting. The oil industry has always had the problem of matching its vast development and exploration costs with its ultimate revenues. Two methods have been considered. 'Successful efforts' as advocated by FAS19 (1978) and adhered to by most of the majors, and 'full costs' operated by the independents and juniors.

'Successful efforts' accumulates costs on a property by property method. Thus if oil is found, the costs are amortized over the life of the production and reserves of the property. By the same token, if no oil is found, then the costs are prudently written off during the current period. (c/f SSAP13 there is no ongoing write off until oil is found.)

'Full cost' permits all costs, including lost costs of dry holes to be carried forward, pooled and matched against revenues received. The discerning student reader will readily see the problem, that costs could be carried forward at an enormously high level, inflating capital

|                                   | <b>Traditional</b>  | <b>High-tech</b>   |
|-----------------------------------|---|--|
| Basis of overhead absorption      | Labour hours or money   | Machine hours<br>Standard purchases<br>Units of production |
| Cost system                       | Standard actual job   | Authors suggest hybrid but standard would work             |
| Inventory valuation (by category) | Raw materials<br>Work-in-progress<br>Finished goods                       | Raw materials<br>Finished goods*                           |
| Variance measures                 | ← -- Raw material ----- →<br>Direct labour<br>Fixed and variable overhead | Distribution<br>Fixed overhead**                           |
| Cost analysis                     | Variable costing***<br>Break even analysis                                | Full costing   |
| Performance measures              | Production variances  | Defects value added<br>days of inventory                   |

*Notes and comments:*

- \* The author himself has a high-tech background, and records that there was no categorizing of inventory, it was all treated as work-in-progress, with full agreement with the auditors. Very little finished goods stock was held for stock, by the very nature of the business, but delivered direct to customers who had ordered it. In the world of consumer high-tech electronics it is likely that a different situation would prevail.
- \*\* The author fails to see why there would be any real change here, and supports the view expressed by Arnold and Hope that the only meaningful overhead variances are the total variances, with perhaps a concession to overhead absorption.
- \*\*\* The student reader should remember that this is based on an American article based on American practice. Some of their accepted traditions of working were already unacceptable in the British Isles because of SSAP restrictions. It should be noted also that the performance measures are really unlikely to change dramatically. What will change in fact will be the standards against which the performance measures are set.

Figure 4.3 *Suggested updated cost accounting system*

employed as well as the risk of flouting the prudence convention by matching against reserves rather than revenues generated.

Following research undertaken by ICA (Canada) a new guideline has been developed which requires:

- (a) Cost centres must be established on a country by country basis, to eliminate the problem of multinationals treating all properties as one irrespective of location.



- (b) Costs may be capitalized on the basis of proven reserves.
- (c) Certain costs may be excluded from the category of those subject to depreciation, such as the costs of acquiring and evaluating unproved properties, and the cost of major development projects, the latter of which may be subject to limited carry forward until production begins.
- (d) Dry holes must be depleted including the capital cost of interest once the depletion begins.
- (e) Gains or losses on realization of properties should only be recognized if material.

To avoid costs being carried forward a ceiling is set, and must be reviewed on a quarterly basis. Also, to avoid the problems of fluctuating prices, it is suggested that the current prices are used to estimate future net revenues, or a twelve month average if prices are fluctuating rapidly. The ceiling is computed on an objective historical cost basis but is an arbitrary figure, reflecting and relating to proven reserves with some concession to probable reserves. Obviously, probability factors would have to be introduced into the equation. In addition, cognisance must be given to the amount of cost deductions that have to be made from the projected income from proven reserves.

As a final measure, the ceiling test on items capitalized is carried out as a two stage exercise, first on the individual national cost centre(s) and then globally, at corporate enterprise level.

The essential calculation is net book value compared to:

- (a) Cost, net of impairments of unproved properties and major development projects.
- (b) Future net revenues of proven properties to ascertain if a write down is required.

Again the discerning student reader will note the value to a business concept of asset valuation, reminiscent of the ideas of the Australian Professor Chambers, creeping into the thinking.

### *3 The world of retailing*

A major growth area in western economies has been that of retailing. Commensurate with this growth has been the increased competition in the retailing sector, and hence the increased need to approach the retailing operation with the same desire for cost conscious operation as has been evident in the traditional manufacturing sector.

In response to demands from the retailing operations' managers and marketing managers, certain areas have been investigated. Alan Warner (1981) (amongst others including David Yorke of Manchester Polytechnic) has identified certain areas where the cost accountant's technical expertise can be profitably applied.

- (a) The giving of special discounts. These can vary because of the size of customer, quantity and payment period. It is essential that these

are realistically compared to ensure that the true cost of what is being given away can be identified.

- (b) Product mix – different customers take a different mix of products, and the contribution of these mixes will, almost inevitably, vary. The contribution generated by these order mixes must be identified, possibly by using the multi-product model suggested in Chapter 6. The results of such an analysis may reveal that certain customers are always taking low contribution products, and are in fact of less value to the business than hitherto thought. Such customers must be subject to review, and hopefully the results will be beneficial to both retailer and customer.
- (c) Operating costs are a difficult area. The cost of servicing a customer may require some apportionment of costs, while distribution, where deliveries are provided are likely to become increasingly important as energy costs continue to rise. Actual costs of servicing the customer in terms of demands on the sales force need to be considered in some detail, as well as administration costs. (Clearly, many of these costs will not relate universally to all retail outlets. What we are trying to establish is that there are specific areas that should be considered, and the individual retailer should consider their individual relevance for him or herself.)
- (d) Working capital – the cost of financing a wide variety of inventory is important. Under this heading, will come discounts offered, time taken on customer credit, the diversity of product offered and possibly the location. Consideration of this latter factor against the cost of holding working capital may be a vital one when ensuring the profitable running of a business. Knowledge of the locality will reveal that some products are not worth holding, they will never sell, while others will sell well and possibly with better margins.

The approach to take in such an exercise is to prepare a product/customer profit and loss statement something like this:

Sales (at list or budget price)  
*Deduct* discounts (analysed)  
 Standard cost of goods sold  
 Gross margin  
*Deduct* direct costs:  
     Distribution costs  
     Selling costs  
     Administration costs  
     Finance costs  
 Contribution  
*Deduct* any purely allocated costs  
 Final profit from customer/product

#### *4 Canteens/restaurants/fast food outlets*

Most large organizations provide on-site catering facilities for their employees. Usually, these facilities are treated as a welfare provision,

and subsidized in some form. In this particular study, which comes from India, the problem is approached from the standpoint that the provision has to be made, but there may be logistical limitations that restrict the organization resulting in reduced resources being available to run the facility as effectively as perhaps they would like. While in the West, such a situation may be alleviated by the provision of luncheon vouchers or by subcontracting, this may not always be a practical solution.

'Cost Control in a Workman's Canteen', a paper presented by H. S. Dhar in the *Indian Management Accountant* in 1978 tackles the problem from the approach of a system that can be worked by technician or part-qualified staff, rather than by committing the expensive fully qualified staff to the cost control exercise. As such, it becomes a very interesting exercise in cost effective control.

Dhar uses six self-explanatory ledger accounts:

- (a) The stock register maintained on a FIFO basis and perpetual inventory system.
- (b) Miscellaneous expenditure register – for ancillary costs – inter alia cleaning and food collection.
- (c) Container register – control over chargeable containers.
- (d) Daily food sale register – the sales day book.
- (e) Coupon sales register – which refers to situations where special food allowances are made available.
- (f) Canteen cash register.

The stock register will require periodic checking of the inventory system which will result in possible discrepancies being found, which will require investigation. Obviously, much of any canteen stores is highly perishable, and therefore stock levels will need to be controlled to avoid wastage. Strict control over the authority to dispose of outdated stock must be maintained, and the so-called dry stores (materials which do have a longer shelf life) must be protected from the risk of contamination or even theft. Some consideration has to be given to the possibility of some stores settling or deteriorating during the period of store, creating the need for recognizing both normal or admissible losses, and inadmissible losses.

The miscellaneous expenditure account collects the costs of all the ancillary activities, such as collecting fresh food from markets, cleaning materials and possibly replacements of breakages. Dhar advocates a rigorous voucher control of such expenditure, again because many of the materials are easy targets for theft. The control must highlight usage levels especially to ensure that the controls are not unreasonable.

Many items, particularly large quantities of dry store goods may well be subject to the problem of returnable containers. The subject of container accounting is a problem for the student elsewhere in the course, but it should not be forgotten that charged containers could be quite a material item in operating a small canteen facility.

The daily food sale register records what is sold. In the modern fast food environment the till is equipped to record all the items on the

standard menu, and as the order is placed, so the individual sale is analysed. In a completely computerized fast food system, such as in Macdonalds or Casey Jones, this is also connected to the inventory register, issuing out the individual portions of burgers, fries and other fast food delights. However, the essential principle remains the same, that the total sales are identified, and capable of quick effective analysis. In the all-American style fast food vending operation, an integrated till system would provide an analysis of total sales on a daily or even hourly basis for each vending point, minus the cost of sales on a predetermined standard basis. Dhar sees difficulties in establishing standards and questions their need, but where there is a standard menu throughout the day and year, then standards can be readily established and very effectively operated.

Dhar envisages a situation where operatives are permitted to buy food coupons in advance, say for a month, to alleviate the need for carrying cash with them on a daily basis. Obviously, the concern for control is that vouchers and money received add up correctly to the total daily sales.

Control is manifest very much in the amounts of food issued, and again the similarity with the fast food vendor is evident. Given the analysed sales, there must be a known volume of food issued from stores. The regular checking of this will verify that this is correct, and that there are no shortages.

The report to management will inevitably be a schedule of income versus expenditure:

Canteen receipts

Direct costs (i.e. food, beverages, confectionery)

Gross profit

Expenses

Wages

Energy

Sundries

Net profit (loss) ----->

(Chargeable to the conversion  
cost or production overhead  
account)

The amount that the company is prepared to subsidize a canteen facility will vary greatly from company to company. The profit or more usually a deficit will be controlled by the normal expense budget procedure, based on a policy decision about what is acceptable and/or affordable.

### 5 *Maintenance costs*

This is an area where attention is likely to increase in the future. Traditionally, manufacturing had to consider purely the conflict be-

tween preventive maintenance, and emergency/breakdown repair work. There was usually the additional problem of how much capital employed was committed to the area in terms of spares. The move to reduce capital employed, and particularly working capital led to a run down of the traditional 'Aladdin's Cave' maintenance department. However, with accelerated progress towards higher mechanization, greater 'usi-facture' where minded machines perform what often hundreds of operatives achieved hitherto, has potentially increased the maintenance budget and its inherent problems.

The essential principle expounded by R. M. S. Wilson remains, i.e. sufficient maintenance should be carried out to provide the required level of service, (and maintain the accepted level of safety standards) at an optimum cost. This requires the equation:

Lowest total cost = preventive maintenance costs + cost of breakdowns

Cost collection in a maintenance department is much the same as any other service function, categorizing the cost of salaries, allowances for overtime and callout, consumable spares etc. This should then be controlled against a budget. It is, however, the budget that needs careful consideration. Lock suggests four criteria should be used in formulating the budget.

- (a) The level of maintenance required should be assessed professionally with full cognisance of the demands of the industry.
- (b) The budget should be sufficiently tight to incorporate a demanding management task (in the best traditions of participatory budgeting).
- (c) The budget should be sufficiently flexible to reflect changes in the maintenance load to reflect variations in production/operations levels or quality standards. Cognisance of the fact that this is a non-linear relationship must be brought in here. For example, a steam boiler that is not used daily but only intermittently is susceptible to a greater degree of wear and hence requires more maintenance.
- (d) The budget should be product/service orientated in the context of demand schedules, quality standards demanded, quantities needed and unit costs demanded.

In the actual operation of the controls Goodlad raises a very interesting point. He advocates the introduction of an almost responsibility accounting approach. For example, if a major piece of maintenance work is required as a result of ineptitude on the part of a user function, then the maintenance department should not carry the adverse variance and hence the consequent managerial retribution. In essence, Goodlad takes the view that maintenance is a separate function from pure repairs as a result of operational incidents. While this does place 'blame' in the correct place, in practice, it is likely to be of little consequence, since maintenance is a legitimate conversion overhead

under SSAP9 and wherever the overspend occurs, it will merely gravitate to the overall conversion overhead expense variance.

Using budgetary control will, however, enable effective control of the department, and hopefully its expenses. At the time of writing, (1976) Goodlad identified three interesting problems:

- (a) Is there an effective control against excessive maintenance? i.e. is it really necessary to maintain a 'Rolls-Royce standard' of maintenance, and is the cost of the function well above the maximum cost of lost production if vital equipment went down?
- (b) Are there predetermined standards for the various maintenance tasks. (Certainly, the railways, major road haulage operators, and the bus and coach operators are likely to have timed standards for the numerous essential maintenance tasks they have to perform.)
- (c) In balancing the cost of the maintenance function are the costs of the resultant idle time known? Equally, under this heading could be added the cost of acceptable risk, and the probability of downtime and its consequences.

### 6 *Small hotels*

The catering industry is perhaps one of the best documented service industries with regard to cost accounting and control. This is perhaps not too surprising, since, many hotel and restaurant organizations generate turnover and represent a level of investment in keeping with many traditional manufacturing organizations.

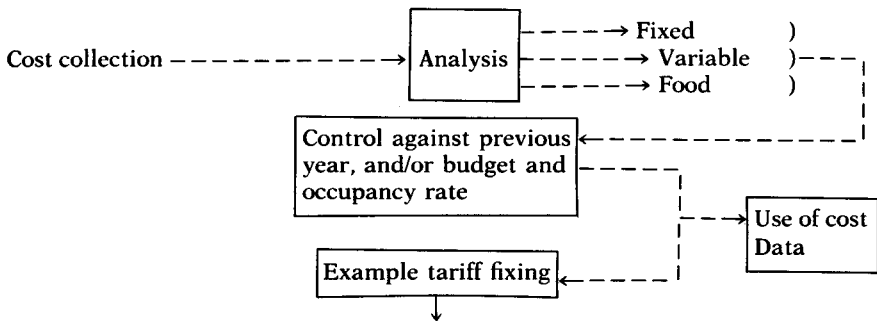
The example selected is from *Bull Costing for Small Hotels* where the author addresses attention to some of the problems inherent in running a small 35–40 bedroom hotel.

Occupancy rate is an important control criteria for any hotel. In many ways, it is as important as the break even point in marginal costing analysis. The occupancy rate is a measure of success in letting of rooms, but also as a guide to profitability. The relationship between it and the break even point is clearly crucial. Obviously, the lower the break even point, the wider the margin of safety as defined between maximum occupancy and break even point, but refined also in relation to the average occupancy rate. Ideally, using the current or attainable standard approach, the average occupancy rate compared with break even becomes a vital measure of performance.

Cost analysis and performance is little different from the traditional manufacturing environment. Essentially, there are three basic categories:

- (a) Fixed costs
- (b) Variable costs
- (c) Food – although Bull suggests that the analysis between fixed and variable costs might be superfluous.

A diagram may best illustrate the way the cost accounting system would work and contribute to the managing of the business. (See Figure 4.4.)



- Stages: 1 Estimate number of guests expected  
 2 Cost up what is needed to cater for them  
 3 Add on an acceptable mark up

Figure 4.4 Costing for a small hotel

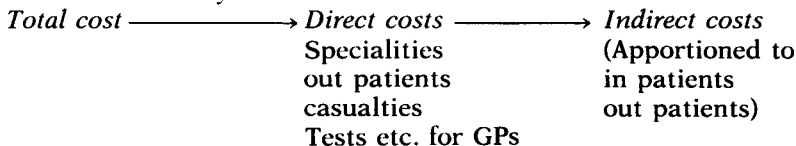
Bull is critical of the approach that advocates basing the tariff on what the traffic will bear, and then identifying how much can be spent on food. The perceptive reader will probably feel that the answer is somewhere in the middle, i.e. that costs plus an acceptable contribution margin must be matched with what the traffic will bear considering the section of the market the establishment will be operating in.

In the tariff fixing exercise, the traditionally trained cost accountant will readily identify the volume methodology used to absorb overheads. Basic analysis of costs, with food taking the place of material, and possibly with the dependence on casual labour, a more variable labour cost than perhaps traditional industries currently have, and the inevitable fixed costs. Actual operational control will be little different from the traditional environment.

### 7 The health service environment

The traditional public sector has been the target of much advancement in cost accounting and control techniques in recent years. One particular approach has been the use of what is called speciality costing in a UK NHS hospital environment. In a study undertaken by Professor Charles Magee in Bridgend, South Wales, Magee first identified the analysis of the costs incurred.

#### Detailed cost analysis



The category described as 'specialities' above, was then analysed in detail as follows:

Speciality —————→ General medicine  
Geriatric  
General surgery  
Ophthalmology  
Paediatric  
Obstetrics/gynaecology  
Orthopaedic  
Dermatology  
Rheumatology

From the cost analysis which is largely direct, it becomes possible to compute the *average cost per in patient day*, and the *average cost per case*.

The importance of such an approach is not to identify areas of profit and loss, since NHS hospitals are not profit orientated centres, but to exercise control over the use and stewardship of scarce resources. The object of the exercise is to identify what is a low-cost and what is a high-cost activity. However, the aim of such techniques is almost a standard costing approach, in that it is a real attempt to identify what an activity should cost. True standard costing in the traditional sense is neither practical or even desirable, but Horngren's approach of generating *attention directing information* rather than just scorekeeping, is partially satisfied, in that loci for what a service to a patient should cost are determined, and major deviations possibly expressed in terms of standard deviation methodology can be the start of an investigation. Using such methodology, exception reports can be readily prepared for the instigation of investigations.

Certain difficulties will be recognized in this approach:

- (a) Clearly, averages cannot be set nationally, because of the wide range of local variables, in available facilities and mix of patients due to both demographic and medical geographic factors. This will always generate problems of actually setting the 'standards' and more to the point establishing their credibility and legitimacy.
- (b) While the approach will recognize that there may be areas of unacceptably, and even unnecessary, high cost, there remains the emotional/ethical/cultural conflict of cost reduction.
- (c) There will always be the problem of identifying controllable expenditure, plus the cultural problem within the UK NHS of ever being able to implement it in quite the way hard nosed finance officers would perhaps like.

The comments above were collected from a report compiled from empirical evidence collected by an academic. A paper presented earlier (1979) by Poynton and Worsley is a little more pragmatic. It is left to the student reader to study the outlines, follow up on the reading list, and form his/her own conclusions.

The accounting system, seen as an information system, is required to satisfy seven objectives. To produce:



- (a) Statutory information needed.
- (b) Local management accounts for control purposes.
- (c) Comply with essential criterion of being readily understandable.
- (d) To be as economical as possible in the use of human and machine time.
- (e) To be adaptable to meet future accounting changes.
- (f) To be capable of including statistical, manpower, and other performance data.
- (g) To produce information speedily.

In addition, the requirement for being readily adaptable for extending into the realm of budgeting and strategic and operational planning needed to be built in. (The student reader might find this section a useful practical illustration for the chapter on cost accounting and information systems.)

Inevitably, such a system attempting to satisfy such criteria, will need to identify cost centres broken down by areas into individual hospitals. Traditional accounting codes apply to enable effective analysis of expense details. Here, the writers were justifiably proud of having minimized the length of the code and introduced coding of expenditure at source to ensure that mistakes were minimized and there was greater data awareness.

The end result is a reporting system not dissimilar in concept to the traditional reports that have developed in classic operating environments. (See Figure 4.5.)

The writers do make reference to the speciality budgeting approach. They are aware of perhaps the problems and conflicts of discipline that potentially thwart progress in this field. It is beyond the scope of both this text and the syllabuses served to develop the ideas in detail, but it is important that the reader is aware of the problem and situations, and is pointed in a general direction.

### *8 Retailing and manufacturing compared*

Retailing also contains many of the aspects of cost accounting that are common to manufacturing. In a series of articles published some time ago (1971) Wooldridge introduced accountants to the basics of cost accounting in a departmental store environment. As far as direct labour is concerned, (a very high proportion of the cost structure because it is a labour intensive operation) he emphasized:

- (a) Each store or even individual department becomes a cost centre. (This develops the theme above of product line or product market costing and profit generation analysis.)
- (b) Care should be exercised in phasing budgets, since the weekends i.e. Saturday is usually the busiest period for trading. Stores now open on Sunday will reflect similar patterns.
- (c) It should be added, that with the changing pattern of trading, there will be variations in costs. An obvious example of this is the trend

| <i>Cost centre</i>   | <i>Annual budget</i> | <i>Budget to date</i> | <i>Expenditure to date</i> | <i>Variance</i> |
|--|----------------------|-----------------------|----------------------------|-----------------|
| Expense category   |                      |                       |                            |                 |
| Salaries etc. (detailed)   |                      |                       |                            |                 |
| Other expenditure (detailed)   |                      |                       |                            |                 |
| Total expense<br>Deduct<br>Credits e.g. services to other authorities, category II fees, other credits |                      |                       |                            |                 |
| Total  |                      |                       |                            |                 |
| Total net expenses   |                      |                       |                            |                 |

Figure 4.5 Suggested operating report (Poynton and Worsley)

in employing quasi-temporary labour for the weekends which will be variable while the established week day staff are likely to be on a purely 35–40 hour week basis.

- (d) There may be three or more types of operation:
  - (i) Direct selling departments.
  - (ii) Workrooms and service areas where a service is provided, or custom-made products are made available. These days with greater standardization, this departmental function may well be replaced by distribution operations.
  - (iii) Non selling or support services.

Staff costs are collected in a manner similar to manufacturing, and the gross and net pay computations are likewise similar. Reporting is what is important.

Clearly there will be:

## Statement of departmental profit and loss (from Wooldridge)

|                        | Month  |        | Cumulative |        |
|------------------------|--------|--------|------------|--------|
|                        | Budget | Actual | Budget     | Actual |
| Turnover               | ( )    | ( )    | ( )        | ( )    |
| Cost of goods sold     | ( )    | ( )    | ( )        | ( )    |
| Gross profit           |        |        |            |        |
| Direct wages           |        |        |            |        |
| Commission             |        |        |            |        |
| Other selling expenses |        |        |            |        |
| Net profit             |        |        |            |        |

Ratios, such as sales per direct headcount, sales per square metre of floor space and similar contribution ratios could be brought into the reports and analysis.

Wooldridge did a whole series of articles on various aspects of departmental store operation. Under the heading of *impersonal* expenses, he identified such things as support people, cleaning, distribution and expenses. Since in many large stores that still deliver, and indeed in many specialist retailers who offer a delivery and support service, distribution is rapidly becoming one of the larger elements of the cost structure. Just as in manufacturing, we can identify an expense control statement which will highlight:

*Sales departments*

(Largely allocated costs possibly on the floorspace basis)

*Distribution:*

Direct wages

Indirect wages and salaries

Vehicle operations costs (possibly detailed into fuel, tax and insurance, repairs and maintenance etc.)

Vehicle depreciation/leasing rentals

Depot costs (possibly allocated depending on location in relation to the selling area)

*Service area:*

Direct wages

Indirect wages and salaries

Vehicle costs (if engineers have to go out to install equipment such as electrical goods and white goods)

Vehicle and site costs (as above)

Consumables

Communications (in vehicle communications for example)

As an expanded illustration of this, we turn to '*Costing in Distribution*' (1977) and a particular paper that illustrates some of the problems encountered by Fine Fare Limited.

Here the distribution department is so large, it has its own budget subdivided into warehousing, transport, depot offices and fleet engineering.

For reporting and control purposes, the following principles have been adopted.

#### *Measuring of depot activity*

This is done on the basis of standard cases moved, with commodities such as bacon converted to standard case units. The similarity with manufacturing's standard hour should be readily discernible.

#### *Accounts, layout and presentation*

We have noted elsewhere that reports, to be realistic, should be consistent with the organization structure. Accounts are presented on the basis of the depot with analysis into functions within the depot. Costs are broken down into *labour costs*, obviously a very large portion of the expenditure, *other controllable expenditure*, and *fixed costs*. Unit costs, per standard case budget and actual are included in every page of the distribution management accounts.

#### *Warehouse operations*

To obtain the best results a considerable amount of work study effort has been put in, revising at the same time layout of warehousing and improved methods of working. Progress in this area has to go in parallel with computerized store ordering systems. What this section does at least illustrate is the use of the management accounting information in the way that it was intended, i.e. to use the information as a basis for developing improved ways of running the business.

#### *Vehicle operations and scheduling*

Control is based on a simple vehicle usage report which identifies trends and areas where management action is required (e.g. drivers, fitters, vehicles etc.). In fulfilling that role, it fits the classic Horngren idea par excellence. Again the data presented provides what good management accounting information should provide. By looking at the data, and surveying store facilities, order sizes and vehicle sizes, delivery schedules were optimized and numbers of vehicles and drivers reduced.

Perhaps these comments from Fine Fare raise the greatest challenge to the aspiring management accountant, or even the accountant in general. Really useful accountants, irrespective of their training background, are the ones who organize these time and scorekeeping systems to allow themselves to get away from the simple bean counting and to use their undoubted technical superiority to improve the running of the organization.

### 9 The transport industry

W. Stuart Cole, a transport economist, includes in his book a chapter on costing as it relates to the transport industry. Space does not permit a detailed analysis of costing methods within the various modes of transport, so only a brief introduction is given here. Like Cole, we will look at three modes – buses, railways and airlines.

#### *Buses*

The costing manual of the former National Bus Company which was prepared in collaboration with CIPFA identifies the three traditional categories of cost: fixed, semi-variable and variable. Under the heading of fixed costs which would be fixed in the long term are administration costs, rent, rates, maintenance and depreciation. Semi-variable costs, considered avoidable in the medium term, include vehicle maintenance, staff supervision, publicity and vehicle lease costs. The variable costs, avoidable in the short term, are labour costs (vehicle crews), fuel, oil, tyres etc. It is worth noting the impact of time scale on the traditional view of cost elements. A short-term variable cost can be saved by cutting out the service, withdrawing the vehicle and sacking the crew. In the medium term, there can be a reduction in publicity, at the risk of losing traffic, and in maintenance, at the risk of breakdowns or accidents. Operating costs in the bus industry will be affected by such factors as where the vehicle operates (i.e. in an urban or rural area), the size of the fleet, the size of the vehicle, and whether it is run as a one-man bus or with a separate conductor.

#### *Railways*

The cost structure for railways falls into six basic categories.

- *Deemed to be overhead*: general expenses (everything that is not listed below); infrastructure (track, overhead catenary and signalling); terminal (stations).
- *Deemed to be variable*: depreciation (obvious but the student should see a conflict with SSAP12, and should consider whether the railways should be subject to a franked SORP); train maintenance; train working; (crews, fuel etc.).

The important thing to remember about railway costing is the allocation of common costs between sectors, the different activities that the railways provide.

The railways are broken down into operating sectors: passenger (consisting basically of Inter-City, Provincial and Network South East); Parcels and Railfreight. Clearly, the situation could arise where a terminal and a stretch of track is used by (say) Inter-City, Network South East, Railfreight and Parcels. The costs of these overheads have to be allocated out to the various user sectors, usually on a deemed usage basis. The student should note that revenue might also be allocated in certain situations where tickets cover more than one sector.

*Airlines*

Here the cost structures are again described as variable and fixed. Variable costs are those which would be avoided if a single flight was withdrawn. They may be subdivided into aircraft related costs such as fuel, landing fees, parking, and the variable elements of engineering costs, and crew costs (wages are fixed).

The other subdivision is load and revenue related costs such as security, catering costs on board, insurance and commission.

Fixed costs are segregated into *allocated* and *apportioned* costs. Allocated costs would include aircraft standing charges such as depreciation and insurance, crew costs and specific accommodation costs. *Apportioned* costs, by contrast, would include engineering costs, traffic handling at Heathrow, Gatwick and Stanstead (or wherever), catering, sales and marketing and terminal facilities.

Clearly the variable costs will be a function of type of airplane, age of airplane, fleet standardization, standard equipment such as engines, and possibly economies of scale.

**Questions**

- 1 The management of a large manufacturing company are considering introducing a system of job costing into their Plant Maintenance and Repair Department. At present all the expenses incurred by this department, which is regarded as a service function to the production departments, are collected and apportioned to the production departments under the expense heading 'General Works Expenses'.

Required:

- (a) Describe the benefits to the company which may result from introducing a job costing system into the Plant Maintenance and Repair Department. (9 marks)
- (b) Outline the information and procedures required in order to establish the total cost of individual repair or maintenance jobs. (8 marks)
- (Total: 17 marks)

*CACA 1.2 June 1985*

- 2 The process plant division of a group of companies has built a food packaging machine to a customer's requirements. A price of £49,000 had been quoted with the intention of achieving a profit of 25% on the selling price:

|                                |                             |
|--------------------------------|-----------------------------|
| Customer:                      | Bond Foods Limited          |
| Customer's Order No:           | 7206 dated 3 February, 1986 |
| Job Order No:                  | 1412                        |
| Date work started:             | 5 March, 1986               |
| Date job completed in factory: | 29 April 1986               |

|                                     |              |              |
|-------------------------------------|--------------|--------------|
| Date delivered:                     | 2 May 1986   |              |
| Date commissioned:                  | 6 May 1986   |              |
|                                     | <i>March</i> | <i>April</i> |
|                                     | £            | £            |
| Materials used:                     |              |              |
| Machining Dept.                     | 2,900        | 700          |
| Assembly Dept.                      | 1,900        | 1,400        |
| Direct wages rate per hour:         |              |              |
| Machining Dept.                     | 4            | 4.40         |
| Assembly Dept.                      | 5            | 5.25         |
|                                     | Hours        | Hours        |
| Direct labour hours:                |              |              |
| Machining Dept.                     | 200          | 100          |
| Assembly Dept.                      | 50           | 500          |
| Machine hours in                    |              |              |
| Machining Dept.                     | 350          | 180          |
| Technical drawings<br>(direct cost) | £2,115       |              |

Production overhead is absorbed at the predetermined rate of £10 per direct labour hour in the Assembly Dept. and £15 per machine hour in the Machining Dept.

Commissioning costs, i.e. installation and initial running-in of the machine at the customer's site, were £750 and these are to be treated as a direct production cost.

Selling and general administration costs are charged to jobs at the rate of 33⅓% of production cost.

You are required to:

- (a) Prepare a job order cost sheet and insert on it the information given above in such a way as to be useful to management. (16 marks)
  - (b) Explain 'job costing' and 'batch costing'. (4 marks)
- (Total: 20 marks)
- 3 (a) Describe the distinguishing characteristics of production systems where:
    - (i) Job costing techniques would be used, and
    - (ii) Process costing techniques would be used. (3 marks)
  - (b) 'Job costing produces more accurate product costs than process costing.' Critically examine the above statement by contrasting the information requirements, procedures and problems associated with each costing method. (14 marks)
- (Total: 17 marks)

#### CACA 1.2

- 4 You have recently been appointed management accountant of a company which has interests in a number of businesses. One of its

major interests is in the hotel business, where it has acquired a number of medium-sized companies, each of which operates its own hotels.

The Chairman of the company has been advised that it would be difficult to operate a system of uniform costing in the hotel group because none of the hotels are alike.

You are required to present a report to the Chairman in which you should discuss the concepts of uniform costing and, in particular, how you would propose to operate such a system in a hotel group.

(20 marks)

*CIMA CA2 November 1984*

- 5 A small private company in a town with 190,000 inhabitants has decided to take advantage of the de-regulation of passenger transport services. It is proposing to operate a bus service on six particular routes where, after carrying out market research, it has been identified that there are opportunities to compete with existing services. Currently, the company has five 3-ton trucks which are engaged in light road haulage for regular established customers and has two mini-vans which are used as a courier service for fast delivery of letters and lightweight parcels.

The company has its own garage facilities for the repair and maintenance of its vehicles. The offices are located on the first floor above the garage and an upper floor, currently used for the storage of old records, is being cleared for conversion into office accommodation. At the rear of the garage and offices is a fenced compound where the vehicles are kept overnight. The compound is locked and floodlit during the hours of darkness and a security firm patrols regularly.

A suitably qualified person has been recruited to manage the bus operation and you have been engaged as the accountant for the expanding business. The owner of the company, a former transport manager, looks after selling and control of routing and utilization of the five trucks and two mini-vans. His wife and a full-time book-keeper undertake all the administrative work. Seven drivers and two garage mechanics are employed.

Cost accounting records kept have been of a rudimentary nature but the financial accounts, prepared at the end of every quarter by the company's auditors, show the business to be very profitable. The owner is conscious that with the expansion, better records will have to be maintained. From the accounts and in conjunction with the auditors, you ascertain that costs for the following expense headings are available:

- Depreciation
- Drivers' wages
- Employer's National Insurance contributions
- Fuel



Holiday pay  
Insurance  
Management and staff salaries  
Mechanics' wages  
Oil  
Rent and rates for garage, office and compound  
Replacement parts and spares  
Road fund licences  
Security costs  
Tyre replacements

The newly-engaged passenger transport manager informs you that six minibuses at a total cost of £210,000 are on order. Each bus can seat twenty people and nine people are allowed to stand. The buses will each be operated by one person and the manager is currently interviewing drivers who hold PSV (public service vehicle) driving licences. He indicates that he will need information from you to ascertain the profitability of each route operated.

You are required, bearing in mind the objectives of cost accounting, to:

- (a) Draft a form for the ascertainment of operating costs for the vehicles currently owned. (10 marks)
  - (b) Draft a form suitable for the proposed passenger service to show income and expenditure. (10 marks)
  - (c) Comment on the allocation and apportionment of overheads now that they have been increased substantially following the recruitment of yourself and the passenger transport manager. (5 marks)
- (Total: 25 marks)

*CIMA Stage 2 November 1987*

## References and further reading

*Note:* This is by no means an exhaustive list. Rather, it is included merely as a point from where the really interested student can begin reading around the subject.

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Students can obtain up to date material by regularly reading Lewis Brown's Synopsis in *Management Accounting*. Specific material on the health service can be obtained from the Association of Health Service Treasurers, while material on specific industries can be obtained by consulting the CIMA Framework series – *Accountancy by Sectors*. It is worth adding that these are on the reading list, and that the examiner will expect the student to have studied them.

# 5 Job costing

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## Introduction and definition

In the introduction to various types of costing in Chapter 4 we noted that the *Terminology* defined job costing as that form of specific order costing which applies where work is undertaken to customers' special requirements and each order is of comparatively short duration (compared with those to which contract costing applies).

The *Terminology* further added that 'the work is usually carried out within a factory or workshop and moves through processes and operations as a continuously identifiable unit. The term may also be applied to work such as property repairs and the method may be used in the costing of internal capital expenditure jobs'.

Organizationally, the jobbing environment is characterized by the existence of departments through which the order travels, such as a machine shop, an assembly shop and perhaps specialist functions such as heat treatment or grinding. In such contexts, it is likely that the individual departments will be cost centres, and the costs incurred by each order will be allocated to it as it goes through. For this to work satisfactorily, and be controlled efficiently, there must be:

- 1 A suitable system for booking time to jobs.
- 2 Comprehensive documentation for materials.
- 3 Clearly defined cost centres.
- 4 Adequate labour analysis.
- 5 Suitable bases for the absorption of overheads.

The mechanics of implementing these requirements are illustrated in Figure 5.1.

From Figure 5.1 the reader can readily envisage the order, having been received, going through an organization, whereby material is requested from and drawn from the stores, the labour allocated to the job

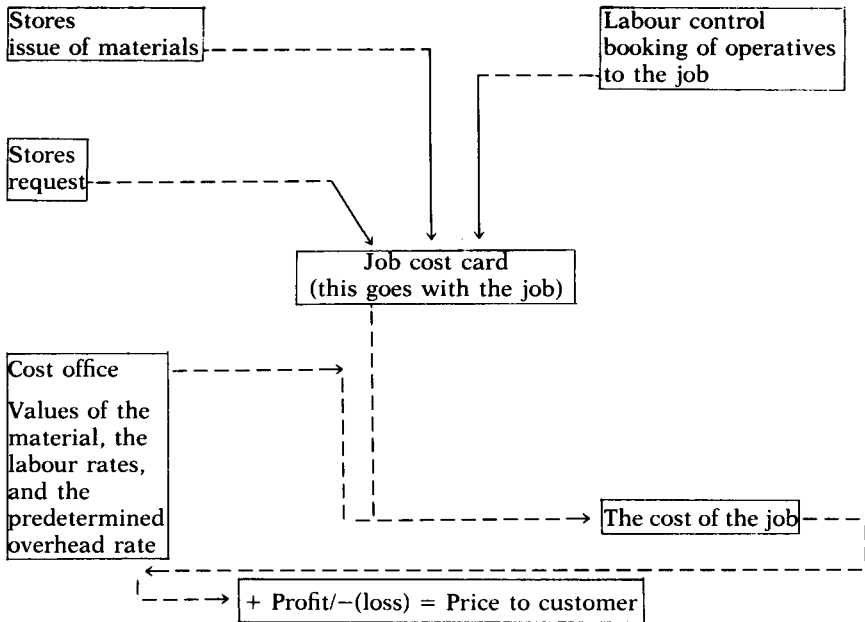


Figure 5.1 The mechanics of job costing

is similarly recorded on the job cost card, and the cost office is finally responsible for adding the costs of materials issued, the cost of the labour, and the overhead absorption rate. The student reader should be particularly aware of the service industry approach here. In many jobbing service industries, such as automobile maintenance, the job cost card will not show an overhead rate, but an inflated labour rate. In such industries, this rate includes not only the rate for the direct labour on the job, but also the allocation of overhead for the workshop and the profit margin. This will have implications for the valuing of work-in-progress at a later date.

To illustrate the mechanics of job costing, we will now talk through a detailed example.

*Example 5.1*

Crosswell receives an order to supply Jones, a local farmer with a delivery of cattle feed.

The job passes through three departments, collecting costs as follows:

- Mixing department:      100kg of D at £2 per kg
- 50kg of E at £1 per kg
- 20kg of F at 50p per kg
- 10 hours of labour at £4 per hour

Boiling department: 20 hours of labour at £3 per hour  
 60 hours of the boiling machine  
 Cooling and skimming: 50 hours of labour at £2 per hour  
 Hire of giant thermometer and scoop £200.

Normal job activity levels are:

| <i>Department</i> | <i>Labour hours</i> | <i>Machine hours</i> | <i>Budgeted overheads (£)</i> |
|-------------------|---------------------|----------------------|-------------------------------|
| Mixing            | 200                 |                      | 1,600                         |
| Boiling           | 250                 | 700                  | 9,100                         |
| Cooling           | 550                 |                      | 4,950                         |

Basis of overhead absorption: Mixing: labour hours  
 Boiling: machine hours  
 Cooling: labour hours

Selling and administrative expenses are deemed to be 30 per cent of factory cost.

You are required to prepare a statement showing the profit or loss on the job, if the price agreed is £2,500.

We will approach this question as though we were writing up the job cost card.

**Job cost card**

**Customer:** Jones

*Mixing department*

*Material from stores*

| <i>Material from stores</i> | <i>Price</i> | <i>Total</i> |     |
|-----------------------------|--------------|--------------|-----|
| 100 kg of D                 | 2            | £200         |     |
| 50 kg of E                  | 1            | 50           |     |
| 20 kg of F                  | 50p          | <u>10</u>    | 260 |

Labour booked to job

|          |   |           |    |
|----------|---|-----------|----|
| 10 hours | 4 | <u>40</u> | 40 |
|----------|---|-----------|----|

Overhead absorbed

Preliminary working

Overhead absorption rate

$$= \frac{\text{Budgeted expense}}{\text{Labour hours}}$$

$$= \frac{1600}{200} = \text{£8 per hour}$$

|                    |  |           |    |
|--------------------|--|-----------|----|
| Thus 10 hours @ £8 |  | <u>80</u> | 80 |
|--------------------|--|-----------|----|

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|   |     |        |
|---|-----|--------|
| Total cost incurred in mixing department  | b/f | £380   |
| <u>Moving into the boiling department</u>   |     |        |
| Here there is only a labour cost  |     |        |
| 20 hours worked @   | 33  | 60     |
| Overhead absorption   |     |        |
| $\frac{9,100}{700} \times 60$ boiling hours   |     | 780    |
| Sub total for the department  |     | £840   |
| <u>Moving into the cooling and skimming department</u>  |     |        |
| Here we have a direct expense, the hire of the thermometer  |     |        |
|   |     | 200    |
| Labour  |     |        |
| 50 hours  | 2   | 100    |
| Overhead absorption   |     |        |
| $50 \times \frac{4,950}{550}$   |     | 450    |
| Sub total for the department  |     | £750   |
| Total factory or production cost  |     | £1,970 |
| To this, the cost office will add the 30 per cent uplift for the selling and distribution allowance |     |        |
| 30% of £1,970 =   |     | 591    |
| Total cost  |     | £2,561 |
| Price quoted and charged  |     | £2,500 |
| Therefore profit/(loss)   |     | £(61)  |

This example illustrates two aspects of cost accounting that have already been intimated above.

- 1 Prices are not a function of costs, but of what the market will bear, and therefore costs should take cognisance of market forces.
- 2 The selling and administration allowance is not a cost, but an allocation, designed as an attempt at either absorption of these costs for pricing and quotation purposes, or for cost control. In the latter case, at the end of the trading period, Crosswell will compute his actual selling and administration overhead, and compare the costs absorbed with his actual. This approach is a useful attention directing device, highlighting the cost of the selling and administration, and demanding that action be taken to consider price increases, or if this is not practical, (and the elasticity of the market may mitigate against it), to take a long and hard look to see what cuts can be made in the selling and administration cost burden.

Before moving away from job costing it will be worthwhile to review the cost accounting entries needed in a jobbing environment. It is likely

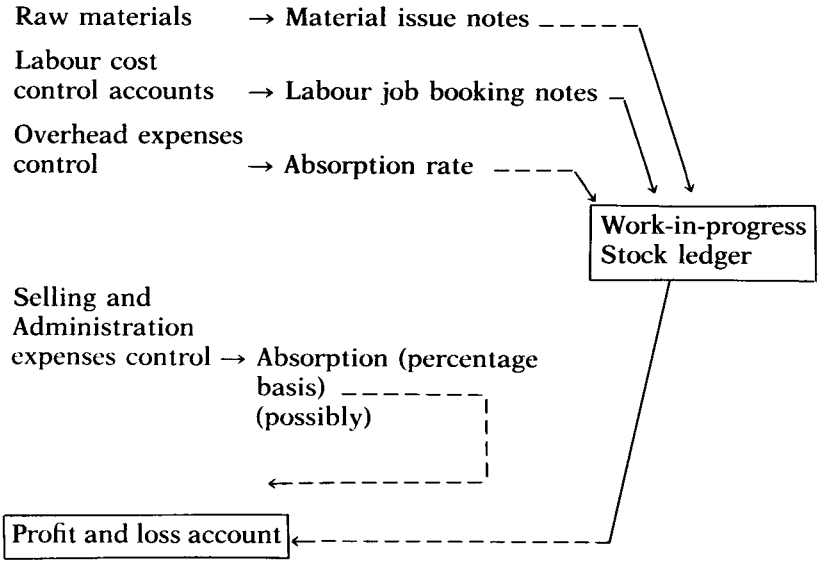


that the work-in-progress stock ledger will be maintained on the basis of an account for each individual order. Thus for the Jones order taken by Crosswell above we would see a stock ledger 'T' account something like this:

*Crosswell work-in-progress stock ledger: Customer Jones*

| (Debit side only) |                 |                       |               |                 |               |
|-------------------|-----------------|-----------------------|---------------|-----------------|---------------|
|                   | <i>Material</i> | <i>Direct expense</i> | <i>Labour</i> | <i>Overhead</i> | <i>Total</i>  |
| <i>Department</i> |                 |                       |               |                 |               |
| Mixing            | 260             |                       | 40            | 80              | 380           |
| Boiling           |                 |                       | 60            | 780             | 840           |
| Cooling           |                 | 200                   | 100           | 450             | 750           |
|                   | 260             | 200                   | 200           | 1310            | <u>£1,970</u> |

It will also be helpful to consider the double entries involved:



Armand Layne has evaluated job costing and highlighted its advantages and disadvantages.

**Advantages**

- 1 It satisfies the essential requirement that it is a costing system that compiles data in a manner that is useful for the business. In the Crosswell example above, management can readily see where the costs are being incurred, and if expenses are being adequately absorbed.
- 2 It readily highlights whether or not a job is likely to be profitable or

not, and if operated against detailed planned estimates or standards, losses or profits can be pinpointed accurately and acted upon.

- 3 It is a good control technique.
- 4 It readily fits into the double entry system, and lends itself to combining with performance evaluation and review techniques.

### ***Disadvantages***

- 1 From the Crosswell example it will be apparent that the procedure is expensive in clerical work. Even a simple task like repairing or servicing a motor car involves a number of entries on a variety of ledgers and labour cost sheets, especially when operatives move from one job to another as work progresses through the organization and individual departments.
- 2 The expense problem of clerical work is compounded when it is recalled that it often requires operatives to stop work to perform clerical duties. While these are necessary, it has two serious implications. First, it diverts operatives away from what they are paid to do, and from their money earning activities, so there is an effective opportunity cost. Secondly, it is a weak link in the control function. Operatives even often at supervisory level, are seldom the best or the most reliable of record keepers. Thus in times of intense activity, there is a real likelihood of entries being omitted or forgotten, incorrectly recorded, or supporting documents lost. Further, working environments in the traditional jobbing industries do not readily lend themselves to meticulous recording, with the result that, errors can creep in because of dirt or poor quality recording on the documentation.

### **Contract costing**

From our earlier review of costing methods, we can recall the *Terminology* definitions.

Contract cost is defined as 'aggregated costs relative to a single contract designated a cost unit'.

Contract costing is defined as 'that form of specific order costing which applies where work is undertaken to customers' special requirements and each order is of long duration'.

This consistent with the SSAP9 definition, (paragraph 22) which emphasizes the construction of a single substantial asset (or provision of service) 'where the time taken substantially to complete the contract is such that it falls into different accounting periods'.

It is this point about going beyond a single accounting period that is significant. While the essential costing methodology is the same as in conventional job costing, the likelihood of the job not being finished at year end requires consideration of the profit earned to date. There are good conceptual reasons for doing this. If the prudence convention is followed, and turnover and profit deferred until the contract is finished, then results will either only reflect contracts finished in the year or

fluctuate wildly because in certain years, on contracts are finished. This, SSAP9 (paragraph 7) argues is inappropriate and not 'true and fair'.

Taking full cognisance of the variety of contracting businesses that exist, SSAP9 (paragraphs 8–11) gives the following instructions:

- 1 Where the outcome of a contract can be ascertain with reasonable certainty before its conclusion, then attributable profit should be calculated on a prudent basis and included in the accounts for the period under review. The profit needs to recognize the proportion of the work carried out and any known inequalities of profitability. The procedure recognizes a portion of the contract value to date as turnover, and deducts costs to date.
- 2 Where the outcome cannot be easily foreseen, no profit should be taken, and if no loss is likely, then no loss either.
- 3 Where the outcome is a loss, then this should be identified and brought to account immediately.

To demonstrate contract costing, we will talk through two examples. The essential characteristic features of contract costing are:

- 1 The posting to the ledger of items that might not be readily associated with an expense and certainly a conversion cost work-in-progress ledger.
- 2 The certifying of work completed by an independent inspector before permission is given to raise invoices.
- 3 The need to match profits over the duration of the contract.
- 4 The possible existence of retention money after completion of the contract.

A typical question would require a student to

- 1 Write up the contract account.
- 2 Calculate the turnover and hence profit to be taken.
- 3 Prepare a balance sheet extract in accordance with the disclosure rules (paragraph 13).

Our example will assume a contract that has been started during the year under review.

#### *Example 5.2*

Kathleen Limited started work on the construction of an office block for a contracted price of £750,000 on 1 October 19X5. Completion was promised by 31 December 19X6. The estimated cost of the contract was £600,000. The construction company's financial year was 30 June 19X6 and on that date the accounts appropriate to the following balances:

|                                  | £k  |
|----------------------------------|-----|
| Materials issued to site         | 161 |
| Materials returned from site     | 14  |
| Wages paid                       | 68  |
| Own plant in use on site at cost | 96  |
| Hire of plant and scaffolding    | 72  |
| Supervisory staff: direct        | 11  |
| indirect                         | 12  |

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|   |     |
|---|-----|
| Head office charges                     | 63  |
| Value of work certified to 30 June 19X6 | 400 |
| Cash received related to work certified | 330 |

In addition, we are told:

Depreciation on own plant is to be provided at the rate of 10 per cent per annum on cost.

£2,000 is owing for wages.

Estimated value of materials on site is £24,000.

It is likely that the costs to complete the contract, including some rectification work are likely to be a further £260,000 including provisions for depreciation of equipment. No difficulties are envisaged during the remaining time to complete the contract.

You are required to

- 1 Prepare the contract account for the period to 30 June 19X6 showing the amount to be included in Kathleen Limited's profit and loss account.
- 2 Explain the reason(s) for including the amount of profit to be shown in the profit and loss account.
- 3 Show extracts from Kathleen Limited's balance sheet at 30 June 19X6 so far as the information provided above will allow.

*Approach to solution:*

As might be expected from a question that is really only an extension of job cost accounting, the methodology is basically the same. The most essential part of any examination question will be the contract 'T' account.

*Kathleen Limited  
Contract account*

|                             | £k    |  | £k    |
|-----------------------------|-------|--|-------|
| Materials issued to site    | 161   | Materials returned from site                               | 14    |
| Wages                       | 68    | Materials still on site c/f                                | 24    |
| Wages accrued               | 2     |  |       |
| Supervision: direct         | 11    |  |       |
| indirect                    | 12    |  |       |
| Direct expenses             |       |  |       |
| Hire of plant and machinery | 72    |  |       |
| Overheads                   |       |  |       |
| Head office charges         | 63    |  |       |
| Plant at cost               | 96    | ← Plant carried down ----- →                               | 86    |
|                             |       | (These two entries<br>give the charge<br>for depreciation) |       |
|                             |       | Cost to date c/d   | 361   |
|                             | £485k |  | £485k |

**Calculation of profit**

This is an important part of contract cost accounting. The traditional method required a calculation of the costs to complete the contract to be matched and apportioned in accordance with the duration of the contract. Additional provisions were frequently introduced to acquiesce with the prudence convention. Even so, such a procedure still anticipates profit, and brings an element of profit into the value of the closing stock. It was this situation that ED40 has sought to remedy. To help the student appreciate what SSAP9/ED40 has tried to do, we will calculate Kathleen Limited's profit on both bases.

*Traditional method based on original SSAP9*

This gave no specific formula but permitted:

A proportion of the profit by reference to the work done to date.

Profit = Contract value – total costs to date + total costs to complete including any rectification work.

Thus from the 'T' account produced above, we know:

|                         |                |
|-------------------------|----------------|
| Costs to date           | £361,000       |
| Total costs to complete | <u>260,000</u> |
| Total cost of contract  | £621,000       |

Total value of the contract £750,000

Total profit is likely to be (750,000 – 621,000) = £129,000.

It would be out of keeping with traditional conservative accounting to take this entire profit to the profit and loss account, so a provision is made to reduce the profit. Various formulae are suggested, three possibilities being:

- $2/3 \times \text{Estimated total profit} \times \frac{\text{Value of work certified}}{\text{Total contract price}}$
- $2/3 \times \text{Estimated total profit} \times \frac{\text{Cost of work completed}}{\text{Estimated total costs}}$
- $2/3 \times \text{Notional estimated profit to date} \times \frac{\text{Cash received}}{\text{Value of work certified}}$

The prudence convention advocates that the more conservative formulae should be used in the earliest stages of the contract, and the less conservative nearer the end, when it is possible to see the final outcome more clearly. We have already noted that if a loss is envisaged, prudence dictates that it should be brought to account and written off at the earliest opportunity.

Using the first formula suggested above, we get:

$$2/3 \times 129 \times \frac{400}{750} = \text{£}45.86\text{k} \text{ [say £}46\text{k]}$$

The accounting entry for this profit is to debit the contract work in progress account, and credit the profit and loss account. This creates the profit in stock situation already indicated. This was in direct conflict with the Companies Act 1985 and was one of the main reasons why, when ED40 was introduced, it emphasized the problems of contract cost accounting and in particular the value of work in progress.

Profit to profit and loss account £45k

Having calculated the figure for the profit and loss account, (the £45k) and discussed the problem of profit in contract accounts, we can now do the balance sheet extract.

*Kathleen Limited*  
*Balance Sheet Extract*

---

|                                    |                           |              |              |
|------------------------------------|---------------------------|--------------|--------------|
| Fixed assets                       | Plant on site at cost     | 96k          |              |
|                                    | Depreciation              | [10]         | -----86      |
|                                    |                           |              |              |
| Current assets                     |                           |              |              |
| Stock                              |                           |              |              |
| Materials on site                  |                           | 24           |              |
| Work in progress:                  | At cost                   | 361          |              |
|                                    | Profit element            | 129          |              |
|                                    | less provision            | <u>[83]</u>  |              |
|                                    |                           | 46           |              |
|                                    |                           | -----        |              |
|                                    | Value of work-in-progress | 407          |              |
|                                    | less progress payments    | <u>[330]</u> |              |
|                                    |                           | -----        |              |
|                                    |                           | 77           |              |
|                                    |                           |              |              |
| Current liabilities                |                           |              |              |
| Wages accrued                      |                           | [2]          |              |
| Net current assets                 |                           |              | 99           |
| Total capital employed on contract |                           |              | <u>£185k</u> |

Under the revised SSAP9, the procedure will be:

|  |                 |
|--|-----------------|
| Total value of the contract certified and hence invoiced | £400,000        |
| Total costs to date                                      | <u>£361,000</u> |
| Profit to date   | £ <u>39,000</u> |

Cognisance should be given to the fact that the contract is 60 per cent complete with regard to costs, but only 53.3 per cent has been invoiced. The indications from the question also suggest that there will be a cost over run of £21,000. Prudence would suggest that some kind of provision might be needed.

Table 5.1 Kathleen Limited Contract Account

| Contract                           | 1       | Balance Sheet | Profit & Loss |
|------------------------------------|---------|---------------|---------------|
| Turnover                           |         |               |               |
| Value of work certified (invoiced) | £400k   |               | £400k         |
| Payments on account                | £330k   |               |               |
| Recoverable (Debtors)              | £70k    | £70k          |               |
| Total cost to date                 | £361k   |               |               |
| To cost of sales                   | £(361)k |               | £(361)k       |
| Gross profit to date               |         |               | <u>£ 39k</u>  |

What perhaps is advantageous about this revised approach is in the presentation and disclosure. SSAP9 (Appendix 3) displays a grid that shows how the contract will be analysed in respect of the profit and loss account and the balance sheet.

From this the student can readily see how turnover can be formulated, an acceptable level of profit, and where relevant, a work in progress that does not have profit included in it. The grid makes for provision for such situations as:

Progress payments ahead of work certified.

Provision for accruals and foreseeable costs.

(It might have been prudent to have added in the provision for known overspends of £21,000, reducing the profit by £21,000 and showing a provision on the balance sheet of £21,000.)

In addition, the work-in-progress account is being progressively cleared out as sections of the contract are completed.

Critics of this 'new' approach would argue that it is ideal where the contract can be recognizably split into sections, costed and costs matched easily against invoiced work. Contracts for defence systems, which can be readily split up and standard costed followed this methodology long before ED40 had even been thought of. The difficulty is still likely to remain where the contract is for an amorphous job, like a motorway, the Channel Tunnel or even a bridge or railway electrification. In such circumstances, the 'manner appropriate to the stage of completion of the contracts, the business and the industries in which they operate' (paragraph 8) is likely to be quite significant. One obvious solution may lie in the fact that since contracts are likely to be controlled by some form of Critical Path Analysis technique, the stages are likely to be readily identifiable from each branch of the network and the progress along the critical path.

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We will now turn to a more difficult question, which brings in the problem of profit brought forward from an earlier accounting period.

The following data refers to a contract being undertaken by Bydgoszcz Limited, a major building contractor.

|   |         |
|---|---------|
| Contract data                             | £       |
| Contract price                            | 620,000 |
| Value of work certified                   | 570,000 |
| Cash received from contractee             | 480,000 |
| Work-in-progress at 1 October 19×5        | 421,370 |
| Cost incurred during the year             |         |
| Materials                                 | 46,412  |
| Labour                                    | 31,283  |
| Overhead excluding depreciation           | 12,513  |
| Plant – valuation at 1 October 19×5       | 83,465  |
| Plant – valuation at 30 September 19×6    | 87,220  |
| Plant – purchased during the year 19×5/×6 | 21,478  |
| Cost of work not yet certified            | 30,913  |

The contract is nearing completion and the quantity surveyor's estimate that a further £25,000 will be incurred to complete the job, and that any plant remaining on the site will be sold for £70,000 at completion. No further plant purchases are planned for this contract.

You are required to write up appropriate ledger accounts to record the transactions disclosed above, and show how they would appear in the balance sheet of Bydgoszcz Limited as at 30 September 19×6.

*Approach to solution:*

We will use the grid approach suggested in SSAP9 (Table 5.2).

Table 5.2 *Bydgoszcz Limited Contract Account 30 September 19×6*

|                             | £         | Balance Sheet | Profit & Loss   |
|-----------------------------|-----------|---------------|-----------------|
| Recorded as turnover        | 570,000   |               | 570,000         |
| Payments on account         | (480,000) |               |                 |
| Amounts recoverable         | 90,000    | 90,000        |                 |
| Total costs (See working)   | 529,301   |               |                 |
| Cost of sales               | (498,388) |               | (498,388)       |
| Long term contract balances | 30,913    | 30,913        |                 |
| Profit to date              |           |               | £ <u>71,612</u> |



|                      |                 |
|----------------------|-----------------|
| Workings             |                 |
| Calculation of costs |                 |
| Brought forward      | £421,370        |
| Added during year    |                 |
| Materials            | 46,412          |
| Labour               | 31,283          |
| Overhead             | 12,513          |
| Depreciation         | <u>17,723</u>   |
| Total                | <u>£529,301</u> |

|  |                 |
|--|-----------------|
| Calculation of depreciation charge     |                 |
| Plant brought forward 1 October 19×5 = | £83,465         |
| Additions during year                  | <u>21,478</u>   |
|  | £104,943        |
| Less valuation at year end             | <u>(87,220)</u> |
| Thus depreciation                      | <u>£ 17,723</u> |

From the grid, we can easily identify the profit to date, and the balance sheet extract.

**Bydgoszcz Limited**  
**Balance Sheet Extract 30 September 19×6**

---

|                                   |        |                 |
|-----------------------------------|--------|-----------------|
| Fixed assets                      |        |                 |
| Plant at valuation [per question] |        | £ 87,220        |
| Current assets                    |        |                 |
| Contract work in progress         | 30,913 |                 |
| Debtors                           | 90,000 |                 |
| Total current assets              |        | <u>120,913</u>  |
| Total capital employed            |        | <u>£208,133</u> |

To complete our review of contract cost accounting, and the implications of implementing SSAP9, we will now talk through a question that involves three contracts:

- one that has just been started,
- one that is approaching conclusion and going well,
- and one that is likely to make a loss.

*Example 5.4*

A construction company is currently undertaking three separate contracts and information relating to these contracts for the previous year, together with other relevant data, is shown below.

| Contract         | MNO   | PQR   | STU    | Construction services |
|------------------|-------|-------|--------|-----------------------|
| Contract price   | £800k | £675k | £1100k |                       |
| Balances b/f     |       | 190   | 370    |                       |
| Material on site |       |       | 25     |                       |

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|   |    |     |     |    |
|---|----|-----|-----|----|
| Written down value<br>of plant and<br>machinery         |    | 35  | 170 | 12 |
| Wages accrued   |    | 2   |     |    |
| <i>Transactions</i>                                     |    |     |     |    |
| <i>during year:</i>                                     |    |     |     |    |
| Material to sites                                       | 40 | 99  | 180 |    |
| Wages paid  | 20 | 47  | 110 | 8  |
| Payment to<br>subcontractors                            |    |     | 35  |    |
| Salaries and<br>other costs                             | 6  | 20  | 25  | 21 |
| Plant issued to<br>sites                                | 90 | 15  |     |    |
| Transferred from<br>sites [w.d.v.]                      |    | [8] |     |    |
| <i>Balances c/f at</i>                                  |    |     |     |    |
| <i>end of year:</i>                                     |    |     |     |    |
| Material on site  | 8  |     |     |    |
| Plant and machinery                                     | 70 |     | 110 | 5  |
| Wages accrued   |    | 5   |     |    |
| Pre-payments to<br>subcontractors                       |    |     | 15  |    |
| Value of work<br>certified at end of<br>year            | 90 | 390 | 950 |    |
| Cost of work not<br>certified at the<br>end of the year |    |     | 26  |    |
| Payments received<br>from contractees                   | 70 | 450 | 900 |    |

The cost of operating the construction services department which provides technical advice to each of the contracts, is apportioned over the contracts in proportion to wages incurred.

Contract STU is scheduled for handing over to the contractee in the near future and the site engineer estimates that the extra costs required to complete the contract in addition to those tabulated, will total £138,000. This amount includes an allowance for plant depreciation, construction services and for contingencies.

You are required to:

- 1 Construct a cost account for each of the three contracts for the previous year and to show the cost of the work completed at the year end.
- 2 Recommend how much profit or loss should be taken, for each

contract, for the previous year, and explain the reasons for each of your recommendations.  
 [Chartered Association (modified)]

*Approach to the solution:*

There are essentially three stages to this question.

- 1 The apportioning of the construction services costs.
- 2 The writing up of the contract accounts grids.
- 3 The computation of the profit to be taken as appropriate.

1 Apportionment of the construction services department overhead.  
 (Always an area where the student has difficulty!)  
 This can best be done using a simple 'T' account.

*Construction Services*

|               |      |                 |      |
|---------------|------|-----------------|------|
| Plant b/f     | £12k | Plant c/f       | £5k  |
| Wages paid    | 8    | To contract a/c |      |
| Salaries paid | 21   | [Balance]       | 36   |
|               | £41k |                 | £41k |

On the basis of direct wages paid [i.e. 20 + 47 + 110 = 177] the apportionment is as follows:

$$\text{MNO} \quad 36 \times \frac{20}{177} = 4$$

$$\text{PQR} \quad 36 \times \frac{47}{177} = 10$$

$$\text{STU} \quad 36 \times \frac{110}{177} = 22$$

Working 'T' accounts will help to gather the costs together.

*Contract cost accounts*

*MNO*

|                          |      |               |      |
|--------------------------|------|---------------|------|
| Material                 | £40k | Materials c/f | £8k  |
| Wages paid               | 20   | Plant c/f     | 70   |
| Salaries and other costs | 6    | Cost of sales | 82   |
| Plant allocated          | 90   |               |      |
| Construction services    | 4    |               |      |
|                          | £160 |               | £160 |

*PQR Working 'T' account*

|                            |       |                |      |
|----------------------------|-------|----------------|------|
| Cost of completed work b/f | £190k | Wages b/f      | £ 2k |
| Plant b/f                  | 35    | Plant returned | 8    |
| Materials                  | 99    | Cost of sales  | 411  |

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|                       |             |              |
|-----------------------|-------------|--------------|
| Wages                 | 47          |              |
| Salaries              | 20          |              |
| Additional plant      | 15          |              |
| Construction services | 10          |              |
| Wages c/f             | <u>5</u>    |              |
|                       | <u>£421</u> | <u>£421k</u> |

*STU Working 'T' account*

|                            |              |                |              |
|----------------------------|--------------|----------------|--------------|
| Cost of work completed b/f | £370k        | Plant c/f      | £110k        |
| Material b/f               | 25           | Prepayment c/f | 15           |
| Plant b/f                  | 170          | Cost of work   |              |
| Materials added            | 180          | charged to     |              |
| Wages                      | 110          | cost of sales  | 812          |
| Subcontractors             | 35           |                |              |
| Salaries                   | 25           |                |              |
| Construction services      | <u>22</u>    |                |              |
|                            | <u>£937k</u> |                | <u>£937k</u> |

For contract MNO it could be argued that it is too early in the duration of the contract to reasonably take profit, so the prudence convention could override the matching convention, and no profit is taken. A provision could thus be added to the grid.

It is difficult to decide when to bring profit into the contract cost accounts. The SSAP gives no guideline figure, apart from the comment contained within paragraph 9. However, it does say within that paragraph that the profit should be calculated on a prudent basis, and therefore to make a provision on the grounds that the outcome cannot be foreseen with reasonable certainty would be acceptable. This is the best we have, since there are few explicit commitments in the Cost Accounting literature, and the current Terminology is silent. As a rule of thumb, a contract should be one-third (1/3) complete and the outcome visible before any consideration of taking profit should be made.

PQR has run into a loss situation. The grid highlights the loss, and it is brought to account and written off immediately as required by SSAP9.

Profit has been taken on STU, since the end can reasonably be foreseen, and all additional costs have been provided for in the current year accounts.

As further guidelines the student should consider:

- 1 Why the value of the work certified and hence invoiceable was behind costs expended.
- 2 If it were due to a cost escalation that is not recoverable in the price of the contract, or the delay in certification will cause additional rectification costs which are also not recoverable, then provisions need to be made.

Table 5.3 Schedule of contracts

| <i>Contract</i>                               | <i>MNO</i> | <i>PQR</i> | <i>STU</i> | <i>Balance</i> | <i>Profit</i>   |
|---|------------|------------|------------|----------------|-----------------|
|   | <i>£k</i>  | <i>£k</i>  | <i>£k</i>  | <i>Sheet</i>   | <i>and Loss</i> |
| Turnover<br>(work certified)                  | 90         | 390        | 950        |                | 1430            |
| Payments on<br>account                        | (70)       | (450)      | (900)      |                |                 |
| Debtors                                       | 20         |            | 50         | 70             |                 |
| Balance (excess)<br>of payments on<br>account |            | (60)       |            | (60)           |                 |
| Costs ('T'<br>account)                        | 82         | 411        | 812        |                |                 |
| Additional<br>costs (Q note)                  |            |            | 138        |                |                 |
| To Profit<br>& Loss A/C                       | (82)       | (411)      | (924)      |                |                 |
| To Balance<br>Sheet                           |            |            | 26         | 26             |                 |
| Provision                                     |            |            | (138)      | (138)          |                 |
| Profit taken                                  | 8          | (21)       | 26         |                | 13              |

- 3 An overall review of the contract should be made to see if the cost escalation is likely to deteriorate further, and cause further losses.

Since many questions ask for a balance sheet extract, we can use the grid to provide the relevant information:

*Balance sheet extract*

|                                    |            |
|------------------------------------|------------|
| Fixed assets at written down value | £k         |
| MNO                                | 70         |
| PQR                                | 8          |
| STU                                | <u>110</u> |
|                                    | 188        |

Current assets

|                        |           |
|------------------------|-----------|
| Materials (MNO)        | 8         |
| Work in progress (STU) | 26        |
| Debtors (MNO and STU)  | 70        |
| Prepayment (STU)       | <u>15</u> |
|                        | 119       |

Current liabilities

|               |     |
|---------------|-----|
| Accrual (PQR) | (5) |
|---------------|-----|

|                                    |              |              |
|------------------------------------|--------------|--------------|
| Advance payments<br>from customers | (60)         |              |
| Provision                          | <u>(138)</u> |              |
|                                    | (203)        |              |
| Net current assets                 |              | <u>(84)</u>  |
| Net capital employed               |              | <u>£104k</u> |

### Batch costing

As we have seen, (Chapter 4) the *Terminology* defines batch costing as 'that form of specific order costing which applies where similar articles are manufactured in batches either for sale or for use within the undertaking'.

The actual batch cost is defined as 'aggregated costs relative to a cost unit which consists of a group of similar articles which maintains its identity throughout one or more stages of production'.

Almost inevitably, the *Terminology* adds the point that batch costing is similar to job costing in methodology. Batch costing can be found in the printing, packaging, clothing and building products industries, amongst others.

As with most aspects of cost accounting, batch costing is best explained and illustrated by talking through an example.

#### *Example 5.5*

Lucille Mouldings Ltd designs and manufactures blow moulded specialist containers for a variety of industries and customers. A customer has invited them to quote for supplying a specially designed container to which the following data relates:

- Design/development engineers' time: 11 hours at £5/hour.  
Draughtsman's time: 12 hours at £3/hour.  
Materials: £18.  
Engineering machine shop time: 15 hours at £8.60/hour.  
Project supervision £35  
General overhead allocation £40
- The production machine that will be used for the manufacture of the container requires twelve hours of engineers' time (at £3.60/hour) to tool and set up, and has an output of fifty containers per hour. It will be used exclusively on the production of this type of container for twelve (eight hours day shift four hours twilight) hours per day, five days per week, until the order is completed. For runs of over 5000 containers, i.e. after 100 hours, the machine will need to be stopped for routine tool maintenance. This takes six hours and costs £5.00 per hour.
- Daytime machine minders are paid £2.50 per hour, and the twilight machine minders £1.75 per hour. Twilight workers are only called in as needed, and can thus be considered a purely variable cost. The

machine requires one machine minder continuously while it is running. Overhead is absorbed on the basis of £1.25 per hour, and the direct materials cost of each container is £0.20. For batches in excess of 8000 units, a discount of 20 per cent can be offered on the unit material price. The containers have to be coloured, and the colour pigment costs £20.00 per 2000 containers. Once a packet is opened, it cannot be resealed, so for orders less than 2000, the surplus pigment would have to be dumped.

- 4 The customer has specified a call off rate of 2000 containers per week, but if the order exceeds 6000, then it must be completed in three weeks. This will require that both the day shift and the twilight shift be worked, to maintain delivery schedules.
- 5 It is Lucille Mouldings' policy to provide for a profit of 12.5 per cent on design and development costs, and 25 per cent on production costs.

You are required to calculate the price per 100 containers for the supply of:

- 1 2000
- 2 4000
- 3 7000
- 4 9000 containers

*Approach:*

In practice, such a quotation would be prepared in a manner so that the prospective customer could readily see the differing elements of cost and decide for himself the optimum amount of the order to place. Frequently, in such circumstances, conditions are such, that the market can fluctuate wildly, requiring very quick revisions of estimates of demand. An obvious example in the packaging industry, would be the demand for soft drink and ice cream containers in relation to the summer weather. A dramatic improvement in the traditional English summer would create a commensurate increase in demand.

The best practical approach would be to consider the design and development work first. This is a fixed cost irrespective of the number of containers eventually sold.

*Lucille Mouldings Limited*

Quote No. \_\_\_\_\_

Design and development

|  |                  |
|--|------------------|
| Materials                                  | £18.00           |
| <i>Direct labour</i>                       |                  |
| Development engineer<br>11 hours @ £5/hour | 55.00            |
| Draughtsman<br>12 hours @ £3/hour          | 36.00            |
|  | ----- 91.00      |
|  | <i>Overheads</i> |

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|                                      |                |              |
|--------------------------------------|----------------|--------------|
| Engineering machine shop time        |                |              |
| 15 hours @ £8.60/hour                | 129.00         |              |
| Supervision                          | 35.00          |              |
| General overhead                     | 40.00          | -- 204.00    |
| Total cost of design and development | -----> £313.00 |              |
| Profit allowance                     |                | <u>39.13</u> |
|                                      | <u>£352.13</u> |              |

Clearly, that was a simple job costing exercise. Attention can now be directed to the production cost estimates.

*Lucille Mouldings Limited*

|                                      |                  |          |          |          |
|--------------------------------------|------------------|----------|----------|----------|
| Quote No. _____                      | Production costs |          |          |          |
| Quantity                             | 2000             | 4000     | 7000     | 9000     |
| Hours                                | 40               | 80       | 140      | 180      |
| <i>Materials</i>                     |                  |          |          |          |
| Direct material<br>(at 20p per unit) | 400              | 800      | 1400     |          |
| (at 16p per unit)                    |                  |          |          | 1440     |
| Pigment                              | 20               | 40       | 80       | 100      |
| <i>Labour</i>                        |                  |          |          |          |
| Day shift                            | 100              | 200      | 300      | 300      |
| Twilight 20 × 1.75                   |                  |          | 35       |          |
| 60 × 1.75                            |                  |          |          | 105      |
| <i>Overhead</i>                      |                  |          |          |          |
| £1.25/hour                           | 50               | 100      | 175      | 225      |
| <i>Direct Expenses</i>               |                  |          |          |          |
| Development                          | 352.13           | 352.13   | 352.13   | 352.13   |
| Set up 12 hours @ £3.60              | 43.20            | 43.20    | 43.20    | 43.20    |
| Routine maintenance                  | —                | —        |          |          |
| 6 hours @ £5/hour                    |                  |          | 30.00    | 30.00    |
| Total cost                           | 915.33           | 1,435.33 | 2,240.33 | 2,595.33 |
| Mark up on production costs          | 140.80           | 270.80   | 472.05   | 560.80   |
| Total price                          | £1,056.13        | 1,706.13 | 2,712.38 | 3156.13  |
| Price per 100 containers             | 52.81            | 42.65    | 38.74    | 33.07    |

This question illustrates most of the possible variables that can be introduced into a batch costing situation. Paramount of course, is the overriding principle that the longer the production run, the lower the unit costs. This is seen from above, that despite the increased fixed costs



arising from the longer runs and the need for extra maintenance, the quoted price for the 9000 containers is some 30 per cent lower than that for only 2000.

### **Batch costing considerations**

From the illustrated example above, it is ostensibly advantageous to both supplier and customer to have as long a run as possible. There is however, the inherent risk of obsolescence. The retail fashion house, might indeed benefit from a long run of garments, but at the risk of being caught with a large amount of unsaleable stock if fashions suddenly change. By the same token, the soft drinks or ice cream manufacturer can order large quantities of containers to capitalize on a prolonged spell of warm weather, only to become a victim of the English summer when a rapid change causes the market to slump. At least, unlike the fashion house, he may be able to store the containers in the hope of another spell of fine weather.

The reference to storage brings in the other side of the batch costing equation. The customer of Lucille Mouldings may well benefit from the advantageous rates available from buying in a large batch. However, the following considerations will need to be made:

- 1 Available cash flow to purchase the stock.
- 2 The availability of storage space to receive the large batch when produced.
- 3 The rate at which the containers will be used.
- 4 The time required for preparing the production of the batch (readers will recall that the demand was a 2000 per week call off).
- 5 The demands of other items waiting to use the facilities such as liquids to be put into the containers.
- 6 The interest on capital invested in the stock.

As we saw in the earlier chapters on the elements of stock, this requires identifying the economic batch quantity, either by trial and error, or graphically or using the EOQ model.

As cost accountant, the purchasing officer has come to you with the quote from Lucille Mouldings, and in the light of various operational considerations, has asked you to compute which option is the best in the circumstances. You are told that the annual demand is for 180,000 units, cost of ordering is £35, and the annual storage cost 25p per unit. Thus using the formula:

$$Q = \sqrt{\frac{2RS}{K}}$$

where Q = Economic order quantity

S = Cost of placing an order

R = Demand or requirement per annum of the item

K = Cost of holding one item in store for a year

Then substituting:

$$Q = \sqrt{\frac{2 \times 35 \times 180,000}{0.25}} = \underline{7099 \text{ units}}$$

Thus, in making the final recommendations, the cost accountant will point out, that while it may be cheaper in terms of unit costs of purchasing to buy in batches of 9000, delivered over a three week period, usage patterns and storage costs indicate that it may be preferable to go for the 7000 batch option.

## Questions

- 1 In order to identify the costs incurred in carrying out a range of work to customer specification in its factory, a company has a job costing system. This system identifies costs directly with a job where this is possible and reasonable. In addition, production overhead costs are absorbed into the cost of jobs at the end of each month, at an actual rate per direct labour hour for each of the two production departments.

One of the jobs carried out in the factory during the month just ended was Job No. 123. The following information has been collected relating specifically to this job:

400 kilos of Material Y were issued from stores to Department A. 76 direct labour hours were worked in Department A at a basic wage of £4.50 per hour. 6 of these hours were classified as overtime at a premium of 50%.

300 kilos of Material Z were issued from stores to Department B. Department B returned 30 kilos of Material Z to the storeroom being excess to requirements for the job.

110 direct labour hours were worked in Department B at a basic wage of £4.00 per hour. 30 of these hours were classified as overtime at a premium of 50%. All overtime worked in Department B in the month is a result of the request of a customer for early completion of another job which had been originally scheduled for completion in the month following.

Department B discovered defects in some of the work, which was returned to Department A for rectification. 3 labour hours were worked in Department A on rectification (these are additional to the 76 direct labour hours in Department A noted above). Such rectification is regarded as a normal part of the work carried out generally in the department.

Department B damaged 5 kilos of Material Z which then had to be disposed of. Such losses of material are not expected to occur.

Total costs incurred during the month on all jobs in the two production departments were as follows:

|                                      | <i>Department A</i><br>£ | <i>Department B</i><br>£ |
|--------------------------------------|--------------------------|--------------------------|
| Direct materials issued from stores* | 6,500                    | 13,730                   |
| Direct materials returned to stores  | 135                      | 275                      |
| Direct labour, at basic wage rate†   | 9,090                    | 11,200                   |
| Indirect labour, at basic wage rate  | 2,420                    | 2,960                    |
| Overtime premium                     | 450                      | 120                      |
| Lubricants and cleaning compounds    | 520                      | 680                      |
| Maintenance                          | 720                      | 510                      |
| Other                                | 1,200                    | 2,150                    |

Materials are priced at the end of each month on a weighted average basis. Relevant information of material stock movements during the month, for materials Y and Z, is as follow:

|                    | <i>Material Y</i>  | <i>Material Z</i>                 |
|--------------------|--|-----------------------------------|
| Opening Stock      | 1,050 kilos<br>(value £529.75)   | 6,970 kilos<br>(value £9,946.50)  |
| Purchases          | 600 kilos at<br>£0.50 per kilo<br>500 kilos at<br>£0.50 per kilo<br>400 kilos at<br>£0.52 per kilo | 16,000 kilos at<br>£1.46 per kilo |
| Issues from stores | 1,430 kilos  | 8,100 kilos                       |
| Returns to stores  | —  | 30 kilos                          |

\* This includes, in Department B, the scrapped Material Z. This was the only material scrapped in the month.

† All direct labour in Department A is paid a basic wage of £4.50 per hour, and in Department B £4.00 per hour. Department A direct labour includes a total of 20 hours spent on rectification work.

Required:

- (a) Prepare a list of the costs that should be assigned to Job No. 123. Provide an explanation of your treatment of each item. (17 marks)
- (b) Discuss briefly how information concerning the cost of individual jobs can be used. (5 marks)  
(22 marks)

### CACA 1.2

- 2 The manager of a small business has received enquiries about print-

ing three different types of advertising leaflet. Information concerning these three leaflets is shown below:

| <i>Leaflet type</i>              | <i>A</i> | <i>B</i> | <i>C</i> |
|----------------------------------|----------|----------|----------|
|                                  | £        | £        | £        |
| Selling price, per 1000 leaflets | 100      | 220      | 450      |
| Estimated printing costs:        |          |          |          |
| Variable, per 1000 leaflets      | 40       | 70       | 130      |
| Specific fixed costs, per month  | 2,400    | 4,000    | 9,500    |

In addition to the specific fixed costs a further £4,000 per month would be incurred in renting special premises if any or all of the above three leaflets were printed.

The minimum printing order would be for 30,000 of each type of leaflet per month and the maximum possible order is estimated to be 60,000 of each leaflet per month.

Required:

- (a) (i) Examine and comment upon the potential profitability of leaflet printing. Make whatever calculations you consider appropriate. (8 marks)
- (ii) Assuming that orders have been received to print each month 50,000 of both Leaflet A and Leaflet B calculate the quantity of Leaflet C which would need to be ordered to produce an overall profit, for all three leaflets, of £1,800 per month. (4 marks)

- (b) It is possible that a special type of paper used in printing the leaflets will be difficult to obtain during the first few months. The estimated consumption of this special paper for each type of leaflet is:

|           |                            |
|-----------|----------------------------|
| Leaflet A | 2 packs per 1000 leaflets  |
| Leaflet B | 6 packs per 1000 leaflets  |
| Leaflet C | 16 packs per 1000 leaflets |

Advise the manager on the quantity of each leaflet which should be printed in order to maximize profit in the first month, if 50,000 of each type of leaflet have been printed, there remains unfulfilled orders of 10,000 for each type of leaflet and there are 170 packs of special paper available for the rest of the month.

(5 marks)

- (c) 'If the manager of the above business wastes ten packs of special paper then the cost to the business of that waste is simply the original cost of that paper.'

Critically examine the validity of the above statement.

(5 marks)

(Total 22 marks)

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- 3 Calculate the selling price per unit allowing for a profit of 15% of the selling price. The following data are given:

|                                     |  |         |
|-------------------------------------|--|---------|
| Budgeted output for the year        | 9,800 units                                |         |
| Standard details for one unit:      |  |         |
| Direct materials                    | 40 square metres at £5.30 per square metre |         |
| Direct wages:                       |  |         |
| Bonding department                  | 48 hours at £2.50 per hour                 |         |
| Finishing department                | 30 hours at £1.90 per hour                 |         |
| Budgeted costs and hours per annum: |  |         |
| Variable overhead:                  | £  | hours   |
| Bonding department                  | 375,000                                    | 500,000 |
| Finishing department                | 150,000                                    | 300,000 |
| Fixed overhead:                     |  |         |
| Production                          | 392,000                                    |         |
| Selling and distribution            | 196,000                                    |         |
| Administration                      | 98,000                                     |         |
|                                     | (15 marks)                                 |         |

*CIMA CA 1 May 1980*

- 4 (a) Describe the distinguishing characteristics of production systems where:
- (i) Job costing techniques would be used.
  - (ii) Process costing techniques would be used. (3 marks)
- (b) 'Job costing produces more accurate product costs than process costing.' Critically examine the above statement by contrasting the information requirements, procedures and problems associated with each costing method. (14 marks)
- (Total 17 marks)

*CACA 1.2 December 1984*

- 5 One of the building contracts currently engaged in by a construction company commenced 15 months ago and remains unfinished. The following information relating to work on the contract has been prepared for the year just ended.

|  |       |
|--|-------|
|  | £000  |
| Contract price                         | 2,100 |
| Value of work certified at end of year | 1,840 |
| Cost of work not yet certified         | 35    |
| Costs incurred:                        |       |
| Opening balances                       |       |
| Cost of work completed                 | 250   |
| Materials on site (physical stock)     | 10    |
| During the year                        |       |
| Materials delivered to site            | 512   |
| Wages                                  | 487   |
| Hire of plant                          | 96    |
| Other expenses                         | 74    |
| Closing balance                        |       |
| Materials on site (physical stock)     | 18    |

As soon as materials are delivered to the site, they are charged to the contract account. A record is also kept of materials as they are actually used on the contract. Periodically a stock check is made and any discrepancy between book stock and physical stock is transferred to a general contract materials discrepancy account. This is absorbed back into each contract, currently at a rate of 0.4% of materials booked. The stock check at the end of the year revealed a stock shortage of £4,000.

In addition to the direct charges listed above, general overheads of the company are charged to contracts at 5% of the value of work certified. General overheads of £13,000 had been absorbed into the cost of work completed at the beginning of the year.

It has been estimated that further costs to complete the contract will be £215,000. This estimate includes the cost of materials on site at the end of the year just finished, and also a provision for rectification.

Required:

- (a) Explain briefly the distinguishing features of contract costing. (4 marks)
  - (b) Determine the profitability of the above contract, and recommend how much profit (to the nearest £000) should be taken for the year just ended. (Provide a detailed schedule of costs.) (14 marks)
  - (c) State how your recommendation in (b) would be affected if the contract price was £3,500,000 (rather than £2,100,000) and if no estimate has been made of costs of completion. (4 marks)
- (Total: 22 marks)

*CACA 1.2 June 1987*

## References and further reading

- 1 *Management Accounting* for December 1986 contains the full text of ED40. The revised SSAP9 was published in September 1988 and is examinable from November 1989. (Examiners assume students, like members, will have read it!)
- 2 Stein, N. D., 'ED40 – Stocks and Long-term Contracts', *Students' Newsletter*, April 1987, pp. 2–4.

# 6 Process costing

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## Introduction

The *Terminology* defines continuous operation or process costing as a basic costing method applicable where goods or services result from a sequence of continuous or repetitive operations or processes to which costs are charged before being averaged over the units produced during the period. Hitherto, the student has been dealing with costing finite units. Process costing introduces the student to the costing of amorphous substances such as chemicals, petroleum products and certain foodstuffs.

The essential problem with process costing is the valuation of work-in-process. The difficulty arises with computing the volumes in stock to produce an acceptable valuation of both finished goods and work-in-progress. In this chapter we will consider

- 1 The basic mechanics of process costing.
- 2 The impact of losses and gains.
- 3 The impact of work-in-progress – the two methods used for valuation.
- 4 An examination of any theory and controversy.

## Basic mechanics

As with other forms of costing, costs are collected and charged to the process. Costs would include materials introduced, direct labour charged, indirect costs and the production overhead to be absorbed. This is best explained by talking through a basic example.

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*Example 6.1*

For September a process manufacturing product C incurs the following costs:

Material A: 500 kg @ £1.25 kg  
 Material B: 3000 kg @ .45 kg

Labour costs: Direct supervision £425  
 Direct wages 2000 hours @ £3

Overhead is absorbed at 73.5% of total direct labour cost

Output is 3500 kg of product C

The cost accounts for the process would take the following form.

*Process account: September*

| Dr                 |                |      |                | Cr                         |                |           |                |
|--------------------|----------------|------|----------------|----------------------------|----------------|-----------|----------------|
|                    | kg             | Unit | £              |                            | kg             | Unit cost | £              |
| Material A         | 500            | 1.25 | 625            | Transfer to finished goods |                |           |                |
| Material B         | 3,000          | .45  | 1,350          |                            |                |           |                |
| Labour:            |                |      |                |                            | 3,500          | 3.75      | 13,125         |
| Direct supervision |                |      | 425            |                            |                |           |                |
| Direct wages       |                |      | 6,000          |                            |                |           |                |
| Overhead           |                |      | 4,725          |                            |                |           |                |
|                    | <u>3,500kg</u> |      | <u>£13,125</u> |                            | <u>3,500kg</u> |           | <u>£13,125</u> |

The unit valuation of finished goods is:

$$\frac{\text{Total cost } 13,125}{\text{Total units produced } 3,500} = 3.75 \text{ per kg}$$

If there was a second process the 3500 units valued at £13,125 would be transferred to this process.

This example, however, assumed that nothing was lost from the process. Reality is different. Losses are sometimes expected as a normal part of the process called 'normal losses' or a loss occurs that is unrelated to output expectations ('abnormal losses').

A *normal loss* is computed on the basis of past results and is often expressed as a percentage of the input to the process. It has the effect of increasing the unit cost of the good production. In Example 6.1 it is now assumed that normal waste is 5 per cent. Output is normal. The impact is as follows:



*Process account: September*

Dr

Cr

|                  | kg             | Unit cost | £              |             | kg             |                |
|------------------|----------------|-----------|----------------|-------------|----------------|----------------|
| Direct Materials |                |           |                |             |                |                |
| Material A       | 500            | 1.25      | 625            | Normal loss |                |                |
| Material B       | 3,000          | .45       | 1,350          | 5%          | 175            |                |
| Direct labour    |                |           |                | Transfer    | 3,325          | 13,125         |
| Supervision      |                |           | 425            |             |                |                |
| Direct wages     |                |           | 6,000          |             |                |                |
| Overhead         |                |           | 4,725          |             |                |                |
|                  | <u>3,500kg</u> |           | <u>£13,125</u> |             | <u>3,500kg</u> | <u>£13,125</u> |

Unit cost thus becomes  $\frac{13,125}{(3,500 - 175)} = \text{£}3.9474$ , say  $\text{£}3.95$  per kg.

Normal loss can be the result of vapourization during the process or as a residue. This residue may have a sale value which will be a credit to the process. If the normal residue in our example has a scrap value of 25p per kilogramme, then the impact upon the unit cost will be as follows:

*Process account*

Cr

|                | kg            | £                 |
|----------------|---------------|-------------------|
| Normal loss 5% |               |                   |
| Scrap value    | 175           | 43.75             |
| Transfer       | <u>3,325</u>  | <u>13,081.25</u>  |
|                | <u>£3,500</u> | <u>£13,125.00</u> |

Unit cost becomes  $\frac{13,125 - 43.75}{3,325} = \text{£}3.93$  per kg

**Abnormal losses and gains**

Any further losses that occur are abnormal losses and it is therefore necessary for control purposes to record the input and output of each particular process in order that the units lost are correctly accounted for and segregated. Abnormal losses are credited out of the process account into an abnormal loss account at the full unit cost value. Using the data for example 6.1 the assumption is now that 300 kg of output were abnormally lost. However, the 300 kg of scrap has a saleable value of 25p/kg. The impact of this on the process cost accounts will be as follows:

| Process account |         |      | Cr             | Abnormal loss account |        |                     |               |
|-----------------|---------|------|----------------|-----------------------|--------|---------------------|---------------|
|                 |         |      |                | Dr                    |        | Cr                  |               |
| Abnormal loss   | 300     | 3.75 | 1,125          | Process account       | 1,125  | Cash sales of scrap | 75            |
| Transfer        | 3,200   | 3.75 | 12,000         |                       |        | Balance             | 1,050         |
|                 | 3,300kg |      | <u>£13,125</u> |                       | £1,125 |                     | <u>£1,125</u> |

It is, of course not impossible that the loss could be less than expected. This would create the situation of an *abnormal gain*. From the data in Example 6.1 it is assumed that 3400 kg of output were obtained.

The effect of this is:

*Process account*

| Process account |                |      |                |          |                |                |
|-----------------|----------------|------|----------------|----------|----------------|----------------|
|                 | kg             | Unit | £              |          | kg             | £              |
| Direct material |                |      |                |          |                |                |
| Material A      | 500            | 1.25 | 625            | Normal   |                |                |
| Material B      | 3,000          | .45  | 1,350          | Loss 5%  | 175            |                |
| Direct labour   |                |      |                | Transfer | 3,400          | 13,421         |
| Supervision     |                |      | 425            |          |                |                |
| Direct wages    |                |      | 6,000          |          |                |                |
| Overhead        |                |      | 4,725          |          |                |                |
| Abnormal gain   | 75             | 3.95 | 296            |          |                |                |
|                 | <u>3,575kg</u> |      | <u>£13,421</u> |          | <u>3,575kg</u> | <u>£13,421</u> |

The student will notice that the unit cost of production is still based on normal output, i.e. from our original input of 3,500 kg, 3,325 kg or 95 per cent of output was expected. Therefore the value of the unit costs is still

$$\frac{\text{Cost introduced into process}}{\text{Normal output}} \text{ i.e. } \frac{13,125}{3,325} = \underline{\underline{£3.95}}$$

However, since the process has generated more units than anticipated, and hence the credit side of the process account is now greater than the debit, a compensating debit entry is needed for the number of units gained at the normal unit cost.

Examiners frequently report that this is an area where students go wrong and emphasis must be made that in order to keep the book straight the student should record the quantities as well as monetary values. This will be particularly important in balancing off the accounts.

The opposite entry of the abnormal gain is the *abnormal gain account* which is balanced off to the costing profit and loss account.

*Abnormal gain account*

|                         | £          |                    | kg | Unit | £          |
|-------------------------|------------|--------------------|----|------|------------|
| Costing profit and loss | <u>296</u> | Process<br>account | 75 | 3.95 | <u>296</u> |

Where the normal loss is a saleable residue, clearly the abnormal gain has been derived from this, and the abnormal gain account should reflect scrap sales lost. A simple adjustment entry between the normal loss account (sales of scrap) and the abnormal gain account is required.

**The impact of work-in-progress**

The reality of the working environment is that a process could well be incomplete at the point of cut off, requiring a valuation of work-in-progress. The problem is arriving at that valuation. This requires consideration of equivalent units. The *Terminology* defines equivalent units as: 'A notional quantity of completed units substituted for an actual quantity of incomplete physical units in progress, when the aggregate work content of the incomplete units is deemed to be equivalent to that of the substituted quantity of completed units e.g. 150 units 50 per cent complete = 75 **equivalent units**.'

In such a situation, the stages that the student should follow are:

- 1 Ascertain the percentage of completion. Usually this will be 100 per cent materials (introduced at the beginning of the process) and a proportion, usually the same since they may well be linked, of labour and overhead.
- 2 Calculate the equivalent units for each element.
- 3 Divide the total costs elements by the total units of finished output and equivalent units to ascertain the unit costs.
- 4 Scan the unit costs.
- 5 Multiply the total quantities and equivalent quantities by the total costs and post to the process accounts.

An example will illustrate these points.

*Example 6.2*

Product Alpha requires the treatment of input units through three distinct processes at each of which refining material is added and labour and overhead costs are incurred.

Work-in-progress at the beginning of Period 9 consisted of 8000 input units which had passed through the first process, the cost to that point being £96,000. During Period 9, refining material which cost £31,594 was put into the process and labour and overhead costs amounted to £23,940. Process overhead is applied at the rate of 40 per cent of process labour.

7200 units were completed during the Period and transferred to Process 3. Of the remainder the firm's Chief Chemist estimated that in

respect of refining material, labour and overhead, half were 75 per cent complete at the end of Period 9, and the other half, 40 per cent complete. Assume no normal losses or abnormal gains or losses.

You are required to write up Process 2 account for Period 9 showing clearly the cost to be transferred to Process 3, and the value of the work-in-progress at the end of the period.

Dividing out the total costs:

|                   |                             |
|-------------------|-----------------------------|
|                   | £                           |
| From Process 1    | $96,000 \div 8,000 = 12$    |
| Refining Material | $31,594 \div 7,660 = 4.125$ |
| Labour            | $23,940 \div 7,660 = 3.125$ |
| Overhead          | $9,576 \div 7,660 = 1.25$   |
| Total unit cost   | <u>20.5</u>                 |

Posting to the process cost accounts:

*Process 2: Period 9*

|                   | Units  | £              |           | Units | Value | £              |
|-------------------|--------|----------------|-----------|-------|-------|----------------|
| Process 1         | 8,000* | 96,000         | Process 3 | 7,200 | 20.5  | 147,600**      |
| Refining material |        | 31,594         | WIP (1)   | 400   |       | 7,350          |
| Labour            |        | 23,940         | WIP (2)   | 400   |       | 6,160          |
| Overheads         |        | <u>9,576</u>   |           |       |       |                |
|                   |        | <u>161,110</u> |           |       |       | <u>161,110</u> |

Notes:

WIP (1)  $(400 \times 12) + [300 \times (4.125 + 3.125 + 1.25)] = 7,350$

WIP (2)  $(400 \times 12) + [160 \times (4.125 + 3.125 + 1.25)] = 6,160$

\* Only the units of the initial material is important to this example. It depends on the nature of the substance and students should be careful here that they understand the process and nature of the end product.

\*\* Calculation of equivalent units. Since we have the estimate of completion stage, we can move straight to the computation. A grid approach will help to show the workings clearly.

|                            |              |                  | <i>Refining</i>  |               |                 |
|----------------------------|--------------|------------------|------------------|---------------|-----------------|
|                            | <i>Total</i> | <i>Process 1</i> | <i>Materials</i> | <i>Labour</i> | <i>Overhead</i> |
| Process 3                  | 7,200        | 7,200            | 7,200            | 7,200         | 7,200           |
| In WIP (1)                 | 400          | 400 (400 × 0.75) | 300*             | 300           | 300*            |
| In WIP (2)                 | 400          | 400 (400 × 0.4)  | 160*             | 160           | 160*            |
| Equivalent units of output | <u>8,000</u> | <u>8,000</u>     | <u>7,660</u>     | <u>7,660</u>  | <u>7,660</u>    |

The next problem confronting the student is the reverse of the problem just outlined, i.e. the impact upon the computation of opening

work-in-progress. Reality would illustrate a situation whereby during a control period, there would be opening work-in-progress which would be completed during the period under review, work started and finished during the period and work that is incomplete at the end of the period – closing work-in-progress. In approaching such questions, the student has two choices of method, *weighted average* whereby the costs are weighted together, or FIFO where the costs are apportioned assuming that units already in the process are finished first.

*Example 6.3*

The Lexington Manufacturing Company manufactures Product Beta. The produce passes through three successive processes, and the following information is available for the period ended September 19X5 for Process 3 (the final process):

- 1 Opening work-in-progress is 2000 units. These were at the following stages of completion: materials 80 per cent; wages 50 per cent; overhead 40 per cent.
- 2 Cost for the period were:

|                                     | <u>Opening<br/>WIP</u> | <u>Costs this<br/>period</u> |
|-------------------------------------|------------------------|------------------------------|
|                                     | £                      | £                            |
| Process 2                           | 6,100                  | 39,000                       |
| Conversion costs ( Direct materials | 1,980                  | 29,100                       |
| ( Direct wages                      | 1,427                  | 15,920                       |
| ( Production overhead               | 814                    | 9,950                        |
|                                     | <u>10,321</u>          | <u>93,970</u>                |

- 3 During the period 20,000 units were transferred from Process 2 to Process 3, and 20,500 units were transferred to finished goods stock. There was no closing work-in-progress.
- 4 The company has a normal loss in processing of 5 per cent of the current period's input from Process 2. All lost units are recoverable and have a scrap value of £1 each; this is treated as a deduction from the input cost from Process 2.
- 5 Revenue from scrapped units during the period was £1,500; at the point of discovery, these units were 100 per cent complete as regards materials, 80 per cent as regards direct wages and 40 per cent as regards overheads.

You are required to prepare the account for Process 3 for the period using:

- 1 The FIFO method of stock valuation.
- 2 The weighted average method of stock valuation.

*The approach to the FIFO method of stock valuation.*

Use a grid to calculate the equivalent units:

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Equivalent units of production

|  | Total units   | Process 2 |        | Direct materials |        | Direct wages |        | Production overhead |        |
|--|---------------|-----------|--------|------------------|--------|--------------|--------|---------------------|--------|
|  |               | %         | Units  | %                | Units  | %            | Units  | %                   | Units  |
| Completed units                          |               |           |        |                  |        |              |        |                     |        |
| 1 From opening WIP                       | 2,000         | –         | –      | 20*              | 400    | 50*          | 1,000  | 60*                 | 1,200  |
| 2 Started & finished in current period   | <u>18,500</u> | 100       | 18,500 | 100              | 18,500 | 100          | 18,500 | 100                 | 18,500 |
|  | <u>20,500</u> |           |        |                  |        |              |        |                     |        |
| 3 Normal loss                            | 1,000         | –         | –      | –                | –      | –            | –      | –                   | –      |
| 4 Abnormal loss                          | 500           | 100       | 500    | 100              | 500    | 80           | 400    | 40                  | 200    |
| 5 Equivalent units of output this period | 22,000        |           | 19,000 |                  | 19,400 |              | 19,900 |                     | 19,900 |

\* Percentage required to complete the unfinished units.

|                                   |                |                |               |               |              |
|-----------------------------------|----------------|----------------|---------------|---------------|--------------|
|                                   | £              | £              | £             | £             | £            |
| This period costs                 | 93,970         | 39,000         | 29,100        | 15,920        | 9,950        |
| 6 Less scrap value of normal loss | <u>(1,000)</u> | <u>(1,000)</u> | <u>29,100</u> | <u>15,920</u> | <u>9,950</u> |
| 7 Divide by equivalent units      | 22,000         | 19,000         | 19,400        | 19,900        | 19,900       |
| 8 Cost per equivalent unit        | £4.80          | £2.00          | £1.50         | £0.80         | £0.50        |
| 9 <i>Evaluation of output</i>     |                |                |               |               |              |

|  |                |
|--|----------------|
|  | £              |
| Cost of completing units from opening WIP – last period's cost b/f | 10,321         |
| Current period's costs: Materials 400 × £1.50                      | 600            |
| Wages 1,000 × 80p  | 800            |
| Overheads 1,200 × 50p  | 600            |
| Cost of 2,000 units  | <u>12,321</u>  |
| Units started and finished this period: 18,500 × £4.80             | <u>88,800</u>  |
| Total  | <u>101,121</u> |

To help the student follow through the figures below, we list the stages, with the numbers also alongside the figures.

- 1 Identify the units to be completed. This will mean the equivalent units 'needed' to finish off the opening work in progress.
- 2 Identify the units started and finished during the period under review.

- 3 Identify units involved in normal or abnormal losses, in order to bring the implications of these losses into the valuation.
- 4 Where appropriate, identify and compute the equivalent units of closing work-in-progress to be carried forward. (There are none in this particular case.)
- 5 Total up the equivalent units of production during the period. (All these steps are in the grid below.)
- 6 Introduce the period costs incurred, and adjust for any credits arising from sale of scrap.
- 7 Divide 6 above by 5 above to obtain the costs per equivalent unit (8).
- 8 Evaluate the value of the output.

*Calculation of value of abnormal loss:*

|           |             |        |  |
|-----------|-------------|--------|--|
| Process 2 | 500 × £2    | £1,000 |  |
| Materials | 500 × £1.50 | £ 750  |  |
| Wages     | 400 × 80p   | £ 320  |  |
| Overheads | 200 × 50p   | £ 100  |  |
|           |             | £2,170 |  |

*Lexington Manufacturing Co  
Process 3 September 19X5 FIFO method*

|                  | <i>Units</i> | <i>£</i> |                | <i>Units</i> | <i>£</i> |
|------------------|--------------|----------|----------------|--------------|----------|
| WIP b/f          | 2,000        | 10,321   | Normal Loss    | 1,000        | 1,000    |
| Process 2        | 20,000       | 39,000   | Finished Goods | 20,500       | 101,121  |
| Conversion costs |              | 54,970   | Abnormal Loss  | 500          | 2,170    |
|                  | 22,000       | 104,291  |                | 22,000       | 104,291  |

For the record:

*Abnormal loss account: September 19X5*

|           |        |                                 |        |
|-----------|--------|---------------------------------|--------|
| Process 3 | £2,170 | Cash received from disposal     | £1,500 |
|           |        | Costing profit and loss account | £ 670  |
|           | £2,170 |                                 | £2,170 |

*The approach to the weighted average method*

Here, the costs of the work-in-progress brought forward are added to the costs introduced during the period under review, and the total costs *averaged* across the equivalent units. There is no separation between units brought forward and completed and units commenced and finished during the period under review. Closing stocks, if any, would be valued on this average, and not at the costs 'exclusive' to these units deemed to be introduced during the period. Ostensibly, this is a simpler approach than that which uses FIFO. However, as we shall see below in the context of cost control, it does have certain shortcomings.

*Equivalent units of production*

|                 | Total units | Process 2 |        | Direct materials |        | Direct wages |        | Production overhead |        |
|-----------------|-------------|-----------|--------|------------------|--------|--------------|--------|---------------------|--------|
|                 |             | %         | Units  | %                | Units  | %            | Units  | %                   | Units  |
| Completed units | 20,500      | 100       | 20,500 | 100              | 20,500 | 100          | 20,500 | 100                 | 20,500 |
| Normal loss     | 1,000       | —         | —      | —                | —      | —            | —      | —                   | —      |
| Abnormal loss   | 500         | 100       | 500    | 100              | 500    | 80           | 400    | 40                  | 200    |
|                 | 22,000      |           | 21,000 |                  | 21,000 |              | 20,900 |                     | 20,700 |

Total costs:

|                                  | £              | £             | £             | £             | £             |
|----------------------------------|----------------|---------------|---------------|---------------|---------------|
| WIP b/f                          | 10,321         | 6,100         | 1,980         | 1,427         | 814           |
| This period costs                | 93,970         | 39,000        | 29,100        | 15,920        | 9,950         |
|                                  | <u>104,291</u> | <u>45,100</u> | <u>31,080</u> | <u>17,347</u> | <u>10,764</u> |
| Less: scrap value of normal loss | (1,000)        | (1,000)       |               |               |               |
|                                  | <u>103,291</u> | <u>44,100</u> | <u>31,080</u> | <u>17,347</u> | <u>10,764</u> |
| Cost per equivalent unit         | £4.93          | £2.10         | £1.48         | £0.83         | £0.52         |

*Evaluation of output*Completed units:  $20,500 \times £4.93 = £101,065$ 

Computation of value of abnormal loss

|             |   |               |
|-------------|---|---------------|
| 500 × £2.10 | = | £5,050        |
| 500 × £1.48 | = | £ 740         |
| 400 × £0.83 | = | £ 332         |
| 200 × £0.52 | = | £ 104         |
|             |   | <u>£2,226</u> |

The student will observe that the unit value of the units is different, having been weighted out at £4.93.

In the FIFO method, the units brought forward were finally completed at a unit cost of £6.17 (rounded).

Reconciliation between costs is:

$$\frac{(2,000 \times 6.17) + (18,500 \times 4.8)}{20,500} = £4.93$$

*Process 3: September 19X5*

|             | Units         | £              |                | Units         | £              |
|-------------|---------------|----------------|----------------|---------------|----------------|
| WIP b/f     | 2,000         | 10,321         | Normal loss    | 1,000         | 1,000          |
| Process 2   | 20,000        | 30,000         | Finished goods | 20,500        | 101,065        |
| Other costs |               | 45,970         | Abnormal loss  | 500           | 2,226          |
|             | <u>22,000</u> | <u>104,291</u> |                | <u>22,000</u> | <u>104,291</u> |



## Process costing and cost control

So far the emphasis has been upon a costing technique for recording historical costs for reporting and inventory valuation. However, the effective cost accountant is involved in the process of identifying, measuring and communicating economic information to permit informed judgements and decisions by users of the information. (From the definition of accounting – American Accounting Association.) To use a cliché formulated by Charles T. Horngren, cost accounting is not merely score-keeping but the collation and presentation of attention directing information.

In the context of process costing, therefore, this implies cost control and decision making. Under the heading of cost control, the emphasis is on current period costs and comparing with largest expectation, which in a management accounting context, could be standards. Returning to the data in the Lexington example cited above, the resulting process accounts, using the FIFO valuation method, showed the following data:

*Lexington Manufacturing Process 3 account: September 19X5*

|                  | Units  | £              |                | Units  | £              |
|------------------|--------|----------------|----------------|--------|----------------|
| WIP b/f          | 2,000  | 10,321         | Normal loss    | 1,000  | 1,000          |
| Process 2        | 20,000 | 39,000         | Finished goods | 20,500 | 101,121        |
| Process 3        |        |                |                |        |                |
| Conversion costs |        | 54,970         | Abnormal loss  | 500    | 2,170          |
|                  |        | <u>104,291</u> |                |        | <u>104,291</u> |

The two most attention demanding figures are the Process 3 conversion cost and the abnormal loss. Any reasons for the opening work-in-progress or the Process 2 transfer costs to be out of line are irrelevant to the cost control of Process 3 during September 19X5. From the calculations in the grid, unit costs were computed as direct material £1.50, direct wages 80p and overhead 50p. This should pose interesting questions about material cost (was the rate the result of excessive use and hence higher than expected) was the labour less efficient than it should have been and since the overhead rate is linked to it, is the overhead rate similarly overstated? There is, of course the credit side, that the costs may be lower or better than expected and hence management will be anxious to know if this was an isolated freak occurrence or something that can be profitably capitalized upon in the future.

In computing the two methods for bringing forward opening stock, the student will observe that FIFO, by isolating the costs and units generated during the period under review, is a better working document for control purposes.

## Process costing and decision making

The information generated by the process cost accounts will be fundamental to the decision making process. Typically, this will involve

the decision whether to process further or sell. The key to the decision is whether or not the margin generated is increased. A simple example will help in the appreciation of this problem.

*Example 6.4*

Saratoga Chemicals manufactures product Gamma. At present it is sold as a bulk chemical, eliminating the problems of breaking bulk, package and storage. In addition there is product Kappa which, if processed further instead of being sold, could command a higher price because of its higher value added content. The cost accountant has to present information to assist in the decision making appraisal.

The following information is available:

|   |          |
|---|----------|
| Cost of producing 100,000 litres of Gamma | £ 59,000 |
| Cost of packing in 25 litre containers    | £ 5,000  |
| Current bulk selling price                | £100,000 |
| Packed selling price £30 container        |          |
| Cost of processing Kappa                  | £ 2,000  |
| Current selling price                     | £ 2,000  |
| Additional processing costs               | £ 2,100  |
| Revised selling price                     | £ 4,000  |

*For product Gamma:*

|  |                   |
|--|-------------------|
| Current sales price per 100,000 litres               | £100,000          |
| Current cost   | £ (59,000)        |
| Current contribution                                 | <u>£ 41,000</u>   |
| Revised selling price $\frac{100,000}{25} \times 30$ | £120,000          |
| Revised costs 59,000 + 5,000                         | <u>£ (64,000)</u> |
| Revised contribution                                 | <u>£ 56,000</u>   |
| Increase in contribution per 100,000 litres          | <u>£ 15,000</u>   |

It is thus beneficial to undertake the additional breaking of bulk and packing and there is a wide margin of safety to allow for price fluctuation.

*For product Kappa:*

|                       |                 |                     |                 |
|-----------------------|-----------------|---------------------|-----------------|
| Current selling price | £ 2,000         | Revised sales price | £ 4,000         |
| Current cost          | <u>£(2,000)</u> | Revised costs       | <u>£(4,100)</u> |
|                       | <u>£ -</u>      |                     | <u>£ (100)</u>  |

Clearly it is not economic to process Kappa any further. In making such decisions, the student must remember that only direct costs are relevant, and any subjective allocation or non-activity related costs or time related costs is irrelevant to the argument.

The student will notice that in compiling the figures for the decision to be taken, fixed or time-related overhead allowances have been ignored. The reason for this is that while it is essential to include the time related conversion overheads in the valuations of stocks to comply

with both SSAP9 and the requirements of the Inland Revenue, unless a decision requires an increase in the *actual cost* of time-related fixed conversion overhead, then it is irrelevant to the decision. This is because the time related costs will remain unchanged irrespective of which decision is taken.

### **The debate about process costing**

A student can be forgiven if he or she finds the procedures for process costing tedious and possibly complicated. Furthermore, any difficulties may well be exacerbated by the realization that the taught procedures do not always relate to reality.

The core of the controversy is the use of the equivalent units. In research undertaken by David Forrester of Strathclyde University he found that older traditional texts such as Wheldon's *Applied Costing* (1944) ignored in process stocks, while Joan Woodward's survey in the 1950s (familiar to management students) reported that process industries adjusted production to demand. In 1967 however, Horngren, a well known author and researcher on costing topics, questioned the wisdom of setting intricate questions on process costing especially those involving FIFO and equivalent units. He argued from survey data that typical levels of stock were not referred to nor any practice of taking fractions of units rather than of cost to completion (similar to contract costing) as mode of calculating work-in-process values. Forrester is critical of Horngren's results, finding them rather inconclusive. The same can be said of a contemporary study undertaken by the ICAS, although the specific question on the use of equivalent units in work-in-process valuations was not asked, the indications were that it was not. A specific study undertaken by Strathclyde University in 1976 asked questions about equivalent units. Where batch costing operated, especially where the products were short cycled and there were residues requiring cleaning, such as in certain chemicals and paint production, work-in-process was not material. Food and beverages could not be left over weekends, and therefore, again because of relatively short process cycles, work-in-process could be ignored. Brewing revealed that although there was work-in-process, it was valued at standard cost up to the objective stage of completion, and not by the equivalent units method. In distilling, an industry where yields right through maturation to blending and bottling are carefully set and controlled, there are, inevitably, significant quantities complete, but valued on the basis as equivalent to cost of raw materials used.

A more thorough research undertaken by Skinner in both England and Australia surveyed a wide range of process type industries with the emphasis on continuous process industries. (Both processes revealed, like the Strathclyde study, no work-in-process.) The results revealed, despite searching enquiries, that equivalent units methods were not employed and frequently work-in-process was only material costed or

more usually, ignored as being not material. Indeed, material cost valuations were usually employed where it was necessary to note the effects of changing value of a constant level of work-in-process retained for technical reasons. From this evidence, Skinner endorsed Horngren's 1967 viewpoint under the colloquial view, 'process costing – forget it'.

Students, however, should note that Skinner's stand has been challenged by fellow Australian, Graham Partington. Partington felt that Skinner's case is not effectively argued or convincing. Much of Partington's criticism hangs on the problem that if work-in-process is ignored, there is a serious risk of misleading adverse cost absorption variances being generated. Further, Partington points out that the sole basis for Skinner's stand is not the technical inadequacy of the equivalent unit procedure, but just that it is not used. Partington, and indeed Horngren too, suggest that standard costing procedures have all the input and yield control advantages, and evidence suggests that where theoretical process costing is not used, standard costing facilitates the necessary controls. Partington's comments, however, remain rather unconvincing.

The debate appears to have reached no obvious conclusion. In 1980 Forrester asked that the onus of proof be that the Equivalent Units Technique was practised and therefore should be taught, and called for further research into continuous process industries but so far evidence has been lacking. The demands of SSAP9 and the consolidated *Companies Act 1985* have apparently had little impact in motivating firms to use the Equivalent Units Technique.

In preparing for a theoretical essay question on process costing therefore, the student should be aware of

- 1 Early American (pre World War Two) origins and appearance in the UK costing literature with the tenth edition of Wheldon in 1960 (Horngren's costing textbook did not include it until after 1962).
- 2 A thorough knowledge of the practical calculations. No effective, lucid argument about a technique can be made without adequate knowledge.
- 3 The historical evidence and the lack of specific research. Indications rather than conclusions.
- 4 The recent research undertaken by Horngren (1967) Forrester (Strathclyde University) and Skinner (Monash University).
- 5 The Partington criticism.
- 6 The possible alternatives and current state of the argument (Forrester 1982).

### **Joint costs and by-products**

The *Terminology* defines joint costs as 'the costs of providing two or more products or services whose production could not, for physical reasons, be segregated'. The definition is illustrated by the somewhat esoteric example of sheep rearing for both meat and wool.

The *Terminology* also furnishes a definition of joint products, which is 'two or more products separated in the course of processing, each having a sufficiently high saleable value to merit recognition as a main product'.

This latter definition sets the scene of the problem. An activity or process is started, and at the end of it there is more than one saleable product. These products generate revenue, but the cost incurred need to be identified on an equitable basis for matching against the revenues generated.

By-products, by contrast, are 'products which are recovered incidentally from the material used in manufacture of recognized main products, such as a by-product having either a net realizable value or a usable value which is relatively low in comparison with the saleable value of the main products'. While the *Terminology* adds the rider that by-products may be further processed to increase their realizable value, this poses the problem as to when is a saleable value high enough to warrant being regarded as a joint product? Mearns (1980) suggests that a product ceases to be a by-product when it is clear that management had the deliberate intention to produce the product i.e. the result was not incidental. Two or more products were expected, even if one was only a lower grade of the other, and it is irrelevant for the realizable value of the various products to be the same.

The problems for the cost accountant under this heading are:

- 1 Identifying the methods of treating the income.
- 2 The valuing of inventory.

### ***By-products – methods of treating the income***

The problem is best appreciated by talking through an example.

#### *Example 6.5*

Liquids Limited produces product Y. As part of the production process, by-product P is also produced. This has a saleable value. For the month of October 19X6, the costs of the process were £750,000, and the sales data were:

Product Y 12,500 tons at £100 per ton  
 Product P 2,700 tons at £200 per ton.

You are required to prepare a trading account for the month of October using the four alternative methods of treating by-products in the profit and loss account.

#### *Approach:*

The four alternatives available to the cost accountant are:

- 1 Aggregate the sales of major products and by-products and deduct the process costs to arrive at the profit and loss. This approach

- makes no attempt to segregate the costs into a joint cost approach, which in view of the nature of the data provided, i.e. the by-product is potentially a lucrative source of income, has obvious drawbacks.
- 2 Deduct the *net* income (i.e. after deducting any post separation costs) from the by-product from the process cost. This is similar to the approach in process costing, where any income from sales of normal waste or materials normally scrapped is brought into the cost computation. Again this approach has the drawback that it may bring fluctuating sales prices into the cost structure, and in consequence hide inefficiencies. There is a view that suggests that standards could be employed here, but wide fluctuations in volumes and prices could produce some rather meaningless standards.
  - 3 Omit the revenue from the process cost account altogether. This at least has the merit of directing attention to the process costs and avoiding clouding the issue with the by-product income. This method is especially suitable where the income is small, but it would also highlight the situation where the income was increasing, causing the need for an investigation into the reasons. In addition, there still remains the problem of what to do with any post separation costs.
  - 4 Apportion the costs as though the by-product was a joint cost.

*Solution:*

| <i>Method</i> | 1      |       | 2      |       | 3      |       | 4       |       |
|---------------|--------|-------|--------|-------|--------|-------|---------|-------|
| Sales income  |        |       |        |       |        |       | Y       | P     |
|               | Tons   | £k    | £k     | £k    | £k     | £k    | £k      | £k    |
| Y             | 12,500 | 1,250 | 12,500 | 1,250 | 12,500 | 1,250 | 12,500  | 1,250 |
| P             | 2,700  | 540   |        |       |        |       | 2,700   | 540   |
| Process cost  |        | (750) | (210)* |       | (750)  |       | (615)** | (135) |
| Gross profit  |        | 1,040 | 1,040  |       | 500    |       | 635     | 405   |
| Sundry income |        |       |        |       | 540    |       |         |       |
| Net profit £k |        | 1,040 | 1,040  |       | 1,040  |       | 635     | 405   |

*Note:*

\* Process Cost is computed on the basis of:

|                             |              |
|-----------------------------|--------------|
| Total process cost          | £750k        |
| Less income from by product | (540)        |
| Net process cost            | <u>£210k</u> |

\*\* Cost of process apportioned by weight.

There are obvious problems as the grid above illustrates.

Method 1 reveals a net profit to sales of 58 per cent, but gives no indicator as to where the profit has come from. The same can be said for approach 2, while 3 gives a profit before sundry income ratio of 40 per cent, suggesting that the by-product is lucrative, but leaving unanswered the question of how lucrative?

Approach 4 has made some attempt to apportion costs, albeit on the

weight of products giving a ratio of 82:18. From that the profit ratios become 50.8 per cent for Y and 75 per cent for P. If the allocation is correct, then there should be some consideration of developing product P further. However, the method used to allocate the costs was so subjective that the resultant data will have questionable value.

The next problem arises where there is inventory carried forward into the next process period. Taking the illustration above, we will assume that 100 tons of Y were left unsold at the end of the month, and 25 tons of P. The inventory valuations in consequence of the four methods selected above would be:

1 and 3 Assuming nil value to the by-product:

$$\frac{750,000}{12,500} \times 100 = \text{£}6,000$$

2 Again nil value to the by-product, but the income is treated as a reduction in the cost:

$$\frac{(750,000 - 540,000)}{12,500} \times 100 = \text{£}1,680$$

4 Apportioning the costs, for product Y:

$$\frac{615,000}{12,500} \times 100 = \text{£}4,920$$

and for the by-product P

$$\frac{135,000}{2,700} \times 25 = \text{£}1,250$$

The data used has already anticipated the problem of deciding when to turn a by-product into a joint product. This will be considered after looking at the problems of joint products.

### ***Joint products – essential problem***

The essential problem is the apportioning of the joint costs incurred before the split off. There are four options open to the cost accountant:

- 1 Using the ratio of market value of production at the point of separation. This presupposes that this figure is reliably known, but also that it is fairly stable. If it is not, then there is the serious problem of loading products with differing amounts of the joint cost, simply because the price has either risen or fallen.
- 2 Apportion the costs using sales value of production (i.e. the end products) as a base. Again, this could be at the mercy of market forces, but also this method will have little value if there is to be further processing of the product. This problem is exacerbated if there is a disparity between the two or more products in the amount and cost of post split off work to be carried out.
- 3 Apportion, as was intimated in Example 6.5, on the basis of units. This presupposes that some common and reasonable unit can be

found. This method would be useless if one product was measured by weight and another by volume.

- 4 The net sales value method, based on sales value less any post separation costs.

To demonstrate the problem and how it might be handled, we will talk through an example.

*Example 6.6*

Liquigas Limited produces the four products J K L and M through a process which for November cost £1,500,000. Production and sales during the month were as follows:

|   | Production |  | Sales  |     | Split off    |
|---|------------|--|--------|-----|--------------|
|   | Tonnes     |  | Tonnes | £   | market value |
| J | 5000       |  | 4000   | 100 | 50           |
| K | 8000       |  | 6000   | 125 | 65           |
| L | 5000       |  | 4500   | 80  | 20           |
| M | 3000       |  | 2700   | 200 | 110          |

There were no stocks on hand at the beginning of November.

You are required to prepare a statement of both the profit and loss for the month of November, and show the value of the stocks of the four products at the end of November, stating any assumptions that you have made.

*Approach:*

In its original form, the question left it to the student to select the most appropriate method to allocate the costs. To demonstrate the implications of the three alternatives, all three methods will be used.

*1 Market value of production*

Formulating a working grid:

| Product | Production | Market value |        | Process costs | Unit cost |
|---------|------------|--------------|--------|---------------|-----------|
|         |            | Unit         | Total  | £k            | £         |
| J       | 5000       | £50          | £250k  | 312.5         | 62.5      |
| K       | 8000       | 65           | 520    | 650           | 81.25     |
| L       | 5000       | 20           | 100    | 125           | 25        |
| M       | 3000       | 110          | 330    | 412.5         | 137.5     |
|         |            |              | £1200k | £1500k        |           |

From the data prepared in the grid above, we can now prepare both the profit and loss account, and the closing stock valuation.



*Liquigas Limited Profit and Loss Account: November*

|                  |       |         |         |          |           |
|------------------|-------|---------|---------|----------|-----------|
| Product          | J     | K       | L       | M        | Total     |
| Turnover (units) | 4000  | 6000    | 4500    | 2700     |           |
| (£k)             | 400   | 750     | 360     | 540      | 2050      |
| Cost of sales    | (250) | (487.5) | (112.5) | (371.25) | (1221.25) |
| Gross profit     | £150k | 262.5   | 247.5   | 168.75   | 828.75    |

*Value of closing stock*

|            |      |       |      |       |
|------------|------|-------|------|-------|
| Product    | J    | K     | L    | M     |
| Units      | 1000 | 2000  | 500  | 300   |
| Value (£k) | 62.5 | 162.5 | 12.5 | 41.25 |

We will now repeat the process using the second alternative method.

*2 Sales value of production*

Again, we have to format a working grid:

| Product | Production | Selling price | Sales value | Process costs | Unit cost |
|---------|------------|---------------|-------------|---------------|-----------|
| J       | 5000       | 100           | 500         | 300           | 60        |
| K       | 8000       | 125           | 1000        | 600           | 75        |
| L       | 5000       | 80            | 400         | 240           | 48        |
| M       | 3000       | 200           | 600         | 360           | 120       |
|         |            |               | £2500k      | £1500k        |           |

Again from the grid, we can now formulate the profit and loss account, and our schedule of the value of closing stock.

*Liquigas Limited: Profit and loss account November*

|               |       |       |       |       |        |
|---------------|-------|-------|-------|-------|--------|
| Product       | J     | K     | L     | M     |        |
| Total         |       |       |       |       |        |
| Sales (units) | 4000  | 6000  | 4500  | 2700  |        |
| Sales (£k)    | 400   | 750   | 360   | 540   | 2050   |
| Cost of sales | (240) | (450) | (216) | (324) | (1230) |
| Gross profit  | 160   | 300   | 144   | 216   | £820k  |

*Value of closing stock*

|            |      |      |     |     |
|------------|------|------|-----|-----|
| Product    | J    | K    | L   | M   |
| Quantity   | 1000 | 2000 | 500 | 300 |
| Value (£k) | 62   | 150  | 24  | 36  |

### 3 Units basis

This presupposes that the four products are reasonably compatible to facilitate the selection of this option. (Where they are not, there is always the option of using a weighted average approach, by introducing weightings previously computed into the calculations. The obvious drawback here is the potential for further subjective data to be introduced into the valuation equation.) However, the simple units method, where applicable, has the advantage of being independent of any vagaries in market forces that would result in certain products taking more costs simply because the price is high enough for them to carry these additional costs and still ostensibly show a profit. Against that, there could easily develop a situation where, although a product is being produced in large quantities to attract a large allocation of the cost, because of poor prices, it may turn in a loss, or because of poor demand, slow moving stock is being overvalued.

Again we format a working grid:

| Product | Production | Process costs | Unit cost | Closing stock |           |
|---------|------------|---------------|-----------|---------------|-----------|
|         |            |               |           | Quantity      | Value     |
| J       | 5000       | £357.14k      | 71.43     | 1000          | £71.43k   |
| K       | 8000       | 571.42        | 71.43     | 2000          | 142.86    |
| L       | 5000       | 357.14        | 71.43     | 500           | 35.715    |
| M       | 3000       | 214.30        | 71.43     | 300           | 21.429    |
| Total   | 21000      | £1,500k       |           |               | £271.434k |

#### *Liquigas Limited profit and loss account: November*

| Sales         |                         |      |      |      |                |
|---------------|-------------------------|------|------|------|----------------|
| Product       | J                       | K    | L    | M    | Total          |
| Units         | 4000                    | 6000 | 4500 | 2700 |                |
| Value (£k)    | 400                     | 750  | 360  | 540  | 2,050          |
| Cost of Sales | (17,200 units @ £71.43) |      |      |      | (1,228,60)     |
|               |                         |      |      |      | <u>£821.40</u> |

From the three alternative approaches, it is apparent that the profit varies slightly, and hence the closing stock. Also, the apparent individual profit contributed or generated by the individual products appears to vary slightly. This accentuates the real difficulty with joint costing, that is the ascertaining of the true profit generated by the individual *profits*. In selecting the method to use for inventory valuation, and profit identification, the cost accountant is advised to first ascertain why the inventory valuation is required in the first place. If the answer to this question is to arrive at a cost that is indicative of the revenue generating power of the various joint products in stock,

rather than merely to satisfy the needs of spreading the costs, then the choice must fall on the *net realizable value or sales value* (option 2 above). This is the method most likely to provide the closest approximation to the generating power of the individual products. To the accounting purist, this is the solution that most closely follows the requirements of the matching concept in accounting.

### **Joint costs and decision making**

One of the most likely problems to be faced both in the real live cost accounting environment, or in the examination room is where a by-product, or even a joint product is subject to a review as to whether the product should be subject to reprocessing or not. Theoretically, reprocessing should increase value added, and hence the potential to increase the ultimate sales price. Again, to demonstrate this problem, we will talk through a typical question.

#### *Example 6.7*

Helen Limited manufactures two joint products, S and M. The costs of common processing are £15,000 per batch, and output per batch is 100 units of S and 150 units of M. The sales value of S at split off point is £90 per unit, and the similar value of M is £60 per unit. Helen Limited is given the opportunity to quote for the production of T, by processing product S further, at an extra cost of £2,000. One unit of S will produce one unit of T and the new end product will have a unit selling price of £120.

A decision is required as to whether or not, Helen should produce T.

#### *Approach:*

The decision to produce T will depend upon the following equation being satisfied:

Sales value of T – Further processing costs > Sales value of S

Translating this into an accounting format:

|  |               |
|--|---------------|
| Sales value generated from the new product T (100 × 120) | £12,000       |
| Further processing costs                                 | (2,000)       |
| Net value of further processing                          | £10,000       |
| Sales value from product S (100 × 90)                    | (9,000)       |
| Additional benefit derived from reprocessing             | <u>£1,000</u> |

From this simple example, it is evident that the decision should be to take up the opportunity to process S further. The student reader should note carefully that the approach is similar to that of marginal costing, the difference being that the time related costs are replaced by the pre split off costs which would be incurred irrespective of whether the end products were S and M or S and T. Equally, the method of apportionment to be selected is irrelevant to this decision, the answer would come out exactly the same.

Just out of interest, suppose one major customer of the Helen Limited

always took forty units of S and forty units of M. The order for M was based on the availability of S, and if S were not available, then there would be no order for M. Demand for M is not good, and the unsold units of M, because it is highly perishable would have to be dumped. Should Helen Limited still accept the order for the T?

The new decision equation thus becomes:

Sales value of T – (Cost of further processing + Cost of units of M to be written off) > Sales value of S

Since the cost of M has to be considered in the decision making process, the choice of apportionment will be significant.

Possible solutions:

*1 Based on the units method of apportionment*

|                    | Sell product T |        |        | Sell product S |       |        |
|--------------------|----------------|--------|--------|----------------|-------|--------|
|                    | M              | T      | Σ      | M              | S     | Σ      |
|                    | £              | £      | £      | £              | £     | £      |
| Joint costs        | 9,000          | 6,000  | 15,000 | 9,000          | 6,000 | 15,000 |
| Further processing |                | 2,000  | 2,000  |                |       |        |
| Total costs        | 9,000          | 8,000  | 17,000 | 9,000          | 6,000 | 15,000 |
| Sales              | 6,600          | 12,000 | 18,600 | 9,000          | 9,000 | 18,000 |
| Profit             | (2,400)        | 4,000  | 1,600  | 0              | 3,000 | 3,000  |

The indications here are that Helen Limited should reject the order.

*2 Using the total sales value at point of separation method, which in this case is the same as the sales value at point of sale, since there are normally no further processing costs:*

|                    | Sell product T |        |        | Sell product S |       |        |
|--------------------|----------------|--------|--------|----------------|-------|--------|
|                    | M              | T      | Σ      | M              | S     | Σ      |
|                    | £              | £      | £      | £              | £     | £      |
| Joint costs        | 7,500          | 7,500  | 15,000 | 7,500          | 7,500 | 15,000 |
| Further processing |                | 2,000  | 2,000  |                |       |        |
| Total cost         | 7,500          | 9,500  | 17,000 | 7,500          | 7,500 | 15,000 |
| Sales              | 6,600          | 12,000 | 18,600 | 9,000          | 9,000 | 18,000 |
| Profit             | (900)          | 2,500  | 1,600  | 1,500          | 1,500 | 3,000  |

In the event, the decision becomes the same, that the order should still be rejected, but had the valuations been substantially different, then other criteria may have needed to have considered.

**Further considerations**

Some consideration has been given to the construction of models to make a more quantitative and objective approach to joint and by-

product cost accounting possible. Hopefully, with improved education of the users of management and cost accounting data, these models will become part of current practice.

**Questions**

- 1 A product is manufactured by passing through three processes: *A*, *B* and *C*. In process *C* a by-product is also produced which is then transferred to process *D* where it is completed. For the first week in October, actual data included:

|  | <i>Process A</i> | <i>Process B</i> | <i>Process C</i> | <i>Process D</i> |
|--|------------------|------------------|------------------|------------------|
| Normal loss of input                           | 5%               | 10%              | 5%               | 10%              |
| Scrap value (per unit)                         | £1.50            | £2.00            | £4.00            | £2.00            |
| Estimated sales value of by-product (per unit) | —                | —                | £8.00            | —                |
| Output (units)                                 | 5,760            | 5,100            | 4,370            | —                |
| Output of by-product (units)                   | —                | —                | 510              | 450              |
|  | £                | £                | £                | £                |
| Direct materials (6000 units)                  | 12,000           | —                | —                | —                |
| Direct materials added in process              | 5,000            | 9,000            | 4,000            | 220              |
| Direct wages                                   | 4,000            | 6,000            | 2,000            | 200              |
| Direct expenses                                | 800              | 1,680            | 2,260            | 151              |
| Budgeted production overhead for the week is   |                  |                  |                  | £30,500          |
| Budgeted direct wages for the week are         |                  |                  |                  | £12,200          |

You are required to prepare:

- (a) Accounts for Process *A*, *B*, *C* and *D*: (20 marks)  
 (b) Abnormal loss account and abnormal gain account. (5 marks)  
 (Total: 25 marks)

*CIMA CA2 November 1986*

- 2 Wye Chemicals plc manufactures a range of products in a variety of processes and the data given below relate to Process 3 for the month of April.

You are required to prepare:

- (a) A statement showing the cost per unit and the value of the output.  
 (b) An account for Process 3.  
 (c) An abnormal gain or loss account.

|  |              |        |
|--|--------------|--------|
| Transfer from Process 2                    | 10,800 units | £7,980 |
| Transfer to Process 4                      | 9,650 units  |        |
| Direct materials added during process      |              | £2,019 |
| Direct wages incurred in process           |              | £2,889 |
| Production overhead apportioned to process |              | £6,482 |

There is a normal loss in process of 10% of throughput.  
All units scrapped can be sold at £0.20 each.

Opening work-in-progress:

|                       |                            |     |
|-----------------------|----------------------------|-----|
| Degree of completion: | 1200 units                 |     |
|                       | materials added in process | 40% |
|                       | direct wages               | 60% |
|                       | production overhead        | 70% |

Closing

|                       |                            |     |
|-----------------------|----------------------------|-----|
| work-in-progress:     | 1000 units                 |     |
| Degree of completion: | materials added in process | 80% |
|                       | direct wages               | 60% |
|                       | production overhead        | 40% |

Units scrapped:

|                       |                            |     |
|-----------------------|----------------------------|-----|
| Degree of completion: | 1350 units                 |     |
|                       | materials added in process | 50% |
|                       | direct wages               | 40% |
|                       | production overhead        | 20% |

(25 marks)

*CIMA CA1*

- 3 AB Chemicals Limited produces a compound by mixing certain ingredients within two separate processes. For a particular week the recorded costs were:

Process 1 Material: 2000 kilogrammes at £2 per kilogramme  
Labour: £360

Process plant time: 24 hours at £200 per hour

Process 2 Material: 3100 kilogrammes at £6 per kilogramme  
Labour: £240

Process plant time: 40 hours at £76.30 per hour.

Indirect production overhead for the week amounted to £2,400 and is absorbed on the basis of labour cost.

Normal outputs are: Process 1 80% of input  
Process 2 90% of input

Discarded materials have scrap values of £0.30 per kilogramme from Process 1 and £1.50 per kilogramme from Process 2. Assume that sales of scrap are made for cash during the week.

There was no work-in-progress at either the beginning or end of the week.

Output during the week was 1400 kilogrammes from Process 1 and 4200 kilogrammes from Process 2.

You are required to:

(a) Show the accounts for:

- (i) Process 1
- (ii) Process 2

- (iii) abnormal gain loss
  - (iv) profit and loss – relating to transactions in any of the above accounts
  - (v) finished goods (16 marks)
- (b) Explain, in relation to process costing, the concept of 'equivalent units' and give a simple example using your own figures. (4 marks)
- (Total: 20 marks)

*CIMA CAI November 1984*

- 4 Angus Menzies and Company operate a process which produces two joint products. The following details are for the first week of December:

|                                |  |
|--------------------------------|--|
| Opening work-in-process:       | 5000 litres half processed, valued at a cost of £1 per litre (£0.50 for direct material and £0.50 for conversion costs).   |
| Input during week:             | 25,000 litres of A @ £0.60 per litre<br>£15,000<br>20,000 litres of B @ £0.40 per litre<br>£8,000.   |
| Processing costs for the week: | £41,000  |
| Output during week:            | 22,000 litres of C,<br>6000 litres of D,<br>12,000 litres of waste – 2000 litres of this is considered to be abnormal for this level of operations; waste has a value of 5p per litre. |
| Closing work in process:       | 10,000 litres, again half processed.   |

You are required:

- (a) To write up the process account for the week, assuming that:
  - (i) Joint costs are to be apportioned on a physical units basis.
  - (ii) The FIFO convention is to be adopted.
  - (iii) Waste does not arise until the end of the process when the joint products are separated.
- (b) To calculate the average cost of 1000 litres of C and 1000 litres of D output during the week. (12 marks)

*CACA 1.2 November 1985*

- 5 A chemical product manufacturer, Bramley plc, operates three manufacturing departments. Raw material processed in Department 1 yields two joint products, A and B. Normally 1 litre of input into that department produces 0.6 litre of A and 0.3 litre of B. Although

each of these products could be sold at the split off point (and there is a ready demand for each in this state) they are normally refined further, A in Department 2 and B in Department 3. The additional processing enhances their saleable values as follows:

| <i>Established selling prices per litre</i> | A     | B     |
|---|-------|-------|
| Unrefined product at split off point        | £1.00 | £0.30 |
| Refined product (after further processing)  | 1.40  | 0.70  |

The company has been operating at full capacity and the departmental accounts for the last operating period can be summarized as follows:

*Department 1*

|                         | <i>Litres</i>  | <i>£</i>       |                               | <i>Litres</i>  | <i>£</i>       |
|-------------------------|----------------|----------------|-------------------------------|----------------|----------------|
| Opening work-in-process | 7,900          | 3,180          | Output                        |                |                |
|                         |                |                | A transferred to Department 2 | 120,000        | 60,000         |
|                         |                |                | B transferred to Department 3 | 60,000         | 30,000         |
| Inputs                  |                |                | Waste at net realizable value | 20,000         | 1,000          |
| Direct material X       | 162,000        | 46,575         | Closing work-in-process       |                |                |
| Y                       | 40,500         | 24,300         |                               | <u>10,400</u>  | <u>4,186</u>   |
| Processing expense      |                | 21,131         |                               | <u>210,400</u> | <u>£95,186</u> |
|                         | <u>210,400</u> | <u>£95,186</u> |                               |                |                |

*Department 2*

|                               | <i>Litres</i>  | <i>£</i>        |                         | <i>Litres</i>  | <i>£</i>        |
|-------------------------------|----------------|-----------------|-------------------------|----------------|-----------------|
| Opening work-in-process       | 15,000         | 10,875          | Output                  |                |                 |
|                               |                |                 | sales revenue           | 129,000        | 180,600         |
| Inputs                        |                |                 | Closing work-in-process | 6,000          | 4,350           |
| Transferred from Department 1 | 120,000        | 60,000          |                         |                |                 |
| Processing expense            |                | 56,025          |                         | <u>135,000</u> | <u>£184,950</u> |
| Profit                        |                | 58,050          |                         |                |                 |
|                               | <u>135,000</u> | <u>£184,950</u> |                         |                |                 |

*Department 3*

|                               | <i>Litres</i> | <i>£</i>       |                         | <i>Litres</i> | <i>£</i>       |
|-------------------------------|---------------|----------------|-------------------------|---------------|----------------|
| Opening work-in-process       | 5,000         | 3,250          | Output                  |               |                |
|                               |               |                | Sales Revenue           | 62,000        | 43,400         |
| Inputs                        |               |                | Closing work-in-process | 3,000         | 1,950          |
| Transferred from Department 1 | 60,000        | 30,000         | Loss                    |               | 6,200          |
| Processing expense            |               | 18,300         |                         | <u>65,000</u> | <u>£51,550</u> |
|                               | <u>65,000</u> | <u>£51,550</u> |                         |               |                |

The joint costs in Department 1 have been apportioned on the basis of the output (in litres) of A and B. The costs incurred and the processing efficiency for the period to which the above accounts relate can be assumed to be representative of current conditions. All work-in-process is complete as far as material content is concerned and is one half processed.



- (a) You are required to comment on the profitability of the individual departmental operations and the utility of the process accounts for decision making purposes. (14 marks)
- (b) Give your opinions on the 'sales value' methods of apportioning joint costs. Use the above example to illustrate your answer. (Total: 22 marks)

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- 6 (a) Explain briefly the term 'joint products' in the context of process costing. (4 marks)
- (b) Discuss whether, and if so how, joint process costs may be shared amongst joint products in a situation where there is no further processing after the splitting off point. (12 marks)
- (c) Discuss the concept of 'equivalent units' in traditional process costing. (9 marks)

CACA 1.2 June 1987 (modified)

## References and further reading

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- 5 Forrester D. A. R., 'Process Costing – Texts and Context', *Management Accounting*, November 1982, pp. 34–6.
- 6 Horngren, C. T. 'Process Costing – Perspective Forget FIFO', *Accounting Review*, July 1967.
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- 9 Moriarty, S., 'Another Approach to Allocating Joint Costs', *Accounting Review*, October 1975, pp. 191–5.
- 10 Partington, G., 'Process Costing a Comment', *Abacus*, Vol. xv No. 1, pp. 60 p. 66, 1979.
- 11 Scapens, R. W., *Management Accounting – A Review of Recent Developments*, 1985. Particularly Chapter 10.
- 12 Skinner, R. C., 'Process Costing', *Abacus*, Vol. xiv, No. 2, pp. 160–70, 1978.
- 13 Slater and Wootton, C., *Joint and By-product Costing in the UK*, Chartered Institute of Management Accountants, 1984.

# 7 Marginal costing

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## Introduction and definitions

So far, our approach has tended to be one of concentrating on the full cost of a good or service. In considering these costs, we have considered both activity and time related cost components. Marginal costing is an approach which considers only the activity related costs, assuming that the time related costs will be incurred irrespective of any decision taken about incurring activity related expenditure.

The *Terminology* defines *marginal costing* as 'a principle whereby variable (i.e. activity related) costs are charged to cost units, and the fixed (or time related) cost attributable to the relevant period is written off in full against the contribution for the period'. Immediately we must consider the definition of contribution. This is 'the difference between sales value and the variable (or activity related) cost of those sales, expressed either in absolute terms or as contribution per unit'. This can best be understood in terms of a simple proforma profit and loss account.

### *Profit and loss account*

|  |             |
|--|-------------|
| Net turnover                               | (a)         |
| <hr/>                                      |             |
| Variable or activity related cost of sales | (b)         |
| i.e. Direct materials                      |             |
| Direct labour (if a variable cost)         |             |
| Any direct expenses                        |             |
| Variable production overhead               |             |
| <hr/>                                      |             |
| Contribution                               | (c) = a - b |

### *Expenses*

Fixed production overhead.

Gross profit as per the requirements of the *Companies Act, 1985*

The student reader should immediately appreciate that the principal change in approach from what has already been discussed is the exclusion of time related conversion overheads from the stock valuation and hence the cost of goods sold.

In this chapter, and in the context of marginal/direct/incremental costing the student should always remember that he or she is dealing with essentially a decision making technique, while the total absorption approach already discussed, is primarily for inventory valuation. With the point above clearly in mind, we turn back to the pro-forma above. It will be readily appreciated that a situation can be envisaged where if there is no activity, there will be no turnover, but the time related conversion costs will display a large gross loss. As activity commences, this loss will diminish until a point is reached where contribution equals time related conversion costs, beyond which the activity moves into profit. Table 7.1 illustrates this concept.

Dugong Limited has time related conversion costs of £50,000. During the year 19X6, it is likely that sales volumes could be as low as 2000 units, or as high as 15,000. Given that the selling price is £8 per unit, and the variable cost of sales is £3. The results likely to arise from the following sales volumes: 2000, 5000, 10,000, 15,000 units can be tabulated as in Table 7.1

Table 7.1

| Sales volume                  | 2000     |      | 5000     |      | 10,000   |      | 15,000   |      |
|-------------------------------|----------|------|----------|------|----------|------|----------|------|
| Unit price (£)                | 8%       |      | 8%       |      | 8%       |      | 8%       |      |
| Sales                         | £16,000  | 100  | 40,000   | 100  | 80,000   | 100  | 120,000  | 100  |
| Variable cost                 | (6,000)  | 37.5 | (15,000) | 37.5 | (30,000) | 37.5 | (45,000) | 37.5 |
| Contribution                  | 10,000   | 62.5 | 25,000   | 62.5 | 50,000   | 62.5 | 75,000   | 62.5 |
| Time related conversion costs | (50,000) |      | (50,000) |      | (50,000) | 62.5 | (50,000) | 41.7 |
| Gross profit                  | (40,000) |      | (25,000) |      | 0        | 0    | 25,000   | 20.8 |

From Table 7.1 it is apparent that Dugong Limited must achieve a sales volume of 10,000 units to achieve a contribution that is equal to the fixed conversion costs, and hence move into a gross profit situation. This point is called the *break even point* and it is defined as 'the level of activity at which there is no profit or loss'. The perceptive reader will realize that it is not just the conversion costs which have to be considered, when computing the total time related costs. Non-conversion costs also have to be included in the equation to provide a completely realistic picture.

Taking the Dugong Limited example again, suppose we assume that non-conversion fixed costs amount to a further £10,000. Adding this into the table will have the effect shown in Table 7.2

Table 7.2

| Sales volume           | 2000     | 5000     | 10,000   | 15,000   |
|------------------------|----------|----------|----------|----------|
| Contribution           | 10,000   | 25,000   | 50,000   | 75,000   |
| Conversion fixed costs | (50,000) | (50,000) | (50,000) | (50,000) |
| Other fixed Costs      | (10,000) | (10,000) | (10,000) | (10,000) |
| Gross profit           | (50,000) | (35,000) | (10,000) | 15,000   |

This break even point can be represented and indeed computed graphically as shown in Figure 7.1.

By drawing in the variable cost line on top of the fixed cost line, i.e. starting at the point y (1) on the y axis, and the sales line at the point of intersection between x and y (i.e. point O) the break even point for Dugong Limited will be approximately 12,000 units.

This can be proved mathematically by a quite simple calculation. If the fixed costs are assumed to be a large pile of bricks, and each individual sale generating a unit of contribution equal to one of those individual 'bricks' of fixed cost, then it is necessary to find out how many bricks of contribution are required.

Thus if the required volume is x we can write:

$$x = \frac{\text{Total fixed costs}}{\text{Unit contribution}}$$

and substituting in the formula

$$x = \frac{50,000 + 10,000}{(8 - 3)} = \frac{60,000}{5} = \underline{12,000 \text{ units}}$$

This can be readily proved:

|                      |                 |
|----------------------|-----------------|
| Sales volume (units) | 12,000          |
| Sales income         | £96,000         |
| Variable cost        | <u>(36,000)</u> |
| Contribution         | 60,000          |
| Total fixed cost     | <u>(60,000)</u> |
| Profit               | <u>0</u>        |

Alternatively, we can state:

$$\text{Sales value at break even point} = \frac{\text{Total fixed cost}}{\text{Unit contribution}} \times \text{Sales value}$$

$$\text{Substituting} = \frac{60,000 \times 120,000}{75,000} = \underline{£96,000}$$

which is the same sales value as proved above.

Irrespective of whether the break even analysis is computed using a graph or simple arithmetic, it presents to managers an effective way of

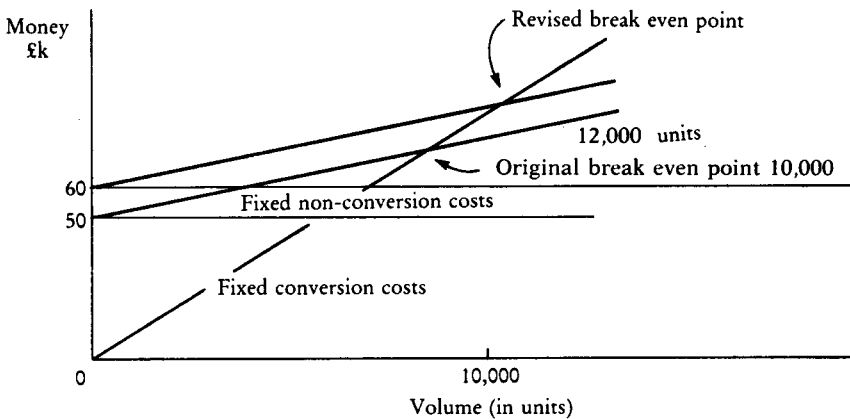


Figure 7.1 Dugong Ltd – break even chart

ascertaining the merits of a certain course of action or of its vulnerability. To this end, the *Terminology* identifies the margin of safety, which is defined as 'the excess of normal or actual sales over sales at break even point'. In the case of our example, Dugong Limited, this works out at:

$$\frac{120,000 - 96,000}{120,000} = 0.25 \text{ or } 25\%$$

This means that if the £120,000 is Dugong Limited's normal sales figure, or even the budgeted sales figure, then a loss of 25 per cent of sales can be sustained without the organization plunging into a loss situation. The *Terminology* actually identifies a *margin of safety ratio* in the context of budgets and forecasting, and this is calculated as follows:

$$\frac{(\text{Forecast turnover} - \text{break even turnover}) \times 100}{\text{Forecast turnover}}$$

This is used as an indicator as to whether the forecast turnover is adequate to achieve the break even point and by what margin, in order to prompt appropriate management to either improve turnover and/or reduce costs. The more perceptive student reader will see this as a useful but crude technique that will serve as an introduction to sensitivity analysis.

In the context of analysis, it is worth mentioning the *contribution/sales ratio*. Curiously, this has been deleted from the current edition of the *Terminology*, although it is to be found in many traditional costing textbooks. Historically, it has been described as the *profit volume ratio* (P/V ratio) although as Mearns (1981) pointed out, this was a misnomer that had persisted for many years, since it equated contribution with profit. Inevitably, the ratio is calculated as:

$$\frac{\text{Contribution} \times 100}{\text{Sales}}$$

Using the Dugong Limited example yet again, sales price per unit was £8.00, and the variable cost was £3.00, thus we can substitute in the formula above.

$$\frac{(8 - 3) \times 100}{8} = 0.625 \text{ or } 62.5\%$$

It is perhaps worth noting that Armand Layne uses the term *Marginal contribution to sales ratio* (MCSR). Whichever format is used, the formula is:

$$\text{Break even} = \frac{\text{Fixed costs}}{\text{Contribution/sales ratio (or the MCSR)}}$$

#### *Example 7.1*

Last year, A Limited sold 13,000 units for £65,000 and made a loss of £5,000. The variable cost was £4 per unit. For the current year, you are informed that fixed costs will increase by £3,000 over those of last year, the sales price will be increased by 20 per cent per unit, and the variable cost will be £5.50 per unit.

You are required to:

- 1 Find the break even point of sales value for the current year.
- 2 Find the profit if 60,000 units are sold in the current year.
- 3 Find the sales volume required to achieve a profit of £5,000
- 4 Calculate and comment on the margin of safety on the assumption that the forecast for the coming year is sales of 52,000 units.
- 5 Calculate the contribution sales ratio.

#### *Approach:*

This question requires us to do some preliminary calculations about last year. From this and the data supplied in the question, we can build up the data for the coming year under review.

| <i>A Limited</i>                   |        |                 |            | <i>last</i> |                 |
|------------------------------------|--------|-----------------|------------|-------------|-----------------|
| <i>Profit and loss account</i>     |        |                 |            | <i>year</i> | <i>new year</i> |
| Turnover units                     | 13,000 | £65,000         | Unit price | £5.00       | £6.00           |
| Variable cost<br>of sales (13 × 4) |        | (52,000)        |            | £4.00       | £5.50           |
| Contribution                       |        | 13,000          |            | £1.00       | £0.50           |
| Fixed cost<br>(balancing number)   |        | (18,000)        |            |             | (21,000)        |
| Loss per question                  |        | <u>(£5,000)</u> |            |             |                 |

From this very typical grid we can now perform the computations.

$$1 \text{ Break even point} = \frac{21,000}{(6 - 5.5)} = \frac{21,000}{0.5} = \underline{42,000 \text{ units}}$$

*Proof:*

|              |              |   |                  |
|--------------|--------------|---|------------------|
| Sales        | 42,000 × 6   | = | £252,000         |
| Costs        | 42,000 × 5.5 | = | <u>(231,000)</u> |
| Contribution |              |   | 21,000           |
| Fixed costs  |              |   | <u>(21,000)</u>  |
| Profit       |              |   | <u>zero</u>      |

2 Profit if 60,000 units are sold:

|              |              |   |                  |
|--------------|--------------|---|------------------|
| Sales        | 60,000 × 6   | = | £360,000         |
| Costs        | 60,000 × 5.5 | = | <u>(330,000)</u> |
| Contribution |              |   | 30,000           |
| Fixed costs  |              |   | <u>(21,000)</u>  |
| Profit       |              |   | <u>£9,000</u>    |

3 Volume required to make a profit of £5,000:

This requires modifying the break even formula slightly. The revised formula becomes:

$$\frac{\text{Fixed costs} + \text{desired profit}}{\text{Unit contribution}}$$

Substituting we get:

$$\frac{21,000 + 5,000}{(6 - 5.5)} = \underline{52,000 \text{ units}}$$

*Proof*

|              |              |   |                  |
|--------------|--------------|---|------------------|
| Sales        | 52,000 × 6   | = | £312,000         |
| Costs        | 52,000 × 5.5 | = | <u>(286,000)</u> |
| Contribution |              |   | 26,000           |
| Fixed costs  |              |   | <u>(21,000)</u>  |
| Profit       |              |   | <u>£5,000</u>    |

4 Margin of safety:

Using the formula above:

$$\frac{(52,000 - 42,000) \times 100}{52,000} = \underline{19.23\%}$$

The 19.23 per cent indicates that there is very little scope for loss of volume, before the loss situation arises. In view of the poor performance last year, the break even point of three times last year's achieved volume is hardly realistic, unless there is a real confidence that the product will sell this year. In view of the somewhat uncertain background, serious consideration must be given to whether the market will stand the price, and whether any reduction in both variable and/or fixed costs can be achieved.

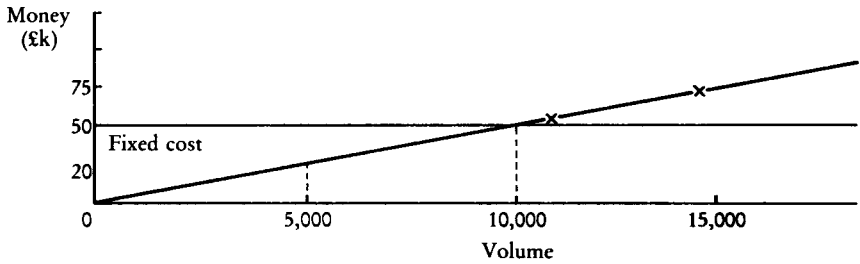


Figure 7.2 *Contribution graph*

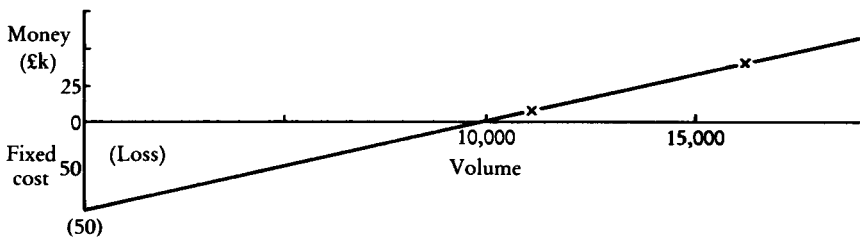


Figure 7.3 *Profit graph*

5 Contribution/sales ratio:

$$\frac{(6 - 5.5) \times 100}{6} = \underline{8.33\%}$$

*Alternative graphical presentations:*

There are two possible alternatives to the presentation illustrated above. These are the *contribution graph* and the *profit graph*. Using the data from Table 7.1 these two graphs can be constructed. (Figures 7.2 and 7.3.)

The contribution graph shows that as volume increases, so does contribution, until a point is reached where contribution equals fixed costs, i.e. break even.

By the same token the traditional profit or profit volume graph shows the emergence of profit after the break even point has been passed.

### **Marginal cost reporting**

One of the most useful ways of using marginal costing is in reporting. It is especially useful, where there is a need to monitor operating divisions or activities, and deal with a corporate fixed overhead. Clearly, if reports are a means of control on operations management, then it is unrealistic for them to take an arbitrary allocated cost over which they



have no control, and then appraise them on it. Furthermore, when we come to consider decision making and marginal costs, it will be apparent that such a course of action could produce misleading data.

*Example 7.2*

Puffers Limited has three operating divisions, Fowler, Stanier and Ivatt, as well as a corporate headquarters. Data for the three divisions for the budget period 19X7 is as follows:

|                          | <i>Fowler</i> | <i>Stanier</i> | <i>Ivatt</i> |
|--------------------------|---------------|----------------|--------------|
| Sales volume             | 100,000       | 100,000        | 100,000      |
| Sales (£)                | 400,000       | 500,000        | 600,000      |
| Contribution/sales ratio | 20%           | 25%            | 30%          |
| Local fixed costs        | 60,000        | 75,000         | 100,000      |

This cost of the corporate centre is expected to be £100,000 and is allocated out to the operating division on the basis of sales.

Prepare a schedule of the expected performance of the three divisions for 19X7.

*Approach:*

Ostensibly, this is quite a straightforward computational question. What is critical is how the answer will appear.

*Solution:*

*Puffers Limited projected profit and loss account 19X7*

|                      | <i>Fowler</i> | <i>Stanier</i> | <i>Ivatt</i> | <i>Total</i> |
|----------------------|---------------|----------------|--------------|--------------|
| Sales (£)            | 400,000       | 500,000        | 600,000      | 1,500,000    |
| Contribution         | 80,000        | 125,000        | 180,000      | 385,000      |
| Local fixed costs    | (60,000)      | (75,000)       | (100,000)    | (235,000)    |
| Allocated fixed cost | (26,667)      | (33,333)       | (40,000)     | (100,000)    |
| Profit/(loss)        | (6,667)       | 16,667         | 40,000       | 50,000       |

Two things are immediately apparent from the grid above. Primarily, Puffers Limited is a profitable organization, albeit with an unexciting net profit to turnover ratio (13%). However, the Fowler Division is ostensibly unprofitable, and the information, as presented, could lead to incorrect decisions being taken about the future of the division. Equally, the inclusion of uncontrollable costs into the data, especially when allocated on a seemingly arbitrary basis, which is almost self defeating is unequitable, especially if the local managers are to be formally appraised on their performance.

A more satisfactory approach would be to treat the profit generated by the divisions as a contribution to the corporate entity, and not allocate out the corporate costs at all.

*Revised presentation:*

*Puffers Limited profit and loss account (projected) 19X7*

| Sales                    | Fowler<br>£400,000 | Stanier<br>500,000 | Ivatt<br>600,000 | Total<br>1,500,000 |
|--------------------------|--------------------|--------------------|------------------|--------------------|
| Contribution             | £80,000            | 125,000            | 180,000          | 385,000            |
| Local fixed cost         | (60,000)           | (75,000)           | (100,000)        | (235,000)          |
| Locally generated profit | £20,000            | 50,000             | 80,000           | → £150,000         |
| Corporate fixed costs    |                    |                    |                  | £(100,000)         |
| Profit                   |                    |                    |                  | £50,000            |

This revised presentation clearly shows what the company has achieved, as well as the performance from the individual operating divisions. Performance can be more accurately reviewed and decisions taken will be less likely to be incorrect.

### **Marginal costs and decision making**

Reference to decision making in Example 7.2 leads us in to the consideration of marginal costing and decision making *per se*. Typically, the management decision(s) involved are based around assessing:

- 1 The impact of price cuts and increased volume.
- 2 Possible increased cost savings.
- 3 Income stimulating expenditure such as advertising.
- 4 Possible rationalization of resources.

In addition, there are make/buy decisions and the problem of limited resources. The implications of all these types of decisions are best seen by talking through a series of problems.

### **Prices, cost cutting and income stimulating expenditure**

#### *Example 7.3*

From the data above that relates to Puffers Limited, let us imagine that we are the corporate cost accountant, and we have been invited to attend the board meeting that is reviewing the data presented in the grids in Example 7.2. We have been told that the unit selling price of Fowler's single product is £4.00, and hence, the variable cost element is £3.20. Four proposals have been put before the board as possible solutions to the problem. These are:

- 1 Close Fowler and save £20,000 in corporate overheads. (This decision assumes that all the local fixed costs will be saved as well.)

- 2 Increase the price of Fowler's product by 12.5 per cent. It is estimated that this will reduce demand by 10 per cent.
- 3 Cut the price of Fowler's product by 12.5 per cent. This will have the effect of a 20 per cent increase in volume. This increased volume will have the added advantage of a quantity discount on the variable costs of materials creating a cost saving of 40p per unit.
- 4 The marketing analyst has computed using a sophisticated advertising appraisal model, that expenditure on advertising of £10,000 will generate 30 per cent extra volume. There is considerable enthusiasm for this idea, since the increased volume will also enable Fowler to take advantage of the saving in material. The buying director adds, however, a word of caution into the euphoric proceedings. To maximize the discount, the material will have to be bought at the beginning of the year, in one major delivery, and this will incur additional storage and financing charges, which he estimates will be £7,500.

Assuming that the three divisions all sell different products, you, as the cost accountant are required to appraise these alternatives.

*Approach:*

Essentially, what is required is to assess the impact on the division under review, and then compare the effect on the resulting overall profit. Quite obviously, the accept or reject criteria must be based on whether or not the proposal advocated increases the corporate profit at present expected to be £50,000.

*Alternative 1:*

Here the technique for presentation is simple. There will be the loss of local profit or contribution from Fowler of £20,000, which will be offset by an estimated saving of £20,000 in corporate overheads. Thus:

|                               |                 |
|-------------------------------|-----------------|
| Profit as already computed    | £50,000         |
| Loss of local profit          | <u>(20,000)</u> |
|                               | 30,000          |
| Saving in corporate overheads | <u>20,000</u>   |
| Revised profit                | <u>£50,000</u>  |

Ostensibly, this proposal does nothing to increase or decrease profit. It could be acceptable if the loss of sales through Fowler were not compounded by losses elsewhere, i.e. caused by customers who only buy from Puffers Limited because they can get the full range of their requirements from all three divisions, and the loss of one of these divisions would cause a loss of custom from the other two. The existence of that possibility, and its impact, would have to be thoroughly investigated before any decision was taken.

*Alternative 2:*

Here, the first exercise is to work out the increased unit price. We were told that the unit price of Fowler's product was £4.00. Thus the new

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price is ( $4 \times 1.125 = 4.50$ ) From the original data the volume of sales is 100,000 units. A 10 per cent loss of volume reduces this to 90,000 units.

|                                      |                               |   |
|--------------------------------------|-------------------------------|---|
| Sales                                | 90,000 units @ 4.50 = 405,000 |   |
| Cost of sales (unit price unchanged) | (288,000)                     | (note 90,000 × 3.20<br>(3.20 = (4 - 0.8)) |
| Contribution                         | <u>117,000</u>                |   |
| Local fixed costs (unchanged)        | (60,000)                      |   |
| Local profit                         | <u>57,000</u>                 |   |
| Add profit from other divisions:     |                               |   |
| Stanier                              | 50,000                        |   |
| Ivatt                                | <u>80,000</u>                 |   |
|                                      | 187,000                       |   |
| Corporate fixed overhead             | <u>(100,000)</u>              |   |
| Revised profit                       | <u>£87,000</u>                |   |

*On the* assumption that the proposed changes in price generate the expected results, this proposal will improve the overall performance of Puffers Limited with no apparent undesirable side effects.

*Alternative 3:*

|  |  |                     |
|--|--|---------------------|
| Revised sales 120,000 units (up 20%) @ £3.50 |  | (down 50p) £420,000 |
| Revised costs incorporating saving:          |  |                     |
| 120,000 units @ (3.20 - 0.40)                |  | (336,000)           |
| Extra storage cost                           |  | (7,500)             |
| Local fixed costs                            |  | <u>(60,000)</u>     |
| Revised local profit                         |  | 16,500              |
| Add contributions from the other divisions   |  | 130,000             |
| Corporate overhead                           |  | <u>(100,000)</u>    |
| Revised profit under this alternative        |  | <u>£46,500</u>      |

This student reader, perhaps with strong convictions about the positive impact of price cutting may be surprised to see that despite the improved volume, it is not enough to offset the discount in price. On that alone, the proposal should be rejected. Price cutting has a further sinister attribute, however. The assumption is that the price cut will increase volume. More often, it precipitates a price war, with the result that the volumes are not achieved, margins are eroded, and in this case, working capital forced up to no avail.

*Alternative 4:*

|  |                  |
|--|------------------|
| Revised sales 130,000 units @ £4.00                | £520,000         |
| Revised cost of sales 130,000 units @ (3.2 - 0.40) | (364,000)        |
| Advertising cost and additional storage            | (17,500)         |
| Local fixed costs                                  | <u>(60,000)</u>  |
| Local profit                                       | £78,500          |
| Contribution from other divisions                  | 130,000          |
| Corporate fixed costs                              | <u>(100,000)</u> |
|  | <u>£108,500</u>  |

Clearly, if the predictions of the marketing model are correct, then this alternative has the best prospect of generating additional profit.

### **Make versus buy decisions**

#### *Example 7.4*

Again a talked through scenario is perhaps the best approach. Let us return to Puffers Limited. The Ivatt Division is approached by Wilkes Barr Inc., who say they can make Ivatt's product cheaper and just as good. They have greater scale economies, and are anxious to break into the protected European market. Their unit cost c.i.f. the Ivatt factory, is £4.00. All Ivatt would have to do is repackage the product and distribute it. This is currently estimated at 45p per unit. However, ostensibly there would be a trade off in that local fixed costs that are production related would be reduced by £15,000 and there is the possibility that Ivatt would be asked to handle all Wilkes Barr's future European marketing activities, possibly on a franchised basis.

You are required to:

- 1 Evaluate whether or not Ivatt should accept the proposal.
- 2 Ascertain the minimum price at which the franchise proposal might be acceptable, bearing in mind that it would only be available if Ivatt accepted the initial Wilkes Barr proposal.

#### *Approach:*

Assuming on the basis of the information available, that Ivatt will continue to sell at the existing price, and that volumes will be left unchanged, then the proposal will quantify as follows:

|                                     |                                   |                 |
|-------------------------------------|-----------------------------------|-----------------|
| Sales                               | 100,000 units at £6.00 = £600,000 |                 |
| Cost c.i.f. Wilkes Barr             |                                   |                 |
| 100,000 units at 4.00               |                                   | (400,000)       |
| Variable packaging and distribution |                                   |                 |
| 100,000 units at 45p                |                                   | <u>(45,000)</u> |
| Revised contribution                |                                   | 155,000         |
| Local fixed costs less saving       |                                   | <u>(85,000)</u> |
| Revised local profit                |                                   | <u>£70,000</u>  |

Ostensibly, and *prima facie*, Ivatt would be out on the deal, since the local profit is reduced to £70,000 from the existing £80,000. On that basis, the proposal should be rejected.

#### *Approach 2:*

Linking the initial proposal to Wilkes Barr's second one, clearly, on the information available, the decision has to be made on the basis of what costs Ivatt will incur and what level of volumes are being considered, since at the end of the day, Ivatt would at least want to recoup the £10,000 lost on the initial proposal, as well as all out of pocket expenses and costs of financing the extra marketing facilities that may be needed.

To that end, therefore, Ivatt should state the price per unit required, i.e. £3.90 would maintain the £80,000 profit.

### ***Limiting factors***

This situation arises where there are shortages, either of facilities, or skilled labour or even materials. Essentially, this involves identifying the contribution per limiting factor, and ranking priorities on the basis of concentrating scarce resources on the product(s) which generate the maximum contribution. There may be the additional problem that a sub optimum solution is required, since it may be vital that certain volumes of all products are produced.

#### *Example 7.5*

Polly Ltd produces four products from the same raw material. The projected order book for the coming period is as follows:

| <i>Product</i>      | <i>P</i> | <i>R</i> | <i>S</i> | <i>T</i> |
|---------------------|----------|----------|----------|----------|
| Selling price (£)   | 42       | 85       | 70       | 50       |
| Sales volume        | 2800     | 2500     | 2800     | 4000     |
| Direct material (£) | 16       | 40       | 30       | 20       |
| Direct labour (£)   | 6        | 12       | 6        | 4        |
| Fixed costs (£)     | 2        | 8        | 6        | 8        |
| Unit profit (£)     | 18       | 25       | 28       | 18       |

Raw materials are going to be in short supply for the coming period under review, and Polly Limited will only be able to purchase £280,000 of material.

You are required to:

- 1 Formulate an optimal production plan.
- 2 Formulate the plan given that the directors intend to produce 2000 units of each product, then rank the utilization of the remaining resources to produce the products that maximize profit.

#### *Approach 1*

First it is necessary to calculate the contribution in terms of the limiting factor, in this example the material. First, however, we have to calculate the individual contribution by adding back the unit fixed costs.

| <i>Product</i>          | <i>P</i> | <i>R</i> | <i>S</i> | <i>T</i> |
|-------------------------|----------|----------|----------|----------|
| Profit per question (£) | 18       | 25       | 28       | 18       |
| Fixed costs             | 2        | 8        | 6        | 8        |
| Contribution            | 20       | 33       | 34       | 26       |
| Material cost           | 16       | 40       | 30       | 20       |
| <i>Contribution</i>     |          |          |          |          |
| Material cost           | 1.25     | 0.825    | 1.13     | 1.3      |
| Ranking                 | 2        | 4        | 3        | 1        |

From this, the resulting profit and loss account would be:

| <i>Product</i>     | <i>P</i> | <i>R</i> | <i>S</i> | <i>T</i> | <i>Total</i>    |
|--------------------|----------|----------|----------|----------|-----------------|
| Sales (units)      | 2800     | 1780     | 2800     | 4000     |                 |
| Sales (value) (£k) | 117.6    | 151.3    | 196      | 200      | 664.9           |
| Direct materials   | (44.8)   | (71.2)   | (84)     | (80)     | (280)           |
| Direct labour      | (16.8)   | (21.36)  | (16.8)   | (16)     | (70.96)         |
| Contribution       |          |          |          |          | 297.94          |
| Fixed costs        |          |          |          |          | (58.40)         |
| Profit             |          |          |          |          | <u>£239.54k</u> |

It will thus be evident that the production of R will be reduced, since it is this product that makes the least profitable use of the scarce resources. The incredulous student reader, rightly suspicious of what might appear to be a simplistic approach, might like to try other possible solutions, if only to satisfy him/herself that £239.54k is the maximum profit.

*Approach 2:*

Turning to the second proposal, where there is to be the insistence that 2000 units of each product are made first, then the situation will be:

| <i>Product</i>          | <i>P</i> | <i>%</i> | <i>R</i> | <i>%</i> | <i>S</i> | <i>%</i> | <i>T</i> | <i>%</i> | <i>Total</i>    |
|-------------------------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Volume                  |          |          |          |          |          |          |          |          |                 |
| Minimum (1)             | 2000     |          | 2000     |          | 2000     |          | 2000     |          |                 |
| Remainder (2)           | 800      |          |          |          | 506      |          | 2000     |          |                 |
| Sales (£k) (1)          | 84       |          | 170      |          | 140      |          | 100      |          | 494             |
| (2)                     | 33.6     |          |          |          | 35.4     |          | 100      |          | 169             |
| Sub total               | 117.6    | 100      | 170      | 100      | 175.4    | 100      | 200      | 100      | 663             |
| material                | (32)     | 38       | (80)     | 47       | (60)     | 43       | (40)     | 40       | (212)           |
|                         | (12.8)   |          |          |          | (15.20)  |          | (40)     |          | (68)            |
| Direct labour           | (16.8)   | 14       | (24)     | 14       | (15.04)  | 9        | (16)     | 8        | (71.84)         |
| Contribution            | 56.0     | 48       | 66       | 39       | 85.16    | 48       | 104      | 52       | (311.16)        |
| Fixed costs (unchanged) |          |          |          |          |          |          |          |          | (58.40)         |
| Profit                  |          |          |          |          |          |          |          |          | <u>£252.76k</u> |

**The use of linear programming**

The discerning student reader, possibly with a more mathematical or information technology background, will be rightly dismissive of such an ostensibly simplistic approach. Such problems can be solved using simple linear programming techniques. Although the student reader may not encounter linear programming until later in his/her course, (say at CIMA Paper MAT or the Chartered Association 2.4) it is worthwhile digressing into the area if only to help the student reader relate quantitative techniques to a cost accounting situation.

*Example 7.6*

Aholibah Limited manufactures two ornamental statues for a lucrative export market, using the brand names 'Margot' (for northern Europe particularly France) and 'Debbie' (for southern Europe and the Near East) The following production details are relevant:

|                         | <i>Margot</i> | <i>Debbie</i> |
|-------------------------|---------------|---------------|
| Unit contribution       | 6             | 5             |
| Mixing department hours | 3             | 4             |
| Glazing department      | 2             | 1             |
| Polishing               | 4             | 3             |

Each department has a limited number of hours available for the forthcoming budget period, as follows:

|           | <i>Hours</i> |
|-----------|--------------|
| Mixing    | 600          |
| Glazing   | 250          |
| Polishing | 720          |

You are required to:

- 1 Formulate the linear programming problem for the above information.
- 2 Solve the problem graphically.
- 3 State the optimal production plan and the associated contribution.

*Approach:*

In the best traditions of schoolday algebra we can begin by writing:

Let  $x$  be the number of units of statue Margot.

Let  $y$  be the number of units of statue Debbie.

Let  $C$  be the total contribution.

Then the objective function to be maximized must be:

Contribution = units of Margot  $\times$  unit contribution + units of Debbie  $\times$  unit contribution

i.e.  $C = 6x + 5y$

We can now insert the constraints or limiting factors:

Mixing time  $3x + 4y < 600$

i.e. every Margot needs 3 hours mixing, and every Debbie needs 4 hours, and the total of mixing hours available is 600.

Glazing time  $2x + y < 250$

Polishing time  $4x + 3y < 720$

This enables the linear programme to be summarized as:

$C = 6x + 5y$  subject to  $3x + 4y < 600$

$2x + y < 250$

$4x + 3y < 720$

and

$x, y > 0$



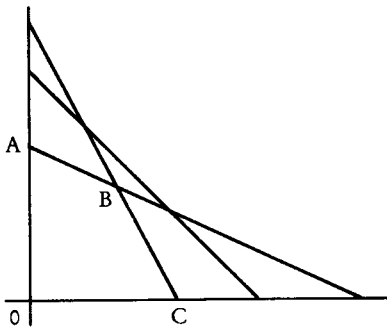


Figure 7.4

A graph can be plotted by writing the equations:

If  $3x + 4y = 600$  then when  $y = 0$   $x$  must equal 200 and  
when  $x = 0$   $y$  must equal 150

By the same token we can also write:

$2x + y = 250$  and when  $x = 0$  then  $y = 250$

if  $y = 0$  then  $x = 125$

and

where  $4x + 3y = 720$  then when  $x = 0$  then  $y$  must equal 240

and when  $y = 0$  then  $x = 180$ .

For the incredulous reader, the substitution in the equation above can be:

$$(4 \times 0) + (3 \times 240) = 720!$$

A graphical presentation can be plotted for each of the expressions. (Figure 7.4.) Clearly, it is based on the simple assumption that coordinates can be identified by assuming that one is valued at zero in turn. Thus from the polishing shop, when we plot a  $y = 0$  on the  $x$  axis, then  $x$  will plot at 180.

By the same substitution methods we can identify the objective function. The equation  $C = 6x + 5y$  has already been formulated, and by the same token, if  $x = 0$  then  $y$  must equal 120 and if  $y = 0$  then  $x$  must equal 100.

From the graph in Figure 7.4 the feasible area must lie in the quadrilateral OABC, at the point furthest away from the intersection of the axes, 0. Inspection indicates that this is B.

At this point two of the limiting factor lines or constraints intersect. We now write down the two equations relevant to the constraints, and solve them simultaneously. Thus at point B:

$$3x + 4y = 600 \text{ (the mixing time)} \quad (1)$$

$$2x + y = 250 \text{ (the glazing time)} \quad (2)$$

Multiplying equation 2 by -4  
 $-8x - 4y = -1000$  (3)

Adding equation 1 and 3  
 $-5x = -400$  or better still  
 $5x = 400$  and thus  $x = 80$

Substituting in equation 1 above:

$$\begin{aligned} (3 \times 80) + 4y &= 600 \\ 240 + 4y &= 600 \\ 4y &= 600 - 240 \\ 4y &= 360 \\ y &= 90 \end{aligned}$$

*Proof:*

*Aholibah Limited*

*Projected contribution statement*

---

|              | <i>Margot</i> | <i>Debbie</i> |
|--------------|---------------|---------------|
| Units        | 80            | 90            |
| Contribution | 6             | 5             |
| Total        | 480           | 450 = 930     |

Again, the incredulous student reader may like to suggest alternatives and test them to see if he/she can exceed the 930 contribution. It will probably be a good idea to try anyway, since it will help the student who may have a mental mathematical reticence to thoroughly understand the technique.

***The impact of labour as a fixed cost***

Traditionally, questions on marginal cost accounting, have made the basic assumption that all direct expenses are variable or activity related. Reality, especially in Europe and the UK is in fact different, and direct labour has become very much a fixed cost. The reader must remember this when considering the break even point and margin of safety analysis. Let us consider the implications of this point by looking at a very simple example.

*Example 7.7*

Norah Limited produces a single product. Expected output for the coming year is 200,000 units at a price of £50 each. The cost structure is as follows:

- Direct material £15.00
- Direct labour (variable) £16.00
- Fixed overheads £760,000

At present, direct labour is employed on a casual basis, but the unions are campaigning for the direct labour to become part of the established headcount and paid in the same manner as the white collar staff.

You are required to:

- 1 Calculate the break even point and margin of safety for Norah Limited.
- 2 Ascertain the implications on the margin of safety and the break even point, if the union campaign succeeds.

*Approach:*

First we identify the unit contribution. This is:

$$50 - (15 + 16) = 19$$

Then we have:

$$\text{Break even} = 760,000/19 = 40,000 \text{ units}$$

From this we can compute the margin of safety ratio:

$$\frac{(200,000 \times 50) - (40,000 \times 50) \times 100}{(200,000 \times 50)}$$

$$\frac{(10,000,000 - 2,000,000) \times 100}{10,000,000} = 80\%$$

On the assumption that the labour cost will remain unchanged, i.e. that the cost will be  $200,000 \times 16 = 3,200,000$ , then the implication is:

$$\text{Break even is } \frac{760,000 + 3,200,000}{50 - 15} = 113,143 \text{ units}$$

By the same token, the margin of safety ratio becomes:

$$\frac{(10,000,000 - (113,142 \times 50) \times 100}{10,000,000} = 43.43\%$$

Clearly, this represents a substantial increase in the break even point and a commensurate decrease in the margin of safety.

## **Marginal costing versus total absorption costing**

The apparent ready relevance of marginal costing to the vital decision making process of management prompts the suggestion that surely it is logical to assume that the technique lends itself to inventory valuation. Such a suggestion gains credibility if one considers that decision making requires one type of valuation, and inventory valuation requires another. Both approaches have merit and we will tabulate them accordingly for the benefit of the student reader.

### ***Using a marginal system***

- 1 Avoids the added complication of identifying unit fixed or time related costs, and of over/under absorption.
- 2 Avoids the risk of subjective judgements over the apportionment of

fixed costs to both cost centres and ultimately to products. Furthermore, it may be that the method of absorption, however precise, may have been subjectively selected.

- 3 Leads to a contribution analysis approach to the decision making process, and the entire cost collection system is orientated towards this.
- 4 Recognizes that profit comes from sales, not production, and of course is in keeping with the essential reality that something must be sold to make a profit. This creates a healthy marketing culture within an organization in consequence.
- 5 Complies with the conservative or prudence accounting convention on the basis of stock valuation by excluding the time related fixed costs. This is particularly relevant when companies are looking for further finance, especially since banks put no value on inventory at all.
- 6 It is easy to understand, especially by non-accountants, and hence users of information.

#### ***Using a total absorption system***

- 1 Avoids the difficulty of classifying production or conversion costs into fixed and variable. This in itself could be rather subjective, and create material distortions in a marginal costing system. This is avoided by including all the conversion costs.
- 2 Identifies what the *total* costs are, thus enabling management to see what has to be achieved to ensure their total absorption and ultimate recovery.
- 3 Prices will be set on the basis of full production costs. (This would seem to be a rather stupid concept, but the critics of marginal costing argue that there is always a risk of under-pricing by over emphasis on contribution rather than paying attention to all the factors in the price establishment exercise.)
- 4 It is common practice and more to the point, is a requirement of SSAP9 and has the support of the Inland Revenue (*Ostime v Duple*).
- 5 It is *conceptually correct*, in that it *matches* costs with revenues more accurately. Quite obviously, no production activity can continue without some time related conversion overheads, and these must be included in the valuation. In response to those who fear that profits are anticipated, then provision for continual reference to the net realizable value is included in SSAP9 to ensure that stocks are never overstated.

#### **Extensions to the marginal costing approach**

From our discussions so far, it will be apparent that certain basic assumptions apply to marginal costing:

- 1 Costs and hence revenues behave in a linear way over the relevant range of output. (The graphs are always straight line.) This presupposes that:
  - (a) Variable direct costs vary directly and proportionally with levels of output and activity.
  - (b) Fixed or time related costs are constant at least for the periods under review.
  - (c) The selling price remains constant regardless of volume of sales.Any realist will readily appreciate that these assumptions are often far from the truth, but in any decision making process and technique, certain assumptions have to be made and stated.
- 2 The analysis relates to either one product or to a constant mix of products in a multi-product organization.
- 3 Movement of stock is ignored. This is correct, since the whole approach of marginal costing is based on what is sold, rather than what is produced.
- 4 Volume is the only factor which affects costs. It is an important one, but it must be recognized that other factors, even outside the organization, can affect costs and price.

Three areas, variations on the main theme, need to be considered:

- 1 Sunk costs/differential costs/opportunity costs.
- 2 Multi-product analysis.
- 3 Mathematical extensions of breakeven analysis.

### ***Sunk costs/differential costs/opportunity costs***

In the context of decision making, the *Terminology* defines the 'sunk cost concept' as 'assets which can continue to serve their present purpose but which have no significant resaleable value for another purpose'. Clearly, this can relate to any expenditure, such as an advertising campaign, or even research and development. Even depreciation can be brought under this heading. Since the asset has been bought, SSAP12 requires that it be depreciated irrespective of any future decisions that may be taken.

By contrast, the definition of a differential cost and hence differential costing identifies the differences in alternatives. The official *Terminology* definition is 'a technique used in the preparation of ad hoc information in which only cost and income differences between alternative courses of action are taken into consideration'. It is worth noting that the term is considered almost synonymous with incremental cost, and of course relates closely to the term 'relevant cost'.

An opportunity cost is defined as 'the value of a benefit sacrificed in favour of an alternative course of action'. This is where a decision is taken or considered to forego say the income from scrapping a fixed asset, to enable some additional revenue to be generated.

To illustrate and explain further the impacts of this additional definitions, we will now talk through an illustrative example.

*Example 7.8*

Cupra Limited expects to have spare capacity during the coming year and its directors are considering whether to undertake a contract for a fixed price of £10,000. Work would have to start almost immediately, and it should take just about the year to complete the order. The accountant has submitted the following statement and advises rejection of the contract:

| <i>Materials</i>                         | £                     |
|--|-----------------------|
| A 100 tons @ £30 per ton                 | 3,000                 |
| B 130 tons @ £9 per ton                  | 1,170 - - - - - 4,170 |
| <br>                                     |                       |
| <i>Direct labour</i>                     |                       |
| 4 operatives @ £20 for 52 weeks          | 4,160                 |
| Supervision (£1,400 + £100 overtime)     | 1,500 - - 5,660       |
| <br>                                     |                       |
| <i>Overheads</i>                         |                       |
| Fixed and variable (80% × direct labour) | 3,328                 |
| Depreciation                             | 1,000 - - 4,328       |
|  | - - - - - 14,158      |
| Profit margin (10% × total cost)         | 1,416                 |
| Total price                              | <u>15,574</u>         |
| Contract price                           | <u>10,000</u>         |
| Shortfall                                | <u>£(5,574)</u>       |

On investigation, you ascertain the following information:

- 1 Forty tons of material A are already in stock and they originally cost £20 per ton. The current replacement cost of material A is £28 per ton and existing stocks would realize £27 per ton net of selling costs. The material has no alternative use, and was due to be sold.
- 2 The required quantity (i.e. the 130 tons) of material B was purchased a year ago at £11 per ton. It has no current alternative use to the company and, due to transportation difficulties, net sale proceeds would be negligible. The current replacement cost is £8 per ton and this is expected to rise to £10 per ton next year, when according to the order book there will be a requirement for 100 tons.
- 3 Four skilled men would be needed for the contract at a weekly wage of £20 each. Three could be transferred from other departments. However, this would require hiring three less skilled men at a wage of £18 per week to fill the gaps created. The fourth man would have to be specially recruited for the contract and would require an initial week's training before the job is commenced. The training would cost £50 plus his guaranteed wage of £18, and he would then be paid at £18. Obviously, he would only work fifty-one weeks, involving the other three in a weeks overtime at a cost of £27 per operative.
- 4 The foreman is a member of the permanent staff and, if the contract were accepted, he would be required to work overtime costing £100. To help with the extra supervision needed, four foremen from other

departments would also have to undertake a similar amount of overtime.

- 5 The company's overhead budget is as follows:

|                    |                |
|--------------------|----------------|
| Variable overheads | £6,000         |
| Fixed overhead     | <u>18,000</u>  |
|                    | <u>£24,000</u> |

The budgeted direct labour cost is £30,000 for the year, disregarding the contract, so overheads are apportioned to jobs at 80 per cent of their direct labour cost. If the contract were accepted, fixed overheads would be £400 in excess of budget. As the sum is not very high, the accountant decided not to adjust the recovery rate.

- 6 The machine needed for the contract is seldom used and it has a book value of £1,000. It was previously decided to scrap it next year and the costs of dismantling it is expected to absorb any sale proceeds. The accountant has charged the contract with £1,000 depreciation because the remaining cost would not otherwise be recovered: so, he argues, the cost of the contract would be understated if a lower figure were charged.

The production director points out that the company could use the machine for subcontract work yielding a net cash inflow of £800, after allowing for direct labour cost of £2,000. However, the accountant points out that this would be unprofitable as neither the depreciation of £1,000 nor the subcontract's overheads (80 per cent of the direct labour cost) have been allowed for in this calculation.

You are required to:

- 1 Present a revised costing statement, and your recommendation to the directors on whether the proposed contract should be accepted, giving reasons.
- 2 Briefly comment on each item in your statement explaining your guiding principles.

*Approach:*

This quite difficult question has been developed from a typical scenario, to test *both* knowledge of techniques, and to argue a case amidst a plethora of misconceptions. Each stage will thus be resolved separately, and the principles involved explained.

*Solution:*

Material A has an opportunity cost. If it was not used on the contract, it would be sold for the £27 per ton. This is a benefit foregone, and this is what should be charged.

Material B, on the assumption that they have no further use for it, is a sunk cost, and the relevant out of pocket costs would be zero. Since, however, there is a firm order on the books that will use it, then it must be charged at the relevant opportunity cost, i.e. £10/ton. A possible alternative would be to buy in the extra material now and store it, given space and finance availability. This would reduce the figure to £8.

The labour cost is the cost of releasing the men, and recruiting the replacement. Thus:

|  |        |
|--|--------|
| 3 operatives @ £18/week for 52 weeks = | £2,808 |
| 1 additional operative $51 \times 18$  | 918    |
| Additional training costs (50 + 18)    | 68     |
| Additional overtime (3 × 27)           | 81     |
|  | £3,875 |

The foreman is a fixed cost, and as such, irrelevant to the decision. However, the overtime is not, and is thus relevant to the decision. All the overtime will arise from the decision, and must be included:

$$5 \times 100 = 500$$

It is reasonable to assume that the contract will incur variable overheads, and these should be allocated accordingly. However, only the variable overhead absorption percentage should be used ( $(2,808 + 918) \times 0.2$ ) = £745.

Fixed overheads will be those which are directly attributable to the contract, i.e. the £400 overspend.

The depreciation is a fixed cost that would be brought into the accounts in computing the profit whatever decision is taken. It is thus irrelevant to the calculations. However, the loss of revenue by not using the machine for a subcontract job is again an opportunity foregone, and should be introduced. The comments about depreciation and unrecovered overheads made by the accountant are again irrelevant.

Now we can prepare the the revised costing statement:

|   |        |         |
|---|--------|---------|
| Materials A 100 tons @ £27/ton  | £2,700 |         |
| B 130 tons (100 @ 10)   | 1,000  |         |
| 30 tons @ 0 (sunk cost) - - - -   |        | £3,700  |
| Direct labour   |        | 3,875   |
| Supervision   |        | 500     |
| Variable overheads  |        | 745     |
| Directly attributable fixed costs   |        | 400     |
| Depreciation (actually contribution foregone from alternative use of machine) |        | 800     |
| Total cost  |        | £10,020 |

This revised computation is now only marginally *more* than the contract price. If the contract was vital, i.e. it would utilize resources currently under used, then it might be worth looking at again to see if some profit could be squeezed out of it.

Even so, with the best will in the world, it is very marginal, and cognisance would have to be given to:

- 1 Accepting an order where the profit is indeed marginal, especially as it could use scarce resources at a time when a really profitable order comes along.



- 2 Such orders are also risky since they allow very little margin for error. However accurate and reliable the estimates and figures used are, there are still best estimates, and as such, are very vulnerable to changing circumstances. Nobody has that good a crystal ball to be able to formulate really reliable estimates about costs/prices or activity levels one year from now.

**Multiproduct situations**

In all our analysis of the impact and use of marginal costing techniques, we have assumed that there has been a constant single product with a single break even point. Reality, however, is often somewhat different. There can be a mix of products, which can also vary. This will imply that there will be a variety of break even points.

The impact of this can be seen by working through an illustrative example.

*Example 7.9*

Olwen Incorporated produces and markets three types of microwave ovens. Information pertaining to the unit selling price, unit variable costs, and unit contribution margins of each model are as follows:

|                | <i>Special</i> | <i>Deluxe</i> | <i>Standard</i> |
|----------------|----------------|---------------|-----------------|
| Selling price  | £700           | £500          | £400            |
| Variable costs | (400)          | (300)         | (250)           |
| Contribution   | £300           | £200          | £150            |

The manufacturing facilities can be used to produce any type of oven. Annual fixed costs of operating the plant are £6,000,000.

If only one product was produced, the break even points would be:

| <i>Special</i>          | <i>Deluxe</i> | <i>Standard</i> |
|-------------------------|---------------|-----------------|
| 6,000,000               | 6,000,000     | 6,000,000       |
| 300                     | 200           | 150             |
| Break even 20,000 units | 30,000 units  | 40,000 units    |

From this data, a graph can be plotted, and from it, we can estimate break even points selling between 20,000 and 40,000 microwave ovens. The actual break even point can be computed for a specific sales mix by dividing the fixed costs by an average unit contribution margin.

The average unit contribution margin is calculated by the equation:

$$\text{Average CM} = p(1) \times (1) + p(2) \times (2) + p(3) \times (3) \dots p(n) \times (n)$$

Where CM = Contribution margin per unit

p(n) = Proportion of sales mix of product n

x(n) = Unit contribution margin of product n

To test this formula, let us assume two situations;

- 1 A 1:1:1 sales mix between products.
- 2 A 3:2:1 sales mix between products.

*Solution 1:*

$$\begin{aligned}\text{Average CM} &= 1/3(300) + 1/3(200) + 1/3(150) \\ &= 100 + 66.67 + 50 \\ &= \text{£}216.67\end{aligned}$$

$$\text{Break even} = \frac{\text{£}6,000,000}{216.67} = 27,691.88 \text{ (say 27,692)}$$

|               | <i>Special</i> | <i>Deluxe</i> | <i>Standard</i> |                   |
|---------------|----------------|---------------|-----------------|-------------------|
| Quantity      | 9,230          | 9,231         | 9,231           |                   |
| Sales (£k)    | 6,461          | 4,615.5       | 3,692.4         |                   |
| Variable cost | (3,692)        | (2,769.3)     | (2,307.75)      |                   |
| Contribution  | 2,769          | 1,846.2       | 1,384.65        | → = 5,999.85      |
| Fixed costs   |                |               |                 | <u>(6,000.00)</u> |
|               |                |               |                 | <u>£(0.15)</u>    |

*Solution 2:*

Again we use the formula:

$$\begin{aligned}\text{Average CM} &= 1/2(300) + 1/3(200) + 1/6(150) \\ \text{CM} &= 150 + 66.67 + 25 \\ \text{CM} &= \text{£}241.67\end{aligned}$$

$$\text{Break even} = \frac{6,000,000}{241.67} = \underline{24,827 \text{ units}}$$

|               | <i>Special</i> | <i>Deluxe</i> | <i>Standard</i> |                |
|---------------|----------------|---------------|-----------------|----------------|
| Quantity      | 12,414         | 8,275         | 4,138           |                |
| Sales (£k)    | 8,689.8        | 4,137.5       | 1,655.2         |                |
| Variable cost | (4,965.6)      | (2,482.5)     | (1,034.5)       |                |
| Contribution  | 3,724.2        | 1,655         | 620.7           | → = 5,999.9    |
| Fixed cost    |                |               |                 | <u>(6,000)</u> |
| Profit        |                |               |                 | <u>(0.1)</u>   |

### ***Extensions of break even analysis***

We have already noted that marginal costing techniques and break even analysis has its limitations. It ignores the implications of risk and uncertainty, which are realities in the business world. As a consequence of this, several writers have attempted to introduce probabilities to the analysis. The single forecast, in such circumstances becomes the mean, and the range of possible outcomes enables the standard deviation to be calculated. (See Figure 7.5.)

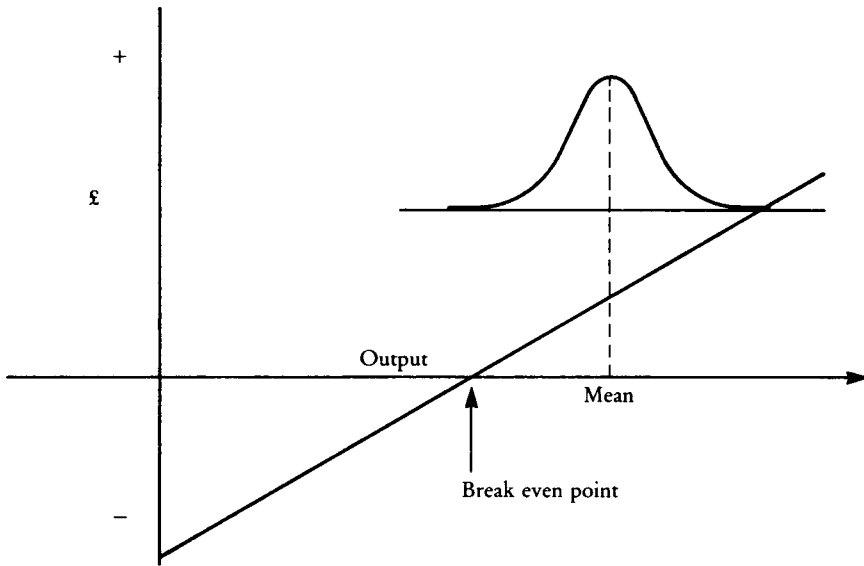


Figure 7.5

From the graph, we can express the data as an equation:

$$E(\pi) = E(u)(SP - V) - FK$$

Where:

$E(\pi)$  = Expected profit

$u$  = Units produced and/or sales

$SP$  = Selling price

$V$  = Variable cost

$FK$  = Fixed Costs

Once the mean and hence the standard deviation is known, using probability tables the decision maker can ascertain the probability of:

- 1 At least breaking even.
- 2 Not achieving the break even sales volume.
- 3 Incurring a loss.
- 4 Profits greater than the mean.

*Example 7.10*

Suppose a particular product sells for £6, and has a variable cost of £4. The expected output and hence sales volume has a mean of 600 units, and the standard deviation ( $\sigma$ ) is 50. If then the fixed costs are £1,000, then traditionally, we can write:

$$\text{Break even} = \frac{1,000}{(6 - 4)} = \underline{500 \text{ units.}}$$

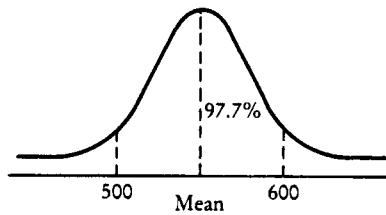


Figure 7.6

Clearly, the expected quantity of 600 units is 100 units more than the mean or the expected figure. Indeed, the extra 100 units represents twice the standard deviation. (Figure 7.6.)

From tables, it is possible to sketch the normal curve, and since the expected sales are two standard deviations above the mean, the probability of breaking even is 97.7 per cent, and obviously, the probability of not achieving break even is 2.3 per cent. Clearly, such data suggests that the organization is on to an almost certainty.

By the same token, the mean level of profit is that expected from the expected sales, and since the distribution is assumed to be normal, then there is 50 per cent probability of profits exceeding the mean, and a similar probability that the mean will not be achieved.

The various writers cited in the notes and references at the end of this chapter have developed and considered further extensions into break even analysis to include fluctuations in both output, selling price, variable cost and fixed cost. Clearly, such developments result in a much more complicated equation, and will doubtless require the use of computers.

Given the availability of the technology, to extend the basic marginal costing equations is argued to be advantageous. This is undoubtedly true, but for very good reasons cited elsewhere in this text, developments in decision making tools and technology are restricted by the ability of the decision makers to understand and use the information presented.

### **The absorption/marginal costing controversy**

Although some reference has been made to this in the text above, and it is well documented in the literature, the student's attention is drawn to an article which appeared in the *Singapore Accountant* in September 1986. In that paper, the author, Professor Michael Trubnick of the California State University at San Bernardino, emphasized that while variable or direct costs are usually used in managerial decision-making, analysts, when making investment decisions, are forced to use statutory accounts based on full absorption costing.

In considering this point, the professor argues that because cost of

sales includes both variances and total absorbed costs, then the matching concept is largely being ignored. (With regard to the variances, the student will readily see the application of the prudence concept.) He further argues that the results produced can be irrational, especially if the inventories have substantially increased. This irrationality comes from the fact that fixed costs are carried forward within inventory, and the paper profit thus generated and used as a distributable profit has, in effect, not been realized.

On both sides of the Atlantic, little consideration is given to legitimizing the variable cost method of valuing inventory. Both SSAP9 and ARB43 (*Accounting Research Bulletin*) advocate cost absorption for inventory valuation. The logic is that the costs are incurred on the anticipation of future benefits. In response to that, both Professor Trubnick and another author, R. V. Hartley (*Cost and Managerial Accounting*) question the validity of time related fixed overheads as falling into the category of being in 'contemplation of future benefits' or 'avoiding a future cost occurrence'.

It is beyond the scope of this text, or even the syllabus to develop this concept further, but the student, if faced with having to debate the current state of the art on inventory valuation, may like to consider the implications of the point raised here.

## Questions

- 1 The data below relate to a company which makes and sells one product.

|  | March  | April  |
|--|--------|--------|
|  | units  | units  |
| Sales  | 4,000  | 6,000  |
| Production   | 8,000  | 2,000  |
|  | £      | £      |
| Selling price per unit   | 80     | 80     |
| Variable production costs, per unit  | 40     | 40     |
| Fixed production overhead incurred   | 96,000 | 96,000 |
| Fixed production overhead cost, per unit,<br>being the predetermined overhead<br>absorption rate | 12     | 12     |
| Selling, distribution and administration<br>costs (all fixed)                                    | 40,000 | 40,000 |

You are required to:

- (a) Present comparative profit statements for each month using:  
 (i) absorption costing  
 (ii) marginal costing (14 marks)
- (b) Comment on the following statement using, for purposes of illustration, if you wish, figures contained in your answer to (a):

'Marginal costing rewards sales whereas absorption costing rewards production.'

(6 marks)

(Total: 20 marks)

*CIMA CA1*

- 2 Emcee plc manufactures three products, standard data for which are given below:

|                                       | Per unit |     |     |
|---------------------------------------|----------|-----|-----|
|                                       | A        | B   | C   |
|                                       | £        | £   | £   |
| Direct materials                      | 70       | 124 | 70  |
| Direct wages:                         |          |     |     |
| Department 1 at £3 per hour           | 15       | 24  | 18  |
| Department 2 at £4 per hour           | 20       | 12  | 16  |
| Variable overhead:                    |          |     |     |
| Department 1 at £2 per hour           | 10       | 16  | 12  |
| Department 2 at £1 per hour           | 5        | 4   | 4   |
| Fixed overhead                        | 35       | 30  | 20  |
|                                       | 155      | 210 | 140 |
| Profit                                | 45       | 30  | 40  |
|                                       | 200      | 240 | 180 |
| Budgeted sales for the period (units) | 1,200    | 800 | 900 |

You are required to:

- (a) Present one graph that shows the profit of the company as a whole and the contribution earned by each of the three products. (10 marks)
- (b) Advise management which product should be produced and state the total contribution for the period, if total hours in Department 2 are limited to 9,000 but there is no such limitation in Department 1. Furthermore, there is a requirement to produce 50 per cent of each product. (10 marks)

(Total: 20 marks)

*CIMA CA2 May 1986 (modified)*

- 3 Carad plc manufactures a high quality car radio which sells for £100. Its head office is located in the south and it operates three factories in the north, east and west, results for which are shown below.

Profit and loss statement year ended 31 December

|                      | <i>East</i> |        | <i>West</i> |        | <i>North</i> |       |
|----------------------|-------------|--------|-------------|--------|--------------|-------|
|                      | £000        | £000   | £000        | £000   | £000         | £000  |
| Sales                |             | 16,000 |             | 12,000 |              | 5,000 |
| Direct materials     | 3,840       |        | 2,880       |        | 1,200        |       |
| Direct wages         | 1,760       |        | 1,200       |        | 450          |       |
| Production overhead: |             |        |             |        |              |       |
| variable             | 640         |        | 720         |        | 250          |       |
| fixed                | 2,400       |        | 1,600       |        | 700          |       |

|                           |              |              |            |
|---------------------------|--------------|--------------|------------|
| Administration overhead   | 2,800        | 2,000        | 1,000      |
| Selling overhead:         |              |              |            |
| variable                  | 480          | 360          | 100        |
| fixed                     | 1,160        | 900          | 400        |
| Head office (apportioned) | <u>2,000</u> | <u>1,500</u> | <u>600</u> |
|                           | 15,080       | 11,160       | 4,700      |
| Profit                    | <u>920</u>   | <u>840</u>   | <u>300</u> |

Management is considering its strategy for next year, particularly in the light of the bad news that one of North factory's main customers (Exe plc, which takes 10,000 radios per annum) has gone into liquidation. A number of possible alternatives have been suggested and are shown below:

- (a) Continue operations at East and West, but reduce output at North on the assumption that no market can be obtained to replace Exe plc
- (b) Continue operations at East and West and operate North at its breakeven level of sales.
- (c) Continue operations at all three factories and accept an offer from an overseas car manufacturer who is prepared to buy from North 10,000 radios per annum at a special price of £80.
- (d) Continue operations at West as at present and transfer the remaining production requirements of North to East. See note below.
- (e) Continue operations at East as at present and transfer the remaining production requirements of North to West. See note below.

*Note*

You may assume that there would be no costs of closing down the North factory; in other words, realizable value of assets would offset redundancy payments etc. However, if the North factory is closed down additional costs would be incurred at the factory which undertook the production requirements which were transferred from North. These costs are estimated as:

|  | <i>East</i> | <i>West</i> |
|--|-------------|-------------|
|  | £           | £           |
| Transport costs to customers of North (per unit) | 2           | 4           |
| Fixed costs per annum:                           |             |             |
| Production                                       | 850,000     | 600,000     |
| Administration                                   | 400,000     | 300,000     |
| Selling  | 240,000     | 300,000     |

You are required to:

Present your evaluation of the five proposals. (20 marks)

- 4 The management of an engineering company manufacturing a range of products is considering next year's production, purchase and sales budgets. Shown below are the budgeted total unit costs for two of the components and two of the products manufactured by the company.

|                   | <i>Component<br/>12</i> | <i>Component<br/>14</i> | <i>Product<br/>VW</i> | <i>Product<br/>XY</i> |
|-------------------|-------------------------|-------------------------|-----------------------|-----------------------|
|                   | <i>£ per unit</i>       | <i>£ per unit</i>       | <i>£ per unit</i>     | <i>£ per unit</i>     |
| Direct material   | 18                      | 26                      | 12                    | 28                    |
| Direct labour     | 16                      | 4                       | 12                    | 24                    |
| Variable overhead | 8                       | 2                       | 6                     | 12                    |
| Fixed overhead    | 20                      | 5                       | 15                    | 30                    |
|                   | <u>£62</u>              | <u>£37</u>              | <u>£45</u>            | <u>£94</u>            |

Components 12 and 14 are incorporated into other products manufactured and sold by the company, but not the two products shown above. It is possible to purchase Components 12 and 14 from another company for £60 per unit and £30 per unit respectively.

The anticipated selling prices of Products VW and XY are £33 and £85 respectively.

Required:

- (a) Advise the management of the company whether it would be profitable to:
- Purchase either of the above components.
  - Sell either of the above products. (4 marks)
- (b) State clearly, and where appropriate comment upon, the assumptions you have made in answering (a) above. (9 marks)
- (c) Consider how the following additional information would affect your advice in (a) above.
- Next year's budgeted production requirements for the two components are 7,000 units of Component 12 and 6,000 units of Component 14. Next year's budgeted sales for the two products are Product VW 5,000 units and Product XY 4,000 units.
  - A special machine is used exclusively by the above two components and two products and for technical reasons the machine can only be allowed to operate for 80,000 machine hours next year.  
The budgeted usage of the machine is:  
Component 12 – 8 machine hours  
Product VW – 6 machine hours  
Component 14 – 2 machine hours  
Product XY – 12 machine hours  
The operating costs of the machine have been included in the unit costs shown in (a) above. (9 marks)
- (22 marks)



- 5 (a) 'Cost-volume-profit analysis should not be restricted by the limitations of break-even analysis and the break-even chart.' Comment on this quotation. Outline the limitations of the conventional break even chart and give your views on whether cost-volume-profit analysis can provide an improved approach  
(9 marks)
- (b) Give your views on the statement that 'The fixed overhead volume (denominator) variance is a measure of the utilisation of capacity'.  
(8 marks)  
(17 marks)

CACA 2.4 June 1984

- 6 A manufacturing company with a single product has the following sales and production results over three financial periods:

|            | <i>Period 1</i><br><i>000 units</i> | <i>Period 2</i><br><i>000 units</i> | <i>Period 3</i><br><i>000 units</i> |
|------------|-------------------------------------|-------------------------------------|-------------------------------------|
| Sales      | 50                                  | 60                                  | 40                                  |
| Production | 70                                  | 40                                  | 60                                  |

The selling price per unit has remained at £10, and direct material and direct labour costs per unit at £5. All manufacturing overheads are absorbed into product cost at predetermined rates per unit of output. Any under/over absorbed balances are transferred to profit and loss in the period in which they arise. Variable manufacturing overhead absorption was predetermined at a rate of £1 per unit in each period. Fixed manufacturing overheads were expected to be £180,000 per period. Normal capacity is 60,000 units of output per period.

Manufacturing overheads actually incurred were as follows:

|          | <i>Period 1</i><br><i>£000s</i> | <i>Period 2</i><br><i>£000s</i> | <i>Period 3</i><br><i>£000s</i> |
|----------|---------------------------------|---------------------------------|---------------------------------|
| Variable | 68                              | 45                              | 60                              |
| Fixed    | 180                             | 180                             | 180                             |

Assume that no further overheads are incurred (i.e. other than manufacturing overheads).

Required:

- (a) Calculate the expected break even point per period. (3 marks)
- (b) Calculate the profit/loss that arose in each of the three periods.  
(8 marks)
- (c) Reconcile your answers to (a) and (b) above, clearly demonstrating, explaining fully the reasons for, and commenting briefly upon, any differences encountered. (11 marks)  
(22 marks)

CACA 1.2

- 7 (a) Explain to a non-accounting colleague how you would calculate the break even point of a company manufacturing and selling one type of product. (6 marks)
- (b) 'If a company reduces its selling price by 10% and sales volume increases by 11% then the profit earned by the company would not change.'  
Examine the validity of the above statement. (3 marks)
- (c) The management of a company is considering automating most of its manufacturing operations. This change would result in a significant reduction in variable costs, but the increase in fixed overheads would be such that, at current levels of activity, profits would not change. Discuss the possible effects of this proposed change on the future profits of the company. (4 marks)
- (d) Consider the effect on a company's reported profit of an increase in production volume with no corresponding increase in sales volume. (4 marks)
- (17 marks)

*CACA 2.4 November 1985*

- 8 For LP Limited the following data are relevant to its products L and P:

| Per unit          | <i>Product L</i> | <i>Product P</i> |
|-------------------|------------------|------------------|
|                   | £                | £                |
| Selling price     | 200.00           | 240.00           |
| Costs:            |                  |                  |
| Direct materials  | 45.00            | 50.00            |
| Direct wages:     |                  |                  |
| Department: 1     | 16.00            | 20.00            |
| Department: 2     | 22.50            | 13.50            |
| Department: 3     | 10.00            | 30.00            |
| Variable overhead | 6.50             | 11.50            |

Fixed overhead is budgeted at £275,000 per annum.

Relevant data for each department are:

|               | <i>Numbers of employees</i> | <i>Hours per employee per week</i> | <i>Wage rate per hour</i> |
|---------------|-----------------------------|------------------------------------|---------------------------|
| Department: 1 | 20                          | 40                                 | 2.00                      |
| 2             | 15                          | 40                                 | 2.25                      |
| 3             | 18                          | 40                                 | 2.50                      |

In the present environment, it is not possible to engage any more employees.

You are required to:

- (a) Show mathematically the objective function and the constraints.
- (b) Show on a graph the mix of products which will optimise the contribution of LP Limited.

- (c) State the production required to obtain the largest contribution and the amount of that contribution. (15 marks)

CIMA CA2 May 1978

- 9 A new subsidiary of a group of companies was established for the manufacture and sale of Product X. During the first year of operations 90,000 units were sold at £20 per unit. At the end of the year, the closing stocks were 8,000 units in finished goods store and 4,000 units in work-in-progress which were complete as regards material content but only half complete in respect of labour and overheads. You are to assume that there were no opening stocks. The work-in-progress account had been debited during the year with the following costs:

|                   | £       |
|-------------------|---------|
| Direct materials  | 714,000 |
| Direct labour     | 400,000 |
| Variable overhead | 100,000 |
| Fixed overhead    | 350,000 |

Selling and administration costs for the year were:

|                | <i>Variable cost</i><br><i>per unit sold</i> | <i>Fixed cost</i> |
|----------------|--|-------------------|
|                | £  | £                 |
| Selling        | 1.50   | 200,000           |
| Administration | 0.10   | 50,000            |

The accountant of the subsidiary company had prepared a profit statement on the absorption costing principle which showed a profit of £11,000. The financial controller of the group, however, had prepared a profit statement on a marginal costing basis which showed a loss. Faced with these two profit statements, the director responsible for this particular subsidiary company is confused.

You are required to

- (a) Prepare a statement showing the equivalent units produced and the production cost of one unit of Product X by element of cost and in total. (5 marks)
- (b) Prepare a profit statement on the absorption costing principle which agrees with the company accountant's statement. (9 marks)
- (c) Prepare a profit statement on the marginal costing basis. (6 marks)
- (d) Explain the differences between the two statements given for (b) and (c) above to the director in such a way as to eliminate his confusion and state why both statements may be acceptable. (5 marks)

(Total: 25 marks)

CIMA May 1988

### References and further reading

- 1 Marginal costing is a well documented, tried and tested technique. Listed below are a selection of articles where academics have attempted to improve the quality of analysis and reliability of existing techniques.
- 2 Charnes, A., Cooper W., and Ijiri Y., 'Breakeven Budgeting and Programming to Goals', 1963. Vickers D., 'On the Economics of Breakeven', 1960. Both these papers appear in Anton and Firmin's *Contemporary Issues in Cost Accounting*, Houghton Mifflin.
- 3 Jaedicke, R. K., Robichek A. A. 'Cost-Volume-Profit Analysis under conditions of Uncertainty', 1968.
- 4 Manes, R., 'A New Dimension to Breakeven Analysis' Both these papers appear in D. Solomon's *Studies in Cost Analysis*, Sweet and Maxwell.
- 5 Morrison T. A., and Kaczka E., 'A New Application of Calculus and Risk Analysis to Cost-Volume-Profit Changes', 1969.
- 6 Hartley, R. V. *Cost and Managerial Accounting*, Newton, 1983
- 7 Trubnick, M., 'The Paradox of Variable Costing', *Singapore Accountant*, September 1986, pp. 23–5.

# 8 Budgets

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## Introduction and definition

Underlying much of what has already been discussed in the preceding pages of the text is the implicit presence of a forecast or target or plan of future events or at least aspirations. We now come to look at these projections into the future on a more formal basis. These projections are known as *budgets*.

A budget is defined as 'a plan quantified in monetary terms, prepared and approved prior to a defined period of time, usually showing planned income to be generated and/or expenditure to be incurred during that period and the capital to be employed to attain a given objective'.

The definition highlights the essential characteristics of the budgeting process. We must note that it is a *plan*, moving towards an objective to be achieved some time in the future, and quantified in money terms. The latter point is not always the case, because a production or activity budget will be structured at least initially, in terms of units to be produced, and a sales budget in terms of units to be sold, or market share.

Budgets are prepared before the period starts, and are approved by senior management. Later on we will discuss who actually prepares the budget.

The period of time reference anticipates another definition, that of *budget period*, which is 'the period for which a budget is prepared and used, which may then be subdivided into control periods'. In most organizations, the budget period is twelve months, equating with the accounting reference period. Indeed, many accountants see it as the beginning of the operational accounting and control cycle, the setting of budgets, through the cycle of budgetary reporting to the final preparation of the financial accounts for audit and submission as a part of the annual return.

Two other definitions are important at this juncture. First is *budgetary control*, 'the establishment of budgets relating to the responsibilities of

executives to the requirements of a policy, and the continuous comparison of actual with budgeted results, either to secure by individual action the objective of that policy or to provide a basis for its revision'.

The other definition is that of the budget cost allowance, which is 'the cost which a budget centre is expected to incur in a control period'. The *Terminology* adds the amplification that, at its simplest, this usually comprises variable/activity/controllable costs in direct proportion to the volume of production or service achieved, and fixed costs as a proportion of the budget. It may be argued that this is a very negative approach. While cost control in itself is a good thing, over emphasis on costs can lead to an attitude that is perhaps unhelpful, and certainly not constructive. Thus a more enlightened approach, where possible, is to look at contribution and profit generation as the essential criteria.

### **Types of budgets**

It is reasonable to suggest that there is a budget available for almost every account that is likely to exist in an organization. Equally, just as many individual accounts are combined through the use of control/summary accounts, so it is true with budgets. If the end product of the accounting process is a profit and loss account and balance sheet, then there is a budget equivalent for this, namely the *master budget*. This is defined as 'a budget which is prepared from, and summarizes, the functional budgets', (Clearly, the functional budgets are the budgeting equivalent of the various financial accounts and summary/control accounts.)

The student reader may be somewhat surprised at the apparent lack of involvement by the finance function. To answer this, the student reader needs to relate across to his or her management studies. Traditionally, budgets were the prerogative of the finance function. However, to be effective control tools, and for the advantages of budgeting to be fully capitalized, then there must be what is known as *participatory budgeting*. Not surprisingly, this is not included in the *Terminology*, but is defined by Edwin H. Caplan as 'allowing individuals who will be responsible for performance under a budget to participate in the decisions by which the budget is established'. This is a formalization of the famous Bob Townsend maxim that 'budgets must not be prepared on high and cast down as pearls before swine. They must be prepared by the operating divisions'. To obtain the desired effect of budgeting, a budget centre must believe in the budget that is set for it. Thus operating areas must be given guidelines, then they will develop the sense of responsibility and challenge and endeavour to achieve the budget.

#### ***The stages in the budget process will thus be:***

- 1 Issue of budgeting instructions e.g. guidelines on the uncontrollable items, such as pension costs, employers' contribution costs, external costs such as rates and energy and possibly indications of how much certain costs may be expected to increase.

Figure 8.1 will illustrate both the variety of budgets, and also the mechanics of their preparation.

| <i>Type of budget</i>               | <i>Source data</i>   | <i>Responsibility</i>    |
|-------------------------------------|--|--------------------------|
|                                     | Budget instructions and guidelines   | Finance                  |
| Sales                               | Order book<br>Expected orders<br>Probability of orders<br>Sales forecasts<br>Sales aspirations | Sales director and staff |
| Production/operations               | Sales data<br>Inventory policy   | Production director      |
| Inventory budget                    |  |                          |
| Headcount (or manpower) budget      |  |                          |
| Conversion expense budget           | Production function requirements   |                          |
| Expenses (selling and distribution) | ----->   | Sales function           |
| (Administration)                    | ----->   | Administration           |
| (Finance)                           | ----->   | Finance function         |
| Collation of function budgets       | ----->   | Finance function         |

Figure 8.1 *Types of budget*

- 2 The sales budget is prepared.
- 3 The production/operations budget (along with the inventory and direct headcount budgets).
- 4 The conversion expenses and other expenses budget.
- 5 The finance function collects all the budget information, collates it together, and in the collation, calculates the overhead absorption rates, and values the production in the terms of money.
- 6 From the collation, the master budget for the profit and loss account can be prepared.
- 7 A review of the profit and expense budgets. (This reviewing process will be taken in stages e.g. at the sales budget and production stage, and also the individual expenses.)
- 8 From the sales data, production and inventory, construction can begin of the budgeted balance sheet and the cash flow. This will also involve consideration of a capital equipment budget which may have been done prior to the commencement of the profit and loss account process.)
- 9 Once the individual budgets have been prepared and collated, they will need to be submitted to senior reviewing management, for approval. This might involve revising certain aspects of the budget, or defending certain, possibly contentious aspects of the budget.
- 10 Budget issued to the operating areas, possibly after being phased for use on a month to month basis. (Guidance to the finance function from the operations areas will be essential for this.)

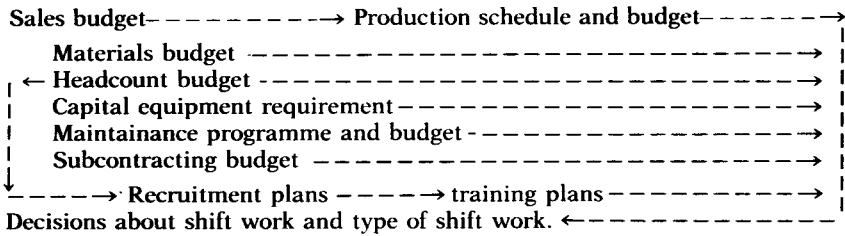


Figure 8.2

### Advantages of budgeting

In the years since budgeting first appeared as a management technique, there has been some debate as to its advantages and disadvantages.

Budgets are an essential feature of most control systems. The advantages of budgets are:

- 1 As an essential part of the management process budgets *compel planning*, making people within an organization think about the future. A formal budgeting procedure, with specified deadlines force ever harassed operations managers to divert their attention away from day to day firefighting and get down to completing the budget.
- 2 Promotes communication and coordination. This may be seen as applying the obvious, but the formal procedure will make the sales function talk to, the operations and/or production function.
- 3 Promotes a guide for action. This is best explained by means of an illustration. (See Figure 8.2.) Suppose the sales budget has been prepared. From that data, and knowing the amount of finished goods inventory that is required to be held, the guide for action shown in Figure 8.2 can be prepared.

The reader will appreciate that each of the subsidiary budgets identified from the production schedule would spawn further action in the same way as we have illustrated the headcount budget.

- 4 Provides a basis for performance evaluation. Although in the section that relates to standard costing and variance analysis will devote space to the control process, budgets are an integral part of control and review procedure in that they establish agreed targets to be achieved, and for performance to be monitored against. This is why participatory budgets are so vital, since operations managers are being effectively asked to achieve an agreed objective within agreed parameters.

### The essentials for effective budgeting

Having outlined some of the principles and debates surrounding budgeting, five precepts have been formulated for effective budgeting:

- 1 The organization must have a set of overall goals. This may involve relating the budget to the corporate plan. Even if there is no formal



corporate plan, there will still be an objective that should be aimed for, even if it is only as informal as a managing director of a small business calling his first line team together to agree the sales target for the next year. It is at this stage that the key or principal budget factor(s) will be highlighted. This may be the market share, production capacity, or availability of certain vital resources.

- 2 The organizational objective(s) should be broken down into meaningful subgoals. This is vital in the context of sales since it takes judicious and effective management to produce sales at a profit in an environment where cost and working capital stewardship must be rigorous.
- 3 The subgoals must be congruent with the overall goal(s) of the organization. Goal congruence is a nasty 'buzz word' that has crept into the language of budgeting. While it has significant behavioural implications that are beyond the scope of this text, let it suffice to say that clearly the operations goals must be to fit those of the sales function, and likewise all the ancillary function goals must also fit within the goal matrix.
- 4 Employees must accept the goals and subgoals and not feel threatened by them. Clearly, this is where the role of communication comes in, to tell 'the lads' what is wanted, agree what is in it for them, and encourage them. Feedback will be vital here, to inform the team how they are doing, and to thank and congratulate them for their efforts.
- 5 The budget must be integrated with some form of feedback and performance review procedure. This must be standard and regular, with the key budget factors highlighted. Ideally, this should take the form of a regular managerial review meeting, organized to take place as soon as possible after the end of the period, and when all the relevant information can be made available. In recent years, possibly as a result of adopting the worst aspects of American budgetary control procedures, reviews have taken place only after the compilation of voluminous reporting packages, with the result these meetings are two to three weeks, and sometimes four after the end of a period under review. Such meetings are too late to be of real value, generate more heat than light, and are exceedingly time consuming. The review procedure should be organized to identify key review factors that can be produced quickly and then the meetings held as soon after the period end as possible. (Ideally, on the Monday morning after the period end at 0830 hours, with a duration of only one hour!)

### **A word about flexed budgets**

Almost by implication, the discussions about budgets have been time related, with little reference to relating the budget to levels of activity. In short the assumption has been that costs are largely fixed, and the only thing to vary is the sales volume. In practice, many firms in

finalizing budgets for operational use, phase their budgets on activity levels but go little further in their treatment of the variable cost element.

Flexed or flexible budgeting 'recognizes the difference in behaviour between fixed and variable costs in relation to fluctuations in output, turnover, or other variable factors such as number of employees, and is designed to change appropriately with such fluctuations'. In essence, this means that the variable elements within a budget and the elements they vary with are identified. Then, when the budget report is prepared, the budget is revised to reflect the actual activity and what the variable budgeted costs should have been for that level of activity. The actual reports are then prepared with actual achievements compared with a revised budget.

The alleged advantage of such a procedure is that there is a greater degree of accuracy in the budget reporting. This improved accuracy is achieved at the cost of:

- 1 A longer time scale in the reporting preparation, to produce a degree of apparent precision that merely produces information that is even more outdated.
- 2 An increased cost of the reporting process.
- 3 An alleged degree of accuracy that may well be based on incorrect assumptions about the relationship of the variable costs.
- 4 A disproportionate amount of attention is given to costs which do not make up the majority of the cost structure. In the UK and Europe most costs are fixed, and the amount and materiality of variable costs does not legitimately justify the extra cost and effort.

Finally, and perhaps most important is the attitude of the users. Even well educated and trained, non-financial managers remain inherently suspicious of the finance function. Consequently any attempt to change control benchmarks will destroy the credibility of the control process in the eyes of the all important users.

As a result of this, flexed budgeting, apart from concessions within the phasing process, is not as widespread in its usage as perhaps it could be. (The author has had experience of flexed budget systems actually being thrown out by senior executives. However with more advanced computer flexed budget programmes, it is likely that the benefits are more easily obtained, as the difficulties are eliminated.)

### **The mechanics of budgeting**

Having spent some time on the principles and precepts of budgeting, we will now talk through a detailed illustrative example.

*Example 8.1*

The Trician Trading Corporation produces a single product. It is embarking on the annual budget preparation exercise, and has begun by looking at a forecast for the year ending 31 December 19X7.

In considering the budget parameters, the MD is conscious of a brief from the parent company that owns Trician, whereby they see the company as a 'cash cow' (i.e. a cash generating, low investment/high profit) operation, and as such have indicated that in the coming year, the requirement for Trician will be to generate enormous amounts of cash to be used elsewhere in the group to finance new developments, which will guarantee the future of the whole group.

*Trician Trading Corporation**Forecast profit and loss account and balance sheet 31 December 19X7**Profit and loss account*

|                  |       |                    |
|------------------|-------|--------------------|
| Turnover (£k)    |       | 10,000             |
| Cost of sales    |       | <u>(4,000)</u>     |
| Gross margin     |       | 6,000              |
| <i>Expenses:</i> |       |                    |
| Selling          | 1,000 |                    |
| Administration   | 1,000 |                    |
| Depreciation     | 1,500 | <u>---</u> (3,500) |
| Pre-tax profit   |       | <u>2,500</u>       |
| Taxation         |       | (875)              |
| Post-tax profit  |       | 1,625              |
| Dividend         |       | <u>(500)</u>       |
| Retained profit  |       | <u>£1,125k</u>     |

*Balance sheet*

|                   |  |                |
|-------------------|--|----------------|
| Fixed assets cost |  | £7,785k        |
| depreciation      |  | <u>(2,500)</u> |
|                   |  | 5,285          |

*Current assets*

|                             |              |                |
|-----------------------------|--------------|----------------|
| Stocks: Raw materials       | 1,000        |                |
| Finished goods              | 1,510        |                |
| Debtors                     | 1,000        |                |
| Cash                        | 205          |                |
|                             | <u>3,715</u> |                |
| Creditors                   | (650)        |                |
| Taxation provision          | (875)        |                |
| Dividends                   | (500)        |                |
| Net current assets          |              | <u>1,690</u>   |
| Total net assets            |              | <u>£6,975k</u> |
| <i>Financed by:</i>         |              |                |
| Ordinary share capital      |              | £3,500k        |
| Reserves (retained profits) |              | 2,350          |
| Current year profits        |              | <u>1,125</u>   |
|                             |              | <u>£6,975k</u> |

The following parameters are being discussed. The product is successful, and demand is increasing. The sales budget will be thus derived from:

- 1 Known orders already received.
- 2 Orders/options that are likely to be received or taken up, possibly sub-divided into probable and possible.
- 3 Enquiries that experience indicates are likely to become firm orders.

In formulating the sales budget, consideration also has to be given to:

- 1 The impact of price.
- 2 The length of the cycle from order to delivery. Capital goods such as weapon systems take months if not years to build, disposable plastic containers for ice-cream and soft drinks can be ordered, produced and delivered in the same week.
- 3 Delivery dates – this will be important in the phasing of the budget.

From this, we are advised that the orders for 1988 are:

|   |          |
|---|----------|
| Firm  | £5,000k  |
| Probable  | £3,750k  |
| Possible  | £2,500k  |
| Enquiries with a chance of becoming firm orders | £1,250k  |
| Total expected sales                            | £12,500k |

If we assume that there are constant prices, then this will represent a 25 per cent increase in production demands. It thus becomes pertinent to discuss briefly how the production budget is framed. Production budgets are initially based on units of product/service. The sales budget will have been translated into numbers of units to be sold. This figure will then be related to the current stock holding of finished product and the policy on future finished goods holding. Capital products are not held in stock, they are often 'once-off' or at best batch items. Plastic containers or cables, however, do not lend themselves so readily to long-term order commitments, and this is reflected in the policy towards manufacturing for stock to enable quick delivery, when experience and statistical projection indicate that they will be required. Stock shelf life will also come into this equation. From the guidelines given, production will have to be stepped up to meet increased demand, requiring consideration of capacity both in terms of equipment and headcount, the need to possibly expend capacity and how to tackle that problem in both the short and medium term.

Thus the parameters for a production budget will be:

- 1 Level of expected sales.
- 2 Policy towards finished goods and the nature of the product.
- 3 Timing of the deliveries.
- 4 Capacity in terms of both machines and headcount.

The total figure can be computed in terms of a simple 'T' account, and is illustrated in money terms below the budgeted cash flow statement (page 191).

*Further relevant information:*

Cost of sales is made up of 40 per cent material, 20 per cent direct labour, and 40 per cent conversion overhead, excluding depreciation. Only 20 per cent of all the conversion costs is considered variable. 20 per cent of the selling costs are considered variable. It is the policy of Trician to depreciate all fixed assets on the basis of 20 per cent straight line, charging a full year of depreciation during the year of acquisition, and none in the year of disposal.

In addition, we are told that:

- 1 Material makes up 40 per cent of the cost of sales, and will increase by 10 per cent during the coming year. However, by going for a 25 per cent increase in sales, a 25 per cent cost rebate will be achieved on all material bought at the new price. However, it will have to be purchased in larger quantities, and this will require the raw material stockholding to treble, and the cost of holding it in an additional storage area, will be £100k.
- 2 All headcount costs are expected to increase by 5 per cent. In addition to the direct labour (20 per cent of cost of sales) all indirect and salaried staff costs will increase by the same amount. This is estimated to be half the overhead portion of the cost of sales, and half the fixed element of the selling expenses, and 60 per cent of the administration expenses. All other costs are expected to increase by 20 per cent.
- 3 The directors are in agreement with the 25 per cent increase in activity, but the production director points out that there will have to be an investment in overtime and new equipment to meet demand. The new equipment will cost £250k and can be installed by the middle of the coming year. For the first half of the year, additional overtime and shift premiums will have to be paid, costing £200k, but for the second half, the new machine will actually generate cost savings in material of £100k and direct labour of £100k.
- 4 The technical director points out that modifying some existing equipment, at a cost of £50k, will create further savings in the second half of the year of £30k.
- 5 In view of the overriding parameters within which Trician has to work, the MD is anxious to approve these projects, but also wants to further improve the bottom line by judicious cost savings. In an uncompromising hard nosed directive he has instructed his function heads to save 10 per cent on their costs, and this must be built into the budgets. He has also directed that he wants working capital cut so that there are only twenty-five days debtors and sixty-five days finished goods. In addition, raw materials are to remain constant (by volume) and trade creditors are to remain the same figure as the forecast, (i.e. £650k).

From these guidelines you are required to frame a budgeted profit and loss account, balance sheet and funds flow statement. You may

assume that all the proposals put forward have been agreed and will be incorporated into the budgets.

*Sales budget matrix*

From the question we know that the sales figure will be £12,500k.

*Cost of sales budget*

The sales budget represents an increased level of sales volume of 25 per cent. On the basis of current forecasts and ratios, this represents a cost of sales of £4,520k. This breaks down to:

|  |  |
|--|--|
| Direct materials (all variable, and will move in line) | $(4,000 \times 0.4) \ 1.25 = 2,000$  |
| Direct labour  | $(4,000 \times 0.2 \times 0.2) \ 1.25$ (variable element) = 200<br>$(4,000 \times 0.2 \times 0.8)$ (fixed element) = 640   |
| Conversion overhead                                    | $(4,000 \times 0.4 \times 0.2) \ 1.25$ (variable element) = 400<br>$(4,000 \times 0.4 \times 0.8)$ (fixed element) = 1,280 |

|   |                |        |
|---|----------------|--------|
| Turning to the direct materials element:  | £k             |        |
| Material cost based on output at current price                                  | 2,000          |        |
| Price increase expected   | 200            |        |
| Savings arising from the new machine  | (100)          |        |
| Rebate because of becoming a high volume user                                   | (550)          |        |
| Cost of materials element of cost of sales                                      | <u>1,550</u>   | -----> |
| Direct labour cost element:   |                |        |
| Current labour cost   | 800            |        |
| Impact of volume increase on variable element<br>(25% of £100k)                 | 40             |        |
| Wages increase expected (5% of £840k)   | 42             |        |
| Expected shift premium  | 200            |        |
| Savings from new machines   | (100)          |        |
| Total labour costs  | <u>982</u>     | -----> |
| Conversion overhead:  |                |        |
| Current cost  | 1,600          |        |
| Volume increase $(1,600 \times 0.2 \times 0.25)$                                | 80             |        |
| Salary increases $(1,680 \times 0.5 \times 0.05)$                               | 42             |        |
| Increase in other conversion overheads costs<br>$(1,600 \times 0.5 \times 0.2)$ | 160            |        |
| Additional storage costs  | 100            |        |
| Technical savings advised   | (30)           |        |
| Total conversion overhead cost  | <u>1,952</u>   | -----> |
| Total budgeted cost of sales: Direct material                                   | 1,550          | ←----- |
| Direct labour   | 982            | ←----- |
| Conversion Overhead   | 1,950          | ←----- |
| Sub total   | <u>4,484</u>   |        |
| Savings demanded by the MD  | (448)          |        |
|   | <u>£4,036k</u> |        |

## Expense budgets:

|  | <i>Selling</i> | <i>Administration</i> |
|--|----------------|-----------------------|
| Current cost                                   | 1,000          | 1,000                 |
| Volume impact<br>(1,000 × 0.2 × 0.25)          | 50             |                       |
| Salary increases:<br>(1,050 × 0.8 × 0.5 × .05) | 21             |                       |
| (1,000 × 0.6 × 0.05)                           |                | 30                    |
| Other cost increases<br>(600 × 0.2)            | 120            | (400 × 0.2) 80        |
| Sub total                                      | <u>1,191</u>   | <u>1,110</u>          |
| MD's saving                                    | (119)          | (110)                 |
| Expenses budget                                | <u>£1,072k</u> | <u>£1,000k</u>        |
| Depreciation charge:                           |                |                       |
| Assets brought forward at cost                 | 7,785          |                       |
| New machine                                    | 250            |                       |
| Modifications to new machines                  | 50             |                       |
| Total  | <u>8,085</u>   |                       |
| Depreciation charge (20%)                      | <u>£1,617k</u> |                       |

We can now lay out the new budget:

*Trician Trading Corporation*  
*Budget profit and loss account 19X8*

---

|                |                       |
|----------------|-----------------------|
| Turnover       | £12,500k              |
| Cost of sales  | <u>(4,036)</u>        |
| Gross profit   | 8,464                 |
| Expenses:      |                       |
| Selling        | 1,072                 |
| Administration | 1,000                 |
| Depreciation   | 1,617                 |
|                | -----→ <u>(3,689)</u> |
| Pre tax profit | <u>£4,775k</u>        |

We have assumed no data available for estimating the taxation provisions or dividends.

The budgeted balance sheet can be computed from the data available:

*Budgeted balance sheet*

---

|                     |                |                 |
|---------------------|----------------|-----------------|
| Fixed assets        | £8,085k        | (Notes 3 and 4) |
| Depreciation        | <u>(4,117)</u> |                 |
|                     | 3,968          |                 |
| Current assets:     |                |                 |
| Stock raw materials | 825            | (Note 1)        |
| finished goods      | 719            | (Note 1)        |

190 *Cost Accounting*

|                                   |                 |                    |
|-----------------------------------|-----------------|--------------------|
| Debtors                           | 856             |                    |
| Cash                              | 6,032           | (Balancing number) |
| Total current assets              | <u>8,432</u>    |                    |
| Current liabilities               | (650)           |                    |
| Net current assets                | -----→ 7,782    |                    |
| Total net assets                  | <u>£11,750k</u> |                    |
| Financed by:                      |                 |                    |
| Ordinary share capital            | 3,500           |                    |
| Retained profits                  | 3,475           |                    |
| Pre tax profits before provisions | 4,775           |                    |
|                                   | <u>£11,750k</u> |                    |

*Notes:*

- 1 *Calculation of finished goods:* Raw materials was based on the impact of the 10 per cent price increase, the 25 per cent rebate and the assumption that there was to be no change in volume.

For finished goods:  
From the formula:

$$\frac{\text{Target end of year stock} \times 365}{\text{Cost of sales}}$$

and letting the closing stock required equal x, we can write:

$$\frac{x \times 365}{4,034} = 65$$

Thus:

$$x = \frac{65 \times 4,034}{365}$$

Therefore:

$$x = 719$$

This implements the cut in stock levels from the existing level to the desired 65.

- 2 By the same token, we can calculate the desired twenty-five day debtors figure. Using the same formula as for the stocks:

$$\frac{\text{Target end of year debtors} \times 365}{\text{Sales}} \text{ we get:}$$

$$\frac{x \times 365}{12,500} = 25$$



and can write

$$x = \frac{25 \times 12,500}{365}$$

$$x = 856.16 \text{ (say 856)}$$

|   |  |                 |
|---|--|-----------------|
| 3 | (See above for the depreciation calculation.) Fixed assets brought forward per question £7,785k. |                 |
|   | Purchases of new plant and equipment   | £250k           |
|   | Capitalized modifications  | 50              |
|   | Carried forward  | <u>£8,085k</u>  |
| 4 | Depreciation brought forward   | £(2,500)k       |
|   | Charged to profit and loss   | (1,617)         |
|   | Carried forward  | <u>£(4,117)</u> |

We can now turn to the budgeted funds flow statement.

*Trician Trading Corporation*

*Forecast sources and application of funds statement*

|                                |       |                |
|--------------------------------|-------|----------------|
| <i>Sources</i>                 |       |                |
| Profit from trading operations |       | £4,775k        |
| Add back non cash items:       |       |                |
| Depreciation                   |       | 1,617          |
| Total funds generated          |       | <u>6,392</u>   |
| <i>Applications:</i>           |       |                |
| Fixed assets purchased         | (300) |                |
| Taxation paid                  | (875) |                |
| Dividends paid                 | (500) |                |
|                                |       | -----> (1,675) |
| <i>Working capital:</i>        |       |                |
| Stocks decrease                | 966   |                |
| Debtors decrease               | 144   |                |
| Creditors                      | —     |                |
|                                |       | -----> 1,110   |
|                                |       | <u>£5,827</u>  |

Total funds generated (cash £205k is £6,032k)

Two of the ancillary budgets can be framed in total from the data provided. Simple 'T' account formats can be used.

*Raw materials and purchases*

|  |                |                           |                |
|--|----------------|---------------------------|----------------|
| Opening raw materials                          | 1,000          | Included in cost of sales | 1,550          |
|  |                | Closing stock             | 825            |
| Savings demanded                               | 155            |                           |                |
| (reduced usage assume<br>10% of cost of sales) |                |                           |                |
| Purchases                                      |                |                           |                |
| (balancing figure)                             | 1,220          |                           |                |
|  | <u>£2,375k</u> |                           | <u>£2,375k</u> |

Equally, the production budget in cost terms can be computed.

*Production budget*

|                                  |                |                              |                |
|----------------------------------|----------------|------------------------------|----------------|
| Opening finished goods           | 1,510          | Cost of goods sold           | 4,036          |
|                                  |                | Closing finished goods stock | 719            |
| Production<br>(balancing number) | 3,245          |                              |                |
|                                  | <u>£4,755k</u> |                              | <u>£4,755k</u> |

Consideration of specific function budgets such as production, and the preparation of a forecast cash flow budget, introduces the requirement to prepare a cash budget. In recent years, effective cash management has become almost a more essential attribute of the cost/management accounting function than cost control and profits themselves. To illustrate this important aspect of budgeting, we will talk through an example based on the Trician Trading budgets already framed.

*Trician Trading preparation of a quarterly cash budget  
(first three months of 19X8)*

*Parameters:*

- 1 Sales are on credit and are paid 50 per cent in the month following sales and 50 per cent in the second month. The forecast balance sheet for the end of 19X7 consists of November £325k, and December £675k. To comply with the MD's edict, for 19X8 sales, the payment ratio is to change to 25 per cent current month, then 50 per cent/25 per cent. The budget sales for the first quarter has been phased 960:960:1205.
- 2 Purchases are phased equally over the year and are paid in the third month after the material is received. Outstanding at year end will be the last quarter of 1987. The forecast figure consists of £425k materials and £225k overheads.
- 3 For simplicity, all wages, salaries and other overheads are assumed to be phased equally over the year. Obviously, wages and salaries are paid in the month in which they are incurred, while the other overheads are the same as the purchases. The wages and salaries outgoings for the first three months are expected to be 307/307/332.
- 4 The dividend is payable in March along with £200k of the outstanding taxation.
- 5 £100k of the amount to be spent on fixed assets is to be paid in February when the orders are placed.

We can now format the monthly cash budget grid.

*Trician Trading phased cash budget for first quarter of 19X8*

| Month              | January | February | March   | Notes                 |
|--------------------|---------|----------|---------|-----------------------|
| Cash in            |         |          |         |                       |
| Debtors            |         |          |         |                       |
| Time of sale       |         |          |         |                       |
| November           | 325     |          |         | }Forecast             |
| December           | 338     | 338      |         | }Balance              |
| January            | 240     | 480      | 240     | 960 split<br>25/50/25 |
| February           |         | 240      | 480     |                       |
| March              |         |          | 301     | 25% of £1,205k        |
| Total income (£k)  | 903     | 1,058    | 1,261   | (a)                   |
| Cash out           |         |          |         |                       |
| Purchases          | (141)   | (142)    | (142)   | per parameters        |
| Overheads*         | (75)    | (75)     | (75)    |                       |
| Wages and salaries | (307)   | (307)    | (332)   |                       |
| Fixed asset        |         | (100)    |         |                       |
| Dividend/tax       |         |          | (700)   |                       |
| Total outlay (£k)  | (523)   | (624)    | (1,249) | (b)                   |
| Net cash (a - b)   | 380     | 434      | 12      |                       |
| Opening balance    | 205     | → 585    | → 1,019 |                       |
| Balance c/f (£k)   | 585     | 1,019    | 1,031   |                       |

A word of warning is timely here. Just as with the funds flow statement, depreciation does not affect the phased cash budget. Students must therefore be wary of overheads that include depreciation, and exclude that figure from their computation. Students who fail to do this eloquently demonstrate to an examiner their basic misunderstanding of a fundamental accounting transaction and, as such, will be presented some ten weeks after taking the examination with a cordial invitation to take it again! Be warned!

### Control against budgets

From the outset of this chapter, we have emphasized that the budget is a plan, and clearly, the control element is to ascertain to what extent the plan is achieved. To demonstrate this, we will go forward into the new period that Trician was planning to see how things go. Let us assume that we are three months into the new year, and reviewing progress at the end of the quarter. To keep the budget aspect simple, we will assume that the quarter represents 25 per cent of the total year's budget. (This is not as silly as it sounds, for in most organizations, the combination of cyclic demands, shut downs and statutory holidays

usually means that the calendar quarters are rarely 25 per cent of the total year.)

Let us assume that despite the assurances given by the sales director, sales were 10 per cent down on budget. Much to the annoyance of the MD, production did not achieve its targeted cost savings, and the selling expenses were actually 15 per cent overspent. The one consolation was that the administration department, by postponing recruitment and firing the personnel function, as well as judiciously monitoring other overheads, actually made savings of £18k.

The profit and loss statement would look something like this:

*Trician Trading Corporation*

*Statement of results for the first quarter 19X8*

|   | <i>Budget</i> | <i>Actual</i> | <i>Variance</i>    |
|---|---------------|---------------|--------------------|
| Turnover (£k)                               | 3,125         | 2,812         | (313) (all volume) |
| Cost of goods sold<br>(usually at standard) | (1,380)       | (1,380)       | –                  |
|   | 1,745         | 1,432         | (313)              |
| Expenses                                    |               |               |                    |
| Selling                                     | (267)         | (308)         | (41)               |
| Administration                              | (250)         | (232)         | 18                 |
| Depreciation                                | (404)         | (404)         |                    |
|   | £842k         | 488           | (336)              |

Perhaps the most significant point of interest is the cost of sales figure. Ostensibly, there is a saving against budget. This is in fact misleading, since the point was made in the preamble to these figures that sales were 10 per cent down and that production had not met its cost saving targets. Hidden in those figures in fact is a considerable overspend of over £100k. This would be highlighted in the report by the use of standard costs, and emphasizing further where the inefficiencies and overspends arose, and it is to the techniques of standard costing that we now direct our attention in Chapter 9.

## Questions

- 1 Exe plc has appointed a new chairman who will soon be involved in a board meeting at which budgets for the next financial year will be appraised. He is concerned with recent reports that managers are claiming that they have no control over a number of items in their budgets, so are losing interest in their performance assessments.

You are required, as management accountant, to write a report to the Chairman to explain and discuss the following:

- (a) The objectives of a system of budgetary control. (10 marks)  
 (b) Some of the concepts or principles of a modern system of budgetary control which could be introduced to alleviate the situation as represented by the managers. (10 marks)

(Total: 20 marks)

*CIMA CA2*

- 2 (a) Outline the organization required for the preparation of a master budget. (10 marks)  
 (b) Contrast the purpose and contents of:  
 [i] The cash budget  
 [ii] The budgeted sources and application of funds statement (10 marks)

*CACA 1.2 December 1985/June 1987 (modified and combined)*

- 3 A company producing and selling a single product expects the following trading results for the year just ending:

|                                     | £000      | £000                     |
|-------------------------------------|-----------|--------------------------|
| Sales                               |           | 900                      |
| Costs: Materials: direct            | 200       |                          |
| Labour: direct                      | 120       |                          |
| indirect, fixed                     | 38        |                          |
| Other production overhead: variable | 50        |                          |
| fixed                               | 80        |                          |
| Administration overhead: fixed      | 78        |                          |
| Selling overhead: variable          | 63        |                          |
| fixed                               | 44        |                          |
| Distribution overhead: variable     | 36        |                          |
| fixed                               | <u>20</u> |                          |
| Net profit                          |           | <u>729</u><br><u>171</u> |

Budgets are now being prepared for the year ahead. The following information is provided:

- (a) A selling price reduction from £9 to £8 per unit is expected to increase sales volume by 50%.  
 (b) Because of increased quantities purchased a 5% quantity discount will be obtained on the purchase of raw materials. Material usage per unit of output is expected to be 98% of the current year.  
 (c) Hourly direct wage rates will increase by 10%. Labour efficiency should remain the same. 20,000 units will be produced in overtime hours at a premium of 25%. Overtime premium is treated as a direct cost.

- (d) Variable selling overhead is expected to increase in total proportionately with total sales revenue.
- (e) Variable production and distribution overhead should increase in total in proportion to the increase in sales volume.
- (f) Fixed overhead is forecast at 20% above the level for the current year. Monthly production will be scheduled so that finished goods stocks at the end of a month are sufficient to meet sales quantities forecast for the following one and a half months.
- (h) Materials will be purchased so that closing stocks of materials at the end of a month are sufficient to meet production requirements in the following month.
- (i) Monthly sales for the first six months are forecast as:
 

|                  |                |                |                |                |                |                |
|------------------|----------------|----------------|----------------|----------------|----------------|----------------|
| <i>Month</i>     | $\frac{1}{10}$ | $\frac{2}{12}$ | $\frac{3}{15}$ | $\frac{4}{11}$ | $\frac{5}{12}$ | $\frac{6}{12}$ |
| <i>000 units</i> |                |                |                |                |                |                |

You are to assume that:

- (i) Prices and efficiency have been at a constant level throughout the year just ending.
- (ii) Stocks of materials and finished goods at the end of the current year are consistent with the above assumptions for the year ahead e.g. closing stocks of raw materials will be sufficient for production requirements in month 1 of the new year.

Required:

- (a) Prepare a budgeted profit statement for the year ahead in marginal costing format. (10 marks)
  - (b) Calculate and compare the break even points for the two years. (8 marks)
  - (c) Prepare a monthly production budget for the first quarter of the new year. (4 marks)
- (Total: 22 marks)

*CACA 1.2 June 1986*

- 4 (a) Discuss the importance of the cash budget to a manufacturing company. (6 marks) CACA
  - (b) Outline the information required, and explain how you would use that information, to reconcile a manufacturing company's monthly budgeted net profit with the company's budgeted cash balance at each month end. (11 marks)
- 5 MS Limited manufactures one product only which is sold for £100 each. There is given below a budgeted profit and loss statement for one year based on sales and production at a normal level of activity.

*Profit and loss statement*

|                                | £000      | £000        |
|--------------------------------|-----------|-------------|
| Sales                          |           | 1,000       |
| Costs:                         |           |             |
| Direct material                | 300       |             |
| Direct wages                   | 200       |             |
| Production overhead:           |           |             |
| variable                       | 50        |             |
| fixed                          | 200       |             |
| Administration overhead: fixed | 100       |             |
| Selling overhead: fixed        | <u>50</u> |             |
|                                |           | <u>900</u>  |
| Net profit                     |           | <u>£100</u> |

Budgets have been prepared for year ending 30 June, 1981 and year ending 30 June, 1982. In the budget to 30 June, 1981 sales have been shown as only 80% of the normal level of activity while production has been included at the normal level of activity. In the budget for year ending 30 June, 1982 sales have been shown as achieving the normal level of activity while production has been reduced to 80% of the normal level of activity to utilize stock made previously.

- (a) You are required to prepare a budgeted profit and loss statement for each of the years ending 30 June, 1981 and 1982, based on a system of:
- (i) absorption costing
  - (ii) marginal costing
- (b) Discuss briefly the effect on profit of these two different systems. (25 marks)

*CIMA CA2 May 1980*

- 6 The marketing director of W Limited is dissatisfied with the variances reported to him on the basis of actual costs being compared with a fixed budget for the costs attributed to the marketing function. He seeks your help and asks you to prepare for him a flexible budget for the calendar year 1987, based on the following information which is stated for an estimated sales level of £10 million unless stated otherwise.

|                                 |             |
|---------------------------------|-------------|
| <i>Fixed costs:</i>             | <i>£000</i> |
| Salaries: Sales representatives | 200         |
| Sales office                    | 60          |
| Salary-related costs            | 32          |
| Rent                            | 100         |
| Depreciation of furniture       | 5           |
| Depreciation of cars            | 67          |
| Insurance                       | 20          |
| Advertising                     | 250         |

*Variable costs:*

|  |     |
|--|-----|
| Sales representatives' commission        | 64  |
| Salary-related costs: 12½% of commission | 8   |
| Sales representatives' ordinary expenses | 25  |
| Bad debts                                | 100 |
| Stationery and postage                   | 50  |
| Agency fees                              | 80  |

*Semi-variable costs:*

Telephone: rentals £2,000, metered calls £14,000

Sales representatives' car expenses excluding depreciation: fixed £7,000, variable £48,000

Sales promotions: the budget figures are to be based on the costs given below which relate to the years 1982 to 1985 and the estimates for 1986.

| <i>Year</i> | <i>Costs</i><br>£000 | <i>Sales</i><br>£million |
|-------------|----------------------|--------------------------|
| 1982        | 384                  | 4.2                      |
| 1983        | 402                  | 5.1                      |
| 1984        | 368                  | 3.4                      |
|             | 450                  | 7.5                      |
| 1986        | Estimate 478         | Estimate 8.9             |

*Ignore inflation*

You are required to:

- Prepare a flexible budget for sales levels of £9 million, £10 million, and £11.5 million. (12 marks)
  - Calculate the total marketing cost allowance, assuming sales of £10.75 million. (3 marks)
- (Total: 15 marks)

*CIMA CAI November 1986*

- What are the differences between a fixed budget and a flexible budget? In what ways are fixed budgets and flexible budgets useful for planning and control? (7 marks)
  - In its budgets for the period ahead, a company is considering two possible sales forecasts for its three products:

|                        | <i>Product A</i> | <i>Product B</i> | <i>Product C</i> |
|------------------------|------------------|------------------|------------------|
| (i) Sales units        | 22,000           | 40,000           | 6,000            |
| Selling price per unit | £10.00           | £6.00            | £7.50            |
| (ii) Sales units       | 30,000           | 50,000           | 7,000            |
| Selling price per unit | £9.00            | £5.70            | £7.10            |



Variable costs per unit are expected to be the same at the different levels of possible sales. The variable costs per unit are as follows:

|                   | <i>Product A</i> | <i>Product B</i> | <i>Product C</i> |
|-------------------|------------------|------------------|------------------|
|                   | £                | £                | £                |
| Direct materials  | 3.00             | 2.00             | 4.00             |
| Direct labour     | 2.00             | 1.50             | 1.00             |
| Variable overhead | 1.00             | 0.50             | 0.50             |

Fixed overheads are expected to total £150,000. These are expected to be unaffected by the possible changes in activity which are being considered. Due to recent high labour turnover and problems of recruitment, direct labour will be restricted to a maximum of £135,000 in the period. It can be assumed that all labour is of the same grade and is freely transferable between products. Other resources are expected to be generally available.

Required:

Take each of the possible sales forecasts in turn.

- (i) For each forecast, calculate the sales budget that you would recommend to maximize profits.
- (ii) What profit would you expect from each sales budget?

In order to answer these questions you must assume that the three products must be sold *either* all at the higher prices *or* all at the lower prices.

(13 marks)

(Total: 20 marks)

*CACA 1.2 December 1987 (modified)*

# 9 Standard costing

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## Introduction

Much of what we have already discussed considers cost accounting in the context of what a good or service has cost. While this is useful information, it is at best, accurate scorekeeping. For cost accounting information to be of real use to management, such information should be compared against what the cost should have been. This is the basic *raison d'être* of standard costing, an attention directing control tool which enables management to both establish benchmarks and compare actual results against them.

Henri Fayol, one of the father figures of management thought, formulated five core elements of management. In these five elements, he emphasized the role of forecasting and planning but also control – seeing that everything occurs in conformity with established rule and expressed command. 'Established rule' means the establishing of controls and standards by which performance can be monitored. To that end, Fayol envisaged cost accounting as recording what a good or service has historically cost and comparing the cost with the established rules or standards.

Having established how standard costing is a vital managerial tool, and related its development to the very essence of management thought, we can turn to the formal definitions.

Standard costing is defined as 'a technique which uses standards for costs and revenues for the purpose of control through variance analysis'.

Similarly, a *standard cost* is defined as 'a predetermined calculation of how much costs should be under specified working conditions'.

The *Terminology* goes on to explain that a standard cost is built up from an assessment of the value of cost elements and correlates technical specifications and the quantification of materials, labour and other costs to the prices and/or wage rates expected to apply during this

period in which the standard cost is expected to be used. The *Terminology* envisages that such standards would be used as already suggested, as established control tools through variance analysis, inventory valuation (standards are an acceptable means for valuing closing stock) and even for fixing prices.

From this, it will be evident that standards have two basic components:

- 1 A price, rate or cost
- 2 A level of usage, which in itself, through quantity discounts and levels of operating experience, may determine the level of cost.

Standards can be set for direct materials, both price and usage, for direct labour, and for indirect fixed or variable conversion expenses (overheads). Within the context of the operating of standard costing, the difference between the goal set and the results achieved can be quantified, analysed, and hopefully, unambiguously communicated. At the very outset, the emphasis on analysis is vital, because whereas the variance itself directs attention to its existence, it is the skill in analysis that correctly draws attention to the reason.

## **The control process**

Essentially the control process envisaged by standard costing is an open loop system. It is classified as an open system because remedial or corrective action is not automatic, but depends upon action from outside. In other words, the system may identify a variance, but cannot either correct that variance (if adverse) or capitalize upon it (if favourable) without external action. Thus, the process of control is as shown in Figure 9.1.

From Figure 9.1, the essential aspects for a control system are as follows:

- 1 Establish and agree the controls essential to achieving the target.
- 2 Issue the instructions.
- 3 Carry out the instructions.
- 4 Monitor the progress of the implementation of the instructions.
- 5 Provide the vital feedback to the operations area of the progress, communicating any decisions about rectification and/or change.
- 6 Eventually achieve the output.

From the standpoint of the cost accountant, his or her role will be at the outset:

- 1 Participating in the establishing of these standards.
- 2 Collecting and collating the information, by which actuals can be monitored against standard.
- 3 Communicating the variances.

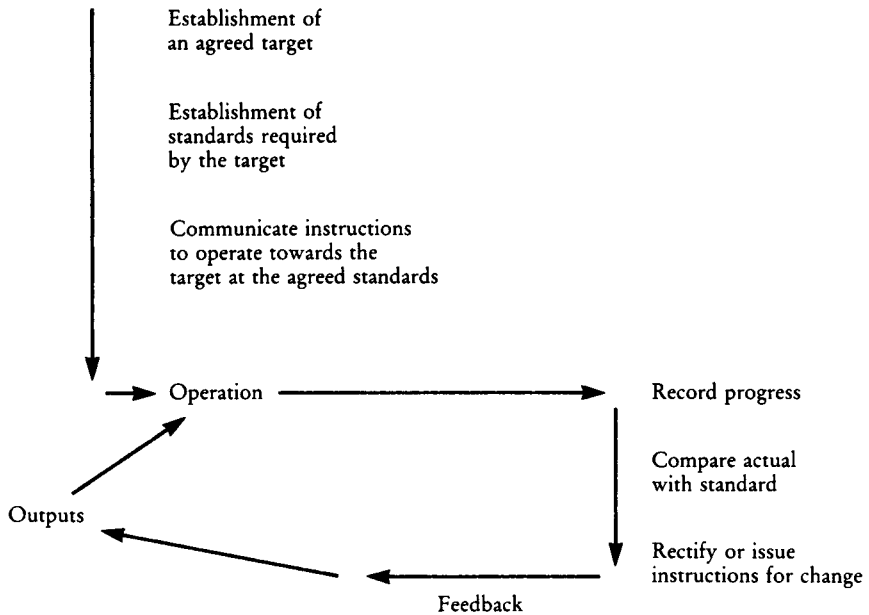


Figure 9.1 *The control process*

The effective operating of a standard costing system presupposes the existence of a cost accountant who is an effective communicator, one who can come away from the world of number crunching and bean counting, into the world of effective management.

## **Types of standard**

The current edition of the *Terminology* identifies four types of standard.

### **1 Basic standard**

'A standard established for use over a long period from which a current standard can be developed.'

Such a standard would remain unchanged for an indefinite period of time. (The author has experienced four/five years in the case of the cable industry.) It is further suggested that such a standard is so fundamental to business operations that the basic goal or desired value is likely to remain unchanged for the foreseeable future.

Clearly, as an effective short-term attention directing control tool, a basic standard is useless. In the last quarter of the twentieth century, the business environment has to be dynamic, and prepared always to cope with change frequently at very short notice. Even where there are products that have a fairly long life, such as a motor car, the demand

for constant on-going model improvement, be it for marketing or productivity reasons is such that even the famous 'red book' of standards used by the automobile industry for the build up of a vehicle, is unlikely to remain constant for any length of time. In short, therefore, while it may be of interest to see to what extent prices of commodities, goods or services have changed over a period of time, in reality, a basic standard is an anachronism, useless as a meaningful control tool, unless coupled to a costly and complicated two tier standard costing system. (Where there is the base standard employed for long term comparisons and a current standard for current period operational control.)

## **2 Ideal standard**

'A standard which can be attained under the most favourable conditions.'

It is worth noting that the *Terminology* goes further by emphasizing that 'no provision is made for shrinkage, spoilage, or machine breakdowns, and as such, advocates believe that the resulting unfavourable variances will remind management of the on-going continual need for improvement in all phases of operations and as such avoid complacency.

However, behaviouralists such as Hofstede and Hopwood argue that such variances are self-destructive and dysfunctional since they eventually remove motivation, since the targets can never be achieved.

In the high technology world of *usi*-facture, the student should consider that where many production processes are now so highly automated, that standards can be machine based and thus, given that the machine can be constantly maintained at 100 per cent 'concert pitch', ideal standards can become a reality. This however, presupposes that the machines can be kept up to 100 per cent operating standard, and constantly fed with work at the required ideal output level. Since both these criteria require some contact with frail humanity, the ideal overall operating standard is still someway off. Even so, usage variances, and usage and efficiency standards, ought to be nearer to ideal in the high technology operating environment, than they were even ten or fifteen years ago. There is another factor that should be considered under the heading of possible ideal standards. High levels of mechanization, with numerical controlled and computer controlled technology should mean that adverse variances are reduced to levels thought immaterial under the old manual regimes. What this does imply, is that the level at which a variance might be investigated or considered worth investigating, has been substantially reduced.

## **3 Normal standard/attainable standard**

Here, the official *Terminology* definition is 'a standard which can be attained if a standard unit of work is carried out efficiently, a machine properly operated or material properly used'.

Such a standard makes allowances for normal wastage, shrinkage,

machine breakdown, operator fatigue. The standard represents future performance and objectives which are reasonably attainable. In addition, such standards, because they are attainable under normal circumstances, can be legitimately used for other purposes such as budgeting and inventory valuation.

Different terms are in use. J. A. Roche, for example, identifies the term the 'normal standard', which is the 'average standard which it is anticipated can be attained over a future period of time, preferably long enough to cover one trade cycle'. Clearly, this is close to the *Terminology* definition, and is virtually synonymous with it. Roche also uses the similar term 'expected standard' which he defines as 'the standard which it is anticipated can be attained during a future specified period'.

#### **4 The current standard**

This the *Terminology* defines as 'a standard established for use over a short period of time, related to current conditions'.

Care should be exercised in using definitions. Many readers will use the term 'current standards' for the standards currently in use. To be absolutely correct, however, the operations standards for use during the accounting or budget period are in fact the attainable or normal standards, while the current standard is the one used in abnormal operating conditions, in that it recognizes current problems and works within current conditions.

#### ***Standard hours***

Another important definition critical to the operating of standard costing is that of the standard hour. This is essentially based on the produced hour already encountered, since it provides a common measure of good work done and hence a basis for measuring output.

The *Terminology* definition of this is 'the quantity of work achievable at standard performance, expressed in terms of a standard unit of work in a standard period of time'.

The student reader should recognize that this definition can be applied and operated in both a labour intensive manufacturing or a capital intensive, highly automated manufacturing environment.

#### ***The computation of output in standard hours***

The standard hour is a common factor for measuring production output. Clearly, where there is a variety of products, there is a need to find a common measure. Each product is reduced to the number of standard hours that it takes to produce, and the performance recorded accordingly. Thus, if we had a product that was rated to take fifteen standard hours to produce, then, each unit of output would be regarded as fifteen standard hours produced, irrespective of the actual time taken.

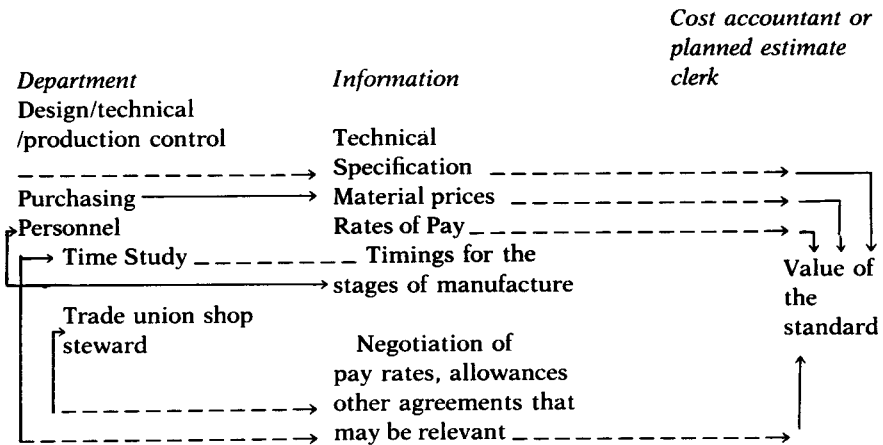


Figure 9.2 *The setting of standards*

## The setting of the standards

For the operating of the mechanics of standard costing, it is necessary to build up costs for each individual component or product. Like a job cost card, standard cost cards are established itemizing at standard, the individual cost components of direct materials, direct or conversion labour, and overheads. It is against these standards that the actuals are compared.

Each standard must:

- 1 Provide a target to aim for. (This is implicit in the definitions of the types of standard.)
- 2 Provide management with a yardstick for the evaluation of actual performance. (The control, review and feedback aspects.)
- 3 Highlight the aspects of the business not operating according to plan. (The provision of attention directing information.)

The physical exercise of setting the standards involves many different functions within the organization. (See Figure 9.2.)

From Figure 9.2 it can be seen that the initial exercise will require a considerable amount of time and effort. And it is not a once for all exercise. Specifications of products change, prices change, negotiated labour rates change, and with experience, timings change, so that standard costing is an on-going dynamic thing, with standards being revised to reflect improvements in the product and methods of working.

**Direct materials.** Such standards will be a function of prices obtained, negotiated and agreed with suppliers. This agreed price may be taken into account any future short-term price increase, which may mean the final standard is based on the mean of a range of prices likely to prevail during the life of the standard. Prices in turn will be based on

quantity to be used, but also quantity bought. The reader should be readily acquainted with such things as quantity discounts and single sourcing, and the standard may well be based on a price negotiated on a certain level of order.

Also built into the standard must be allowances for normal losses, defective material, breaking of bulk, storage deterioration, and wastage in the production process.

As a final point about standards for materials, recognition should be given to the standard costing of packing materials. In many consumer products, the packing forms an important part of the make-up and appeal of the product, and thus must be brought into the standard setting computation.

### ***Direct wages cost***

In most working environments, labour rates for operatives are the result of negotiations with the trade union. With the advent of two year agreements, this part of the standard setting process has become easier, since knowing the time for the job, the labour rate will be readily available. More contentious, however, is the actual time for the job. This will be a function of time taken by the operator, involving effort, conditions and consistency, machine time and type as appropriate, skill required if any, grade of employee, plus any allowances.

Just as with direct materials, allowances need to be built in, where labour is a factor in a standard, (rather than just labour as machine minders) then allowances have to be made for relaxation, (general fatigue) personal needs, (to visit toilets and wash rooms) contingency allowances to read drawings, clean down machinery, setting time, reject allowance, especially when the operatives are working on new products, and adjusting and sharpening tools. Care must be exercised in the permitting of these allowances. Frequently, if these allowances are left unchecked, they can add 15 per cent on to the labour cost. In a world where high productivity is essential, such excesses are intolerable, and need to be monitored ruthlessly.

### ***Conversion overhead***

It is possible, although in practice unlikely, that conversion overhead will be split into fixed and variable costs. The reason for the doubt is that most overhead expenses are time related, few vary materially with actual production or activity. Consequently, most organizations work only on fixed overhead controls.

In principle, total normal conversion overhead must be absorbed into the conversion and hence production cost. This requires:

- 1 Computing the cost of conversion overhead.
- 2 Choosing the base by which it is to be recovered, say standard labour *produced* hours, or machine produced hours, or a percentage on *standard* direct materials.



- 3 Having established the absorption method, computing the rate as follows (say labour produced hours):

$$\frac{\text{Conversion overhead cost}}{\text{Produced hours}} = \text{Standard overhead rate}$$

The reader should note that where the machine hour rate is employed, Inman (1983) has advocated that since the traditional direct labour ceases to have any related control over output, (i.e. operatives are merely machine minders) direct labour (so-called) should be treated as a time related cost with the conversion overheads.

### **Behavioural aspects of standard costing**

In the definitions quoted above, reference was made to the behavioural aspects and problems standard costing is likely to create both as a result of its inter-disciplinary requirements already outlined, and its physical operation and also in negotiating rates and times with union officials. Not surprisingly, much research has gone into this aspect of cost accounting, and Miles and Vergin (1966) have come up with guidelines which are useful to the practical cost accountant anxious to derive as much benefit as possible from a standard costing system, with the minimum of operational conflict.

These guidelines are:

- 1 Standards must be established in such a way that they are recognized as legitimate. (c/f legitimacy in managerial authority.) This requires that the method for deriving the standards must be understood by those affected, and that standards must reflect the actual capabilities of the organizational process for which they are established. This implies that standards must be seen to be attainable, given the operating environment in which they have to work.
- 2 The individual organization member should feel that he has some voice or influence in the establishment of his or her own performance goals. Participation of those affected in the establishment of performance objectives (i.e. attainable standards) helps establish the legitimacy or acceptability of those standards. It could be argued that the operatives would deliberately set low standards, so that they could exceed them easily, and maximize their bonuses. This is very much a MacGregor Theory 'X' approach to the standard setting process. In reality, given a reasonable level of goodwill, standards can be set, with the cooperation of operating individuals, which will both improve productivity and create a motivating environment.
- 3 Standards must be set in such a way that they convey 'freedom to fail'. The individual needs assurance that he or she will not be unfairly censured for an occasional mistake or for variations in performance which are outside his or her control.
- 4 Feedback, recognized as essential in traditional control system designs, must be expanded. Performance data must not only flow

*upward* for analysis by the higher echelons, but they must also be summarized and *fed back down* to those directly involved in the operation.

It is beyond the scope of this book to develop the theories of behavioural aspects of cost accounting in detail, but the outline introduction, to what still stand after twenty years as the basic precepts will help the student reader to at least frame some ideas, and hopefully relate them to other aspects of both his/her course and practical experience.

### **Criticism of standard costing**

Although standard costing has become a well tried and trusted management technique, it is not above criticism. The criticisms mainly arise from:

- 1 Basic validity of the standards especially in periods of highly volatile price changes, both up and down.
- 2 The expensive burden placed upon the accountant, especially in inflationary periods, who was having to contend with standard costs, historical actuals and the preparation of some form of inflation adjusted figure. Within the United Kingdom, the failure of the accountancy profession to agree on a system of credible inflation accounting, coupled to a fall in the indices that measure inflation, have caused enthusiasm for this point to wane considerably.
- 3 The costs involved in exercises that have been described as both time consuming and downright misleading. These on-going costs have to be added on to the costs of establishing and constantly updating the system itself.
- 4 The fact that price and ratios are a function of effective bargain hunting and good negotiation, and in reality, the standard establishing exercise is little more than a skilled exercise in prediction. This point is also basic to the research carried out into the validity of variance analysis and the most cost effective way of analysing variances. It is argued that many standards are little more than observed averages or means (or at best means close to statistical modes) of a set of actually observed readings.
- 5 The universal suitability of the environment to standard costing. Ideally, it is best utilized in environments of long runs of batch or mass production.
- 6 The growing complexity of the system causes, even with all the advances in computer technology, for the lead time for reporting to lengthen. Worse still, reports generated from such complicated systems are frequently not very user friendly to non-financial managers.
- 7 Further dysfunctional attitudes towards standard costing are that the standard costing is reviewed with suspicion and even cynicism by non-financial management. They see imposed standards as the 'big stick' rather than as a useful managerial aid.

- 8 Additionally, coercive standards do not always motivate because they are used to increase authoritarian control.

In the light of the above, the thoughtful student will recognize that the western world has changed somewhat since Edwin Caplan made that criticism back in 1972. Even at this stage, he or she should consider:

- 1 That control must remain, based on controllable usage and engineering standards, inventory control techniques, key ratio and trend analyses.
- 2 The perception of the standard itself and its value is improved by participation by the operations management and supervision in the standard setting process. Caplan observed that this participation produced desired results when properly administered.
- 3 Compare the viewpoints expressed with the precepts of Miles and Vergin, in order to identify some of the possible sources of solutions to the problems.

## Questions

Questions relating to Chapter 9 and Chapter 10 are collected in a section at the end of Chapter 10.

## References and further reading

- 1 Caplan, E. H., *Management Accounting and Behavioral Science* Addison-Wesley, Reading Mass, 1971. Unhappily, this excellent treatise is now out of print, but despite its age it remains along with Hofstede one of the best treatises on the behavioural problem. In the context of our studies, it has the advantage that it is orientated towards basic cost accounting problems as well as the more advanced problems encountered in management accounting.
- 2 Hofstede, G. H., *The Game of Budgetary Control*, Tavistock, London and Assen, 1968. It should be noted that this book, and the reference to E. H. Caplan have the advantage of being based on considerable amounts of empirical research.
- 3 Hopwood, A. G., *Accounting Systems and Managerial Behaviour*, 1973 (and also a later similarly titled American publication).
- 4 Inman, M. L., A series of articles criticizing the use of standards and their continuing relevance appeared in *Management Accounting* during 1982.
- 5 Miles, R. E. and Vergin, R. C., 'Behavioral Properties of Variance Controls', *California Management Review*, Spring 1966, pp. 57-65.
- 6 Roche, J. A., *Accountancy Control Systems*, Longman, 1982.

# 10 Variance analysis

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## Introduction

In Chapter 9, we set out the principles of standard costing. Now we turn to the essential mechanics of the operation of standard costing, variance analysis. The student reader is required to know these variances almost by heart, and they are the very essence of a cost accounting examination paper. We will take the reader through each variance, defining it, showing the formula, illustrating the variance with a simple calculation, and then attempting to identify possible causes of the variance. This latter point is important, since in the analysis of variances for presentation to user management, the cause of the variance is as important as the actual figures. This is an area where many students are weak, and consequently lose vital marks. Finally, we will go through some large examples, typical of the type of question examiners set.

## The definition of a 'variance'

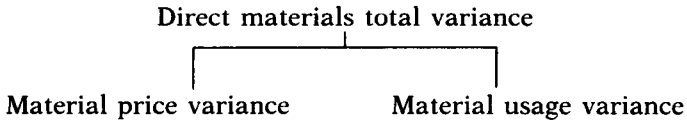
A variance is the difference between planned, budgeted, or standard cost and actual costs (and similarly in respect of revenues).

It is an unfortunate choice of word. The uninitiated student will be forgiven for thinking that the variance is a statistical term. Variance is a statistical term and equals standard deviation squared. Apart from the use of standard deviations in the selection of variances for investigation, the two terms are entirely unrelated and should not be confused with each other.

Remember that variances can arise on both costs and revenues. If a variance is worse than the budget/standard, i.e. costs are excessive or revenues inadequate, then the resultant variance is described as an *adverse variance*. Similarly, if costs and revenues are better than budget/standard then the variance is deemed to be favourable.

We now turn to the discussion on variances in detail.

## Direct materials variances



The direct materials total variance is defined as 'the difference between the standard direct material costs of the actual production volume and the actual cost of the material'.

Formula:

$$(\text{Standard units} \times \text{Standard price}) - (\text{Actual units} \times \text{Actual price})$$

### *The direct materials price variance*

This is defined as 'the difference between the standard price and the actual *purchase* price for the *actual quantity* of the material'. The *Terminology* goes on to add that it can be calculated at the time of purchase (in practice delivery) or at the time of usage. It is considered preferable to calculate such variances at the time of purchase or delivery, since it matches the time that the variance arose. Also it is good conservative or prudent cost accounting to write off adverse variances at the earliest opportunity, and delivery is also the time when the variance can be easily identified. (For consistency, favourable variances are taken to profit at this time. This again matches the time that the variance arose, although the purist might argue that this is tantamount to anticipating an unrealized profit.)

Formula:

$$\text{Actual quantity purchased} \times (\text{Standard price} - \text{Actual price})$$

#### *Example 10.1*

Suppose the standard cost of an item of material is 25p per litre, and the standard usage is 200 litres. 240 litres are purchased at 35p per litre. Calculate the direct material price variance.

From the formula above:

$$\begin{aligned} & 240 \times (25\text{p} - 35\text{p}) \\ &= 240 \times (-10\text{p}) \\ &= \underline{\underline{\pounds-24 \text{ or } \pounds24 \text{ (adverse)}}}} \end{aligned}$$

*Hint:* As an aid to working, always put the standard first, so that if the answer comes out negative, as the answer above, it will always indicate an adverse variance.

### *Causes of material price variances*

An adverse price variance will usually indicate that a supplier has increased his or her price after the standard has been set. In isolation, and in a sellers' market, this is uncontrollable. What really has to be

done is to attempt to contract for prices at a standard that will rule for the duration of the standard itself. This will, however, imply that a certain level of purchases will be required, and a failure to achieve this, may cause the price to increase. This reinforces the criticism levelled at standards, that they are little more than measures of prediction. (Indeed, the fact that the very validity of the standard is challenged as a possible cause accentuates this view.) Another possible cause might be that the normal supplier has been unable to supply, and supplies have been sourced elsewhere, at a higher price.

### ***Direct material usage variance***

This is defined as 'the difference between the standard quantity specified for the actual production, and the actual quantity used, at standard purchase price'.

This is calculated using the formula:

(Standard quantity specified for actual production –  
Actual quantity used) × Standard price

Using the data from Example 10.1 in the formula:

$$\begin{aligned} & (200 - 240) \times 25p \\ & = (-40) \times 25p \\ & = \underline{\underline{£(10) \text{ or } £10(\text{adverse})}} \end{aligned}$$

Usage variances are essentially controllable, they arise within the operation of the organization. Careless storage, causing spillage or deterioration, careless usage causing wastage, failure on final test causing scrapping, or even poor quality material bought are all examples of the causes of adverse usage variances. Typically, there will often be a sizeable favourable price variance, and because the quality of the material was below specification resulting in scrapping during the manufacturing process, there will be a high adverse usage variance. Quality of labour may influence the usage variance. If the labour is unskilled and inexperienced, or even downright careless, it may waste large quantities of material by dropping it on the floor, excessive use in the manufacture, or general abuse.

As a test check, the two variances can now be combined into the direct material total variance

Substituting in the formula above:

$$\begin{aligned} & (200 \times 25p) - (240 \times 35p) \\ & = 50 - 84 \\ & = -34 \text{ i.e. } \underline{\underline{£34 \text{ adverse}}} \text{ (the } £10 \text{ + the } £24) \end{aligned}$$

### ***Direct material mix variance***

Sometimes it is necessary to analyse the usage variance even further into *mix* and *yield variances*. This is appropriate when there is a mix of

ingredients going into a manufacturing process, and where it is required to measure what comes out of the process compared with what was put in. Although these variances are beyond the scope of this book we include the definitions purely for completeness. The difference between the total quantity in standard proportion, priced at the standard price and the actual quantity of material used priced at the standard price.

Formula:

$$\frac{\text{Actual quantity in standard mix proportions} - \text{Actual quantity in actual mix}}{\text{Standard price}}$$

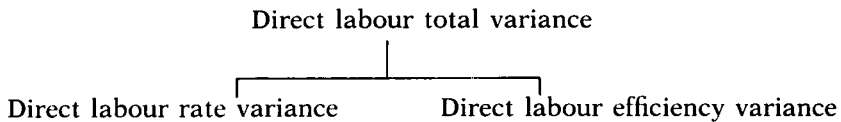
### **Direct material yield variance**

The difference between the standard yield of the actual material input and the actual yield, both valued at the standard material cost of the product.

Formula:

$$\frac{\text{Standard yield of actual input} - \text{Actual yield of input}}{\text{Standard material cost per unit of output}}$$

## **Direct labour variances**



The direct labour total variance is defined as 'the difference between the standard direct labour cost and the actual direct labour cost incurred for the production achieved'.

Formula:

$$\frac{\text{Standard direct labour hours produced} \times \text{standard rate per hour} - \text{Actual direct labour hours worked} \times \text{actual rate per hour}}$$

The important point to emphasize here is the hours worked, actually booked to the job, batch or process are compared with the actual standard hours produced at the end of the programme of work.

### **Direct labour rate variance**

This is defined as 'the difference between the standard and the actual direct labour rate per hour of the total hours worked/paid'.

Formula:

$$\frac{\text{Standard rate per hour} - \text{Actual rate per hour}}{\text{Actual hours worked/paid}}$$

**Example 10.2**

Suppose the standard was 100 direct labour hours at an hourly rate of £4.00 per hour. Actual results were 110 hours worked, but the operatives were paid at a rate of £3.85.

Substituting in the formula above:

$$\begin{aligned} & (4 - 3.85) \times 110 \\ &= (0.15) \times 110 \\ &= \underline{\underline{£16.50 \text{ favourable}}} \end{aligned}$$

Labour rate variances, like material price variances, need not arise if standards are based on the rates negotiated. Timing of negotiations and standard setting may preclude this situation, and it is thus important to always identify the difference between the standard rate and the agreed settled rate. Traditionally, the Chartered Institute had a formal title and definition for this variance, calling it the 'wage rate revision variance'. Something akin to this idea is still retained in the concept of the revision variance. Even so in the classic treatise on *Budgetary Control and Standard Costing* (1950) the then ICWA advocated that standards should be set on the basis of union agreed rates.

Other causes might be the need for overtime, the use of labour that is paid at a different rate, or the need for special allowances.

**Direct labour efficiency variances**

This is defined as 'the difference between the standard hours for the actual production achieved and the hours actually worked, valued at the standard labour rate'.

Formula:

$$\frac{(\text{Standard hours produced} - \text{actual hours worked}) \times \text{Standard rate per hour}}$$

Thus using the data from above:

$$\begin{aligned} & (100 - 110) \times 4 \\ &= (-10) \times 4 \\ &= \underline{\underline{£40 \text{ (adverse)}}} \end{aligned}$$

Efficiency variances can arise from lack of experience in the labour force, causing the job to take longer, or more rejects to be produced. Equally, inadequate materials could cause breakages in the manufacturing process causing fewer produced hours to be generated for the actual hours worked. This point emphasizes the need to correctly assign the cause of a variance, in order to take the correct action.

It should be noted at this juncture that an additional variance called the idle time variance may be introduced here. Idle time is defined by the British Standard BS 5191 as 'the period of time for which a work station is available for production but it is not utilized due to a shortage of tooling, material, operators etc.'. The *Terminology* also introduces the



idea of *waiting time* which is 'the period of time for which an operator is available for production but is prevented from working by shortage of material or tooling, or even a machine breakdown'. Whatever the cause, the result is invariably time paid for which is unproductive. The context of idle and waiting time can be seen from the simple illustration below:

- Hours clocked: What an operative is actually paid for while he is on site.  
Deduct hours spent idle/waiting and hours spent indirect work e.g. setting, maintenance etc.
- Hours worked: Hours worked on the job.
- Hours produced: The standard measure of good output achieved.

The labour rate variance is based on the clocked hours, purely the differential in rates.

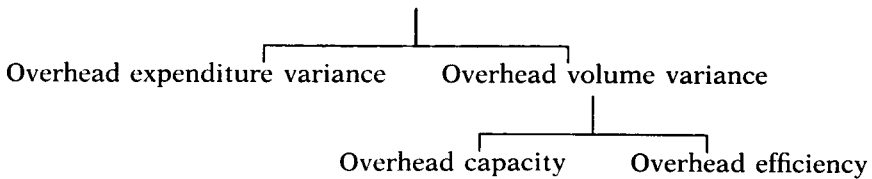
The efficiency variance is based on hours produced – hours worked. The difference between hours clocked/paid and hours worked will form the *idle time variance*.

From the figures worked out, we can now identify the direct labour total variance. Substituting in the formula above:

$$\begin{aligned}
 &(100 \times 4) - (110 \times 3.85) \\
 &= 400 - 423.5 \\
 &= \underline{\underline{\pounds 23.50 \text{ (adverse)}}} \text{ i.e. } \pounds 16.50 - \pounds 40.00 = -23.50
 \end{aligned}$$

### Overhead variances

Overhead total variance (actual expenditure – overhead absorbed)



Essentially, what is being measured here is the absorption of conversion overhead out of the conversion overhead expense control account into work-in-progress. To that end, the total conversion overhead expenditure, under normal circumstances should be totally absorbed through the overhead absorption rate. i.e. Expenditure should equal absorption. (See Figure 10.1.)

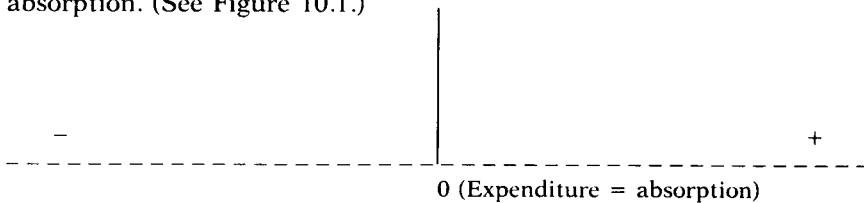


Figure 10.1

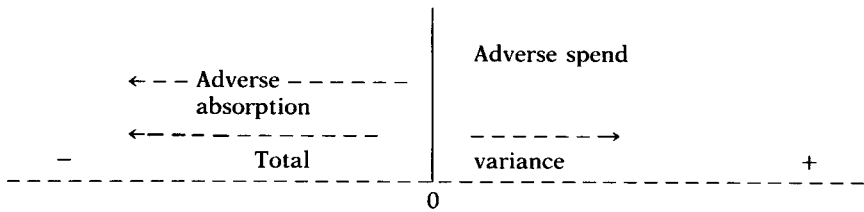


Figure 10.2 (expenditure = absorption)

Reality usually means that there are variances, usually in the form of overspends and/or under absorptions, creating a situation as shown in Figure 10.2.

Figure 10.2 envisages the worst possible situation, an overspend on the conversion overheads, coupled with an under absorption of overheads.

As we saw in the chapter on the elements of cost, it is necessary to use some form of absorption rate to get the expenses out of the control account into work-in-progress. This is the basis for the *overhead absorption rate* (OAR) which is based on:

$$\frac{\text{Budgeted overhead expenditure}}{\text{Standard hours to be produced}}$$

### **Overhead expenditure variance**

This is defined as 'the difference between budgeted and actual overhead expenditure'. The *Terminology* recognizes that it is possible that overheads will be split between variable (activity related) and fixed (time related) but for the purposes of illustrating, we shall assume all overheads to be fixed. In this we are following most organizations who recognize that most conversion overheads are in fact time related rather than activity related, and that if there are any activity related overheads, then they are usually a small proportion of the total conversion costs.

The formula is:

$$\text{Fixed overhead budgeted} - \text{Actual fixed overhead incurred}$$

The overhead volume variance is STD hours produced – budgeted hours × FOAR and can be analysed into:

*Fixed overhead efficiency variance*

Formula:

$$(\text{Standard hours produced} - \text{Actual hours worked}) \times \text{FOAR}$$

*Fixed overhead volume capacity variance*

Formula:

$$(\text{Budgeted hours} - \text{Actual hours worked}) \times \text{FOAR}$$

*Variable overheads*

The total variable overhead variance is:

(Standard hours produced × VOAR) – Actual cost

Where appropriate the definitions for variable overhead variances are:

*Variable overhead expenditure variance*

Formula:

(Actual hours worked × VOAR) – Actual cost

*Variable overhead efficiency variance*

Formula:

(Standard hours produced – Actual hours worked) × VOAR

To help with the understanding and appreciation of these variances, we will now talk through a detailed practical example.

*Example 10.3*

Assume an organization has the following budget data:

Budgeted overhead = £288,000 p.a. over 48 weeks = £6,000 per week

Budgeted production = 96,000 units p.a. over 48 weeks = 2000 units per week.

Actual output for the week under review 2020 units, and the actual overhead cost was £6,200.

In addition, we are told that the standard time per unit is 2 hours, and that the actual hours worked during the week was 4200. Overhead is to be absorbed on a *labour hours produced* basis.

From the data supplied, we are required to compute the variances.

*Approach:*

First it is necessary to compute what would be the absorption rate, i.e. the rate at which the production or conversion overhead would be absorbed. This is calculated on the basis of

$$\text{Overhead absorption rate} = \frac{\text{Budgeted cost}}{\text{Units of output (be it hours or units)}}$$

In this example, the figures are:

$$\frac{£288,000}{(96,000 \times 2)} = \underline{£1.50} \text{ per hour}$$

Then we can turn to the individual variances:

*Fixed overhead expenditure variance:*

Remember the formula is *Fixed overhead budgeted – Actual Fixed overhead incurred*. Thus for our example, 6,000 – 6,200 = £200 (adverse)

Overhead volume variance is divided into *efficiency* and *volume capacity*.

*Overhead efficiency:*

(Standard hours (or units) of production achieved – Actual hours taken (or units produced)) × Fixed overhead absorption rate

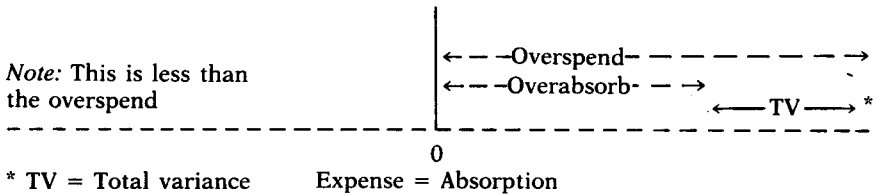


Figure 10.3

In our example, substituting in the formula:

$$((2,020 \times 2) - 4,200) \times 1.50 = \underline{\pounds(240)} \text{ adverse}$$

The adverse variance essentially arose because more hours were taken than specified.

*Overhead volume capacity:*

$$(\text{Budgeted hours} - \text{Actual hours worked}) \times \text{FOAR}$$

and substituting:

$$((2,000 \times 2) - 4,200) \times 1.50 = \pounds300 \text{ favourable}$$

It will be readily appreciated that the two variances add back to the total volume variance above. i.e.  $(240) + 300 = 60$  favourable.

We are now in a position to identify the overhead total variance. To help clarify the definition and formula, let us return to the diagram (see Figure 10.3).

From Figure 10.3, it is obvious that the definition of the overhead total variance is 'the difference between the standard overhead absorbed for the production achieved, and the actual overhead cost incurred'. (*Terminology* definition modified.)

Substituting in the formula we get:

$$(2,020 \times 2 \times 1.5) - 6,200 = \underline{\pounds140} \text{ i.e. } 60 - (200) = \pounds140 \text{ adverse}$$

From Figure 10.3 we must also recognize one important point when calculating variances and deciding whether they are adverse or favourable. Up to now, we have suggested that the standard comes first, so that if actual is greater than standard then the variance is adverse. However, with overhead *volume absorption variances*, because there have been more hours worked than expected, actual greater than standard is favourable. As a result this variance, like sales variance, is the reverse of all other variances. It is easy to remember since absorption, like sales, is a credit to the control account.

For completeness, now let us talk through a simple example involving variable production overheads.

#### Example 10.4

From the data used in Example 10.3 let us assume that:

Budgeted Variable overhead is £192,000 per annum and the actual variable overhead cost for the week under review was £3,950.

Using the hours basis of absorption we get *variable overhead expenditure variance* which is:

$$(\text{Actual hours} \times \text{VOAR}) - \text{Actual cost}$$

Substituting:

$$(4,200 \times 1) - 3,950 = \underline{\text{£250 favourable}}$$

Note:

$$\text{VOAR} = \frac{\text{Budgeted cost}}{\text{Budgeted hours produced}} = \frac{192,000}{96,000 \times 2} = \text{£1/hour}$$

The reason why this variance is based on actual hours should be obvious. We are trying to compare what was *actually spent* with what variable costs *should have been incurred* as a result of that actual level of hours of work or operation. And for the variable overhead efficiency variance we get:

$$(\text{Standard hours produced} - \text{Actual hours worked}) \times \text{VOAR}$$

and substituting:

$$((2,020 \times 2) - 4,200) \times 1 = \underline{\text{£(160) adverse}}$$

This gives a total variable overhead variance of:

$$250 - (160) = \underline{\text{£90 favourable}}$$

### ***The impact of volume on overhead***

The current edition of the *Terminology*, in defining the overhead volume variance introduces the term 'flexed budget allowance'. To understand what is implied here, we must revise the definition of flexed budgets. A flexible budget is one which, 'by recognizing the differences in behaviour between fixed and variable costs in relation to fluctuations in output, turnover, or other variable factors such as the number of employees, is designed to change appropriately with such fluctuations'. Put more simply, it recognizes that to obtain valid variance analysis, the standards should recognize that change in volume will affect the variable costs.

To illustrate the point, we shall assume that in Example 10.3 all the conversion overheads were variable. This means that the conversion overhead budget flexes up to allow for the additional 20 units (40 hours) of output.

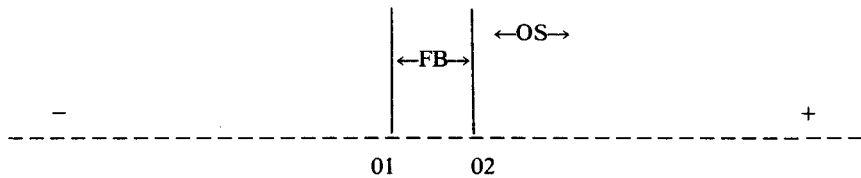
Formula:

$$(\text{Actual hours produced} \times \text{standard rate}) - \text{Variable overhead}$$

Substituting:

$$(2,020 \times 2 \times 1.5) - 6,200 = \underline{\text{£140 (adverse)}}$$

Expressed in terms of the diagram – Figure 10.4.



- 01 = Original budget expense = absorption  
 02 = Flexed budget, (FB) increased to allow for increased level of activity.  
 OS = Amount still overspent against the flexed budget

Figure 10.4

Advocates of the flexed budgeting approach point to the fact that it is spend against real activity, i.e. current standards of performance and as such highlights or draws attention to the real problems of variances, in this case, despite the improved activity level, conversion overheads are still out of control.

### ***Causes of overhead variances***

Obviously, if there is a shortfall in activity, whether on fixed costs or variable, there will be an under absorption. If labour produced hours are used as the basis of absorption, then the causes of the labour inefficiency will have a further impact on overhead absorption, thus 'compounding the felony'. (See Inman 1985.) The reader will, however, appreciate that this is part of the cost of strikes, in that the downing of tools by workers reflects in the non-absorption of overhead burden.

On the expense side, there will be the impact of overhead expenses such as indirect staff or labour, inflated energy costs, inflated communication costs, or a change in depreciation, due to a change in machinery used can all have their impact on the spend side of the conversion overhead control account.

### **Reporting on variances**

The object of variance analysis is to present to management a detailed analysis of the variances that have arisen and to demonstrate their impact on profit. It is normal for all variances to go through the double entry to the costing profit and loss account, and hence to the financial profit and loss account. Figure 10.5 illustrates the way in which this might be presented.

To assist in our understanding of the theory already discussed, we will now work through a detailed example.

#### *Example 10.5 (Detailed example)*

Fischer Ltd manufactures a range of chess sets and operates a standard costing system. Information relating to the Spassky design for the month of March is as follows:

- 1 Standard cost per 100 sets  
 Raw materials:  
 Plaster of Paris: 20kg @ £8 per kg £160  
 Paint: ½ litre @ £30 per litre 15  
 Direct wages: 2½ hours @ £10 per hour 25  
 Fixed production overhead: 400% of direct wages. 100  
 Total cost £300
- 2 Standard selling price per set £3.80.
- 3 Raw materials, work-in-progress and finished goods are maintained at standard cost.

*Profit and loss account in variance form (based on the Trician Trading example in Chapter 8)*

|                             | £k             |
|-----------------------------|----------------|
| Sales                       | 2,812          |
| Standard cost of sales      | <u>(1,241)</u> |
| Gross standard profit       | 1,571          |
| <i>variances*</i>           |                |
| Direct material: Price (40) |                |
| Usage (16)                  |                |
| Total →                     | (56)           |
| Direct labour: Rate (20)    |                |
| Efficiency (8)              |                |
| Total →                     | (28)           |
| Overhead: Expense (40)      |                |
| Efficiency (8)              |                |
| Volume** (7)                |                |
| Total →                     | <u>(55)</u>    |
| Actual gross profit***      | <u>£1,432k</u> |

*Notes:*

- \* Any sales variances would also be included at this stage.
- \*\* This assumes that a flexible budgeting system is in progress.
- \*\*\* Some organizations control their selling, distribution and even administration overhead by a system of recoveries against goods sold. This is achieved by assuming certain percentages for each activity in the price build up, which are then deducted in the detailed analysis of the cost of sales. It is complicated, and based on subjective estimations, but it has the advantage of establishing some form of control over the non-conversion activities.

Figure 10.5

- 4 Stock levels at the beginning and end of March were as follows:
 

|                  | <u>1 March</u> | <u>31 March</u> |
|------------------|----------------|-----------------|
| Plaster of Paris | 2800 kg        | 2780 kg         |
| Paint            | 140 litres     | 170 litres      |
| Finished sets    | 900            | 1100            |
- 5 Budgeted production and sales during the month were 30,000 sets.

Actual sales, all made at the standard selling price, and actual production were 28,400 and 28,600 respectively.

- 6 Raw materials purchased during the month were 5400 kg of plaster of paris at a cost of £43,200 and 173 litres of paint at a cost of £5,800.
- 7 Direct wages were 730 hours at an average rate of £11 per hour.
- 8 Fixed production overheads amounted to £34,120.

You are required to prepare for the month of March:

- 1 The cost ledger accounts for raw materials, work-in-progress and finished goods.
- 2 (a) A budgeted trading statement.  
(b) A standard cost trading statement.  
(c) A financial trading statement.  
(d) A reconciliation between these statements identifying all the relevant variances.

*Source: CIMA*

*Approach:*

This question has the advantage that it will help us to see how the standard costs will fit into the double entry system, in preparation for our consideration of the integrated accounting chapter.

Initially, however, we need to calculate the variances from the information provided. This will also be of use to the student reader, since he will not encounter 'text book style' variance computations in the working environment, and frequently, not in the examination either.

*Material price variances:*

|                  | <i>Standard price</i><br><i>(purchases × standard)</i> |   | <i>Actual price</i> |   | <i>Variance</i> |
|------------------|--|---|---------------------|---|-----------------|
| Plaster of paris | (5,400 × 8)  | – | 43,200              | = | 0               |
| Paint            | (173 × 30)   | – | 5,800               | = | (610)           |

*Material usage variances:*

|                  | <i>(Standard – Actual) ×</i> |  | <i>Standard price</i> |   | <i>= Variance</i> |
|------------------|------------------------------|--|-----------------------|---|-------------------|
| Plaster of paris | (5,720 – 5,420) ×            |  | 8                     | = | 2,400             |
| Paint            | (143 – 143) ×                |  | 30                    | = | 0                 |

Writing up the cost ledger accounts, we now have:

*Raw materials: plaster of Paris*

|                | kg    | £      |               | kg    | £      |
|----------------|-------|--------|---------------|-------|--------|
| Balance b/f    | 2,800 | 22,400 | Issued to WIP | 5,720 | 45,760 |
| Purchases      | 5,400 | 43,200 |               |       |        |
| Usage variance | 300   | 2,400  | Balance c/f   | 2,780 | 22,240 |
|                | 8,500 | 68,000 |               | 8,500 | 68,000 |



*Raw materials: paint*

|             | litres | £      |                | litres | £      |
|-------------|--------|--------|----------------|--------|--------|
| Balance b/f | 140    | 4,200  | Issued to WIP  | 143    | 4,290  |
| Purchases   | 173    | 5,800  | Price variance |        | 610    |
|             |        |        | Balance c/f    | 170    | 5,100  |
|             | 313    | 10,000 |                | 313    | 10,000 |

It is worth noting at this stage the accounting entries for the variances. The variance itself goes to the profit and loss account, as shown in the diagram above. The double entry is:

**Favourable variance:**

Debit stock account (as in the case of the plaster) credit the profit and loss.

**Adverse variance:**

Debit the profit and loss, credit either the purchases or stock account (as in the case of the paint above).

Before we write up the work-up-progress ledger, we now need to calculate the labour variances.

|                   | Standard    | Actual | Quantity | Variance |
|-------------------|-------------|--------|----------|----------|
| Labour rate       | (10 - 11)   | ×      | 730      | (730)    |
| Labour efficiency | (715 - 730) | ×      | 10       | (150)    |

Direct labour total variance  $\longrightarrow$  (880)

Since overhead is recovered on the basis of 400 per cent of direct wages, to maintain the control element, this must be regarded as 400 per cent of direct wages paid for good work produced, i.e. direct wages net of variances.

Since 28,600 sets were produced, this represents a standard labour cost of:

28,600

$100 \times 2\frac{1}{2} \times \text{£}10 = \text{£}7,150$ , not the  $\text{£}8,030$  actually paid to the operatives.  
 $\text{£}7,150 \times 4 = \text{£}28,600$  of overhead recovered.

The ancillary 'T' accounts are as follows:

*Direct labour control account*

|                      |         |                         |         |
|----------------------|---------|-------------------------|---------|
| Direct wages paid    | £ 8,030 | Standard hours produced | £ 7,150 |
| (Cash Book 730 × 11) |         | (28600/100 × 2½ × 10)   |         |
|                      |         | Direct wages variances  | 880     |
|                      | £8,030  |                         | £8,030  |

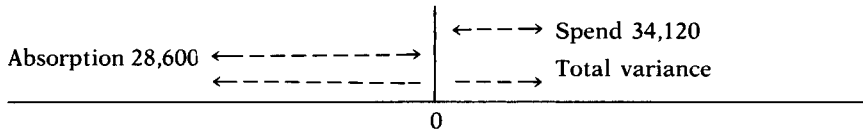


Figure 10.6

*Overhead expense control account*

|               |        |                  |        |
|---------------|--------|------------------|--------|
|               | £      |                  | £      |
| Expenses paid | 34,120 | Work-in-progress | 28,600 |
|               |        | Variences:       |        |
|               |        | Expenditure      | 4,120  |
|               |        | Volume           | 1,400  |
|               | 34,120 |                  | 34,120 |

To show how the overhead variances were calculated, let us again look at the model. (See Figure 10.6.)

Budget =  $(30,000/100 \times 2.5 \times 10 \times 4) = 30,000$

Calculations:

Expenditure variance = Budget – actual  
 = 30,000 – 34,120  
 = (4,120) (adverse)

Volume = Production achieved – budget  
 =  $\left[ \frac{28,600}{100} \times 2.5 \times 10 \times 4 \right] - 30,000$   
 = (1,400) (adverse)

*Work-in-progress*

|                   |        |  |        |
|-------------------|--------|--|--------|
|                   | £      |  | £      |
| Materials         |        | Finished goods                                 |        |
| Plaster of Paris  | 45,760 | $\left[ \frac{28,600}{100} \times 300 \right]$ |        |
| Paint             | 4,290  |  | 85,800 |
| Wages paid        | 7,150  |  |        |
| Overhead absorbed | 28,600 |  |        |
|                   | 85,800 |  | 85,800 |

*Finished goods*

|             |        |        |               |        |        |
|-------------|--------|--------|---------------|--------|--------|
|             | sets   | £      |               | sets   | £      |
| Balance b/f | 900    | 2,700  | Cost of Sales | 28,400 | 85,200 |
| WIP         | 28,600 | 85,800 | Balance c/f   | 1,100  | 3,300  |
|             | 29,500 | 88,500 |               | 29,500 | 88,500 |

The four 'T' accounts, i.e. for raw materials, work-in-progress and finished goods, are the four cost ledger accounts required by the question. The additional material was just part of the essential workings.

The importance of these essentially preliminary calculations will be more apparent as we move on to the second part of the question.

(a) *Budget trading statement:*

|                               |                 |
|-------------------------------|-----------------|
| Sales 30,000 sets @ 3.80      | £114,000        |
| Less                          |                 |
| Standard cost per set (£3.00) | <u>(90,000)</u> |
| Budgeted gross profit         | <u>£24,000</u>  |

(b) *Standard cost trading statement:*

|                                   |                 |
|-----------------------------------|-----------------|
| Actual sales: 28,400 sets @ £3.80 | £107,920        |
| Less 28,400 sets @ £3.00          |                 |
| Standard cost of sales            | <u>(85,200)</u> |
| Standard profit for actual sales  | <u>£22,720</u>  |

(c) *Financial trading statement:*

(This will include the financial cost of all the transactions involved.)

|                            |                 |                |                 |
|----------------------------|-----------------|----------------|-----------------|
| Actual sales               |                 |                | £107,920        |
| Cost of sales              |                 |                |                 |
| Raw materials:             | Plaster         | Paint          |                 |
| Opening stock              | 22,400          | 4,200          |                 |
| Purchases                  | 43,200          | 5,800          |                 |
| Closing stock              | <u>(22,240)</u> | <u>(5,100)</u> |                 |
|                            | 43,360          | 4,900          | -----→ (48,260) |
| Direct wages               |                 |                | (8,030)         |
| Production overheads       |                 |                | (34,120)        |
| Movement of finished goods |                 |                |                 |
| Opening stock              |                 | 2,700          |                 |
| Closing stock              |                 | <u>(3,300)</u> | -----→ 600      |
| Gross profit               |                 |                | <u>£18,110</u>  |

(d) *Reconciliation statement*

|  |                |
|--|----------------|
| Budgeted profit ((a) above)  | £24,000        |
| *Profit lost by virtue of sales volume shortfall ((a) – (b) above) | (1,280)        |
| Manufacturing cost variances (from the 'T' accounts above)         |                |
| Raw materials:   |                |
| Price  | (610)          |
| Usage  | 2,400          |
| Direct labour:   |                |
| Rate   | (150)          |
| Efficiency   | (730)          |
| Fixed production overhead:   |                |
| Expense  | (4,120)        |
| Absorption   | <u>(1,400)</u> |
| Actual profit ((c) above)  | <u>£18,110</u> |

\* This is essentially the sales volume variance which is beyond the scope of the CIMA Stage 2 syllabus.

As a final aid to help clarify the variances and the accounting entries in the mind of the student, we offer a simple diagram.

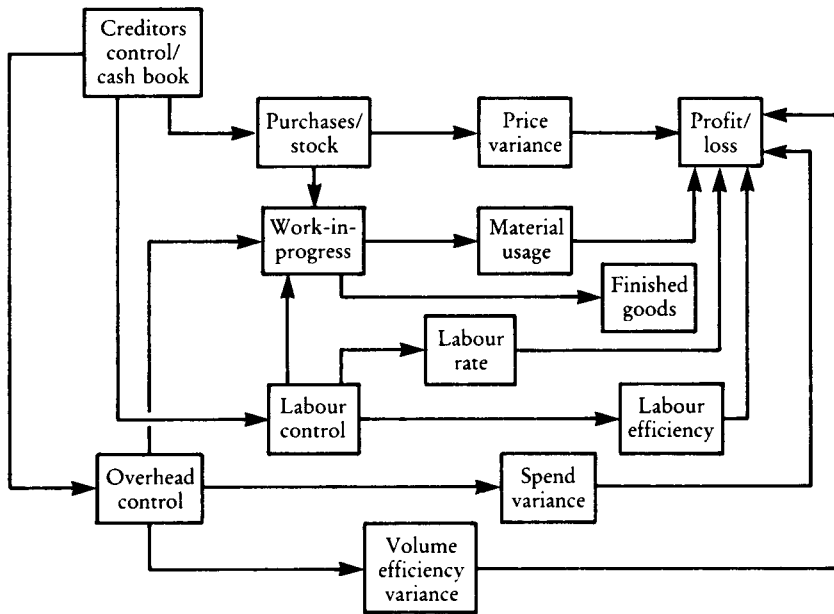


Figure 10.7 *Accounting entries associated with variance computation*

### Investigation of variances

Having completed what appears to be a very long winded exercise, there is the requirement to investigate the causes of the variances, in order to ensure that adverse variances are either checked and/or prevented from recurring, and any benefits that can accrue from favourable variances can be capitalized upon. We have already suggested some of the possible causes of variances, since the possible significance of the variance itself will be important.

Good analysis can only be learned from developing an inquiring mind and experience. Equally, an overriding principle of variance analysis should be its cost benefit. Just as the physical calculation of all the variances is costly, so is the investigation. It is dangerously tempting to shrug such costs off as fixed costs, but excessive time consuming 'nth degree' analysis is bad stewardship of the fixed overhead burden if it does not produce effective action of adverse variances quickly. Another viewpoint would be the opportunity cost aspect, since variance analysis diverts an analyst away from possibly more profitable uses of his/her time.

In selecting variances, therefore, for investigation, the auditing terms materiality and significance need to be brought in, along with consideration of how the variance may have arisen. In principle, Arnold and Hope make two recommendations, first to consider the variance in

the context of the total cost and sales price (materiality). Second to consider the application of statistical analysis to the selection of variances to be investigated.

### Selection of a variance to be investigated

From our knowledge of the standard setting process, we know that many standards are derived from observed means or modes. For example, if a routine job is timed, there will be a variety of different readings around the mean. The standard, with due consideration to allowances, will be based on that mean or mode. In this context, and in a controlled situation, therefore, actuals which generate variances will plot normally around the mean which has been taken as the standard.

Using our knowledge of standard deviations and normal distributions we can thus observe the following procedure. In Example 10.5 we saw that the material price variance of the paint was  $5,800 - (173 \times 30) = \text{£}160$  adverse. Equally, the labour rate variance was  $\text{£}1.00$  per hour. Is it worth investigating?

Taking the material first, the standard was  $\text{£}30.00$  and when we established that standard, the standard deviation ( $\sigma$ ) was 4. Now, applying the formula:

$$\frac{\text{Actual unit cost} - \text{Standard unit cost}}{\text{Standard deviation}}$$

we get:

$$\frac{\frac{[5,800]}{173} - 30}{4} = \underline{0.88}$$

This means that the variance was within 1 standard deviation above the standard. By using normal probability tables, we find that the probability of such a variance (or larger) occurring is 0.1894, or that the probability of the actual cost being that high is about 19%. Management must then establish guidelines to see if this event is sufficiently frequent or likely to justify a costly investigation.

In the case of the labour, let us assume that the standard deviation in this case was  $\text{£}0.50$ . (This is not as fanciful as it may sound since the question did say 'average labour rates'.) Again applying the simple formula, we get:

$$\frac{11 - 10}{0.5} = \underline{2}$$

Referring to the tables, we find that the probability of the direct labour rate being twice the standard deviation from the mean or standard is 0.02275, or just over 2.2%. Clearly, this is something that needs to be investigated.

In selecting variances to be investigated, the first stage is to eliminate

any variances that are uncontrollable. The paint variance above may well fall into that category, while the labour rate, which may have been due to the need for overtime, will come into the category of controllable. Investigations of such variances should then lead to a cost benefit either by capitalizing on a favourable variance, or stopping an unfavourable one. As an aid to selecting such variances, Bierman, Fouraker and Jaedicke (1977) have developed a model. In essence, this model is represented by the following equations:

$C < L(1 - P)$  investigate

$C > L(1 - P)$  do not investigate

where  $C$  = cost of the investigation

$L$  = the present value of the future cost savings

$P$  = the probability of the variance

It is beyond the scope of this text and this level of the CIMA syllabus to go into great detail on this topic, but using the data already calculated, we can see at least what limit we should set on the cost of investigating the two variances identified above. Assuming that the cost of the investigation in each case is 50p per unit, either per litre of paint, or hour of labour, then:

For the paint  $0.50 \approx L(1 - 0.1894)$

$\approx L(0.8106)$

$L \approx (0.50 \div 0.8106) = 0.6168.$

Since from this very rough estimate, the indications are that the savings will exceed the cost of the investigation, then the investigation should be conducted. For the direct labour the value of  $L$  comes to 0.5116, which makes the returns on the investigation very marginal indeed, and the investigation will not prove very worthwhile. It should be noticed here that although the variance was quite significant, the deciding factor was the cost of the investigation, not how large the variance was. Such a situation might call into question whether or not the cost accounting function itself is too costly for the operation within which it finds itself.

### **Ratio analysis and variances**

Recent writers on cost accounting (e.g. Ian Mearns 1980) and control systems (Roche 1982) have introduced readers and students in particular to the use of ratios to reinforce the variance analysis. Although there are instances where organizations have abandoned traditional standard costing for control by ratios, and other situations where traditional variance analysis may be inappropriate, these ratios are regarded here as ancillary to the variance analysis process. Even so, it should be noted that some of these ratios have been used in manufacturing for many years, and they are now included in the *Terminology*.

$$\text{Efficiency ratio} = \frac{\text{Standard hours of actual production achieved}}{\text{Actual number of direct working hours}}$$

Usually expressed as a percentage, this ratio measures the efficiency of the direct labour. In the context of Example 10.5, 715 hours were produced, and 730 hours worked. The efficiency ratio was thus  $(715/730 \times 100)$  i.e. 97.95%.

$$\text{Activity ratio} = \frac{\text{Actual production in standard hours}}{\text{Budgeted standard hours}}$$

For Example 10.5, the budget was 750 hours, thus this ratio was  $(715/750 \times 100) = \underline{95.33\%}$ .

Capacity ratios are described by the *Terminology* as a combination of ratios used to state the volume levels of production capacity. Full capacity, practical capacity, budgeted capacity and idle capacity are all identified. Budgeted capacity is perhaps the most meaningful, since it takes cognisance of the fact that the standard hours planned for the period are a function of budgeted sales, production, and the availability of supplies and operatives.

$$\text{Budgeted capacity ratio} = \frac{\text{Actual hours spent producing work}}{\text{Budgeted standard hours}}$$

This is the 730 worked hours as a percentage of the 750 budgeted hours i.e. 97.33%.

The reader will readily appreciate that this ratio is meaningless in isolation, since it reflects worked hours, and it is produced hours that are the hours that are essential to performance. Roche points out that efficiency ratio  $\times$  budgeted capacity ratio = activity ratio i.e. from the data above  $97.95 \times 97.33 = \underline{95.33}$ .

$$\text{Calendar ratio} = \frac{\text{Actual number of working days in a period}}{\text{Number of working days in the relative budget period}}$$

This ratio presupposes that budgets are phased on calendar working days, and that figure just might be different from the number of actual working days. The pragmatic cost accountant knows this to be a nonsense, and notes that this ratio, plus any references to calendar variances, has been removed from the *Terminology*. Most budgets are phased on the number of working days in a production period, taking into account statutory holidays, annual shut downs, local shut downs, and any other reason why the plant(s) should not be working on an otherwise working day.

In the context of capacity usage Roche identifies standard capacity usage ratio as:

$$\frac{\text{Budgeted number of working hours}}{\text{Maximum possible number of working hours in the same period}}$$

and actual capacity usage ratio as:

$$\frac{\text{Actual number of working hours}}{\text{Maximum possible number of working hours in the same period}}$$

Clearly, the reference to maximum possible number of working hours is rather theoretical, since in reality, irrespective of what a plant might be able to achieve in an ideal situation, this is meaningless in the context of what a plant has budgeted to achieve, and what it has orders for.

Two useful ratios that are included in the *Terminology* in the context of labour utilization and performance are:

$$\text{Direct hours yield} = \frac{\text{Direct hours worked} \times 100}{\text{Available hours of direct workers}}$$

This ratio measures the effectiveness with which nominated direct workers are employed on direct work. It is *not* an efficiency ratio as such, but identifies the proportion of the headcount who actually are involved in achieving the direct objectives of the organization, rather than engaged in ancillary activities. Taken over the total headcount, it could be quite frightening!

$$\text{Diverted hour ratio} = \frac{\text{Diverted hours} \times 100}{\text{Available hours of direct work}}$$

This ratio highlights the hours that nominated direct workers spend away from direct work, i.e. on maintenance work or even capital projects.

As a final thought, the student might like to consider the situation where control is based on identifying key ratios that are close to the organization's primary objectives. For example, if improved productivity is such an objective, operational day-to-day control may be manifest on the basis of key productivity ratios. The electronics industry favours output per square metre of floor space, while retailers think in terms of sales/contribution per square metre.

## Questions

- 1 D Limited currently makes and sells only one product but a new additional product is contemplated for July. An extract from the standard cost of the existing product is given below, together with other relevant details for Period 3.

|                               |                              |
|-------------------------------|------------------------------|
| Direct material:              | 3½ metres at £12 per metre   |
| Direct labour:                | 4 hours at £4.40 per hour    |
| Variable production overhead: | £2.75 per direct labour hour |

The company absorbs variable production costs on the basis of standard hours of production and operates its variance analysis on marginal costing principles.



Production: 2400 units equivalent to 9600 standard hours of production

Direct material: Opening stock 5000 metres  
 Closing stock 8000 metres  
 Purchases – 5000 metres at £11.50 per metre  
 6500 metres at £12.20 per metre

Direct wages incurred were £47,500 for 10,000 hours worked.

Variable production overhead incurred: £28,500.

You are required to:

- (a) State who would be involved (job titles) and the part that each would play in establishing a labour cost standard for the additional new product to be manufactured. (5 marks)
- (b) Calculate variances for material, labour and variable overhead which would be useful to management. (10 marks)
- (c) Identify to which of the variances calculated in (b) above, the following statements refer and comment briefly whether the explanation could be acceptable:
  - (i) 'Normally the buyer purchases at list price less 20% but because the quantity ordered was greater than usual, the price was list price less 25%.'
  - (ii) 'The flow of work was much better following the appointment of an additional production supervisor.'
  - (iii) 'Higher wage costs resulted in higher employer's National Insurance contributions.'
  - (iv) 'The wastage rate allowed for in the standard was exceeded.'
  - (v) 'An expected increase of 10% over the previous year's rate of pay had actually been 15%.' (10 marks)

*CIMA*

- 2 The information shown below is an extract from the previous period's budget and standard cost data for the machining department in a company manufacturing two products and which operates a full absorption standard costing system.

|  | <i>Product X</i> | <i>Product Y</i> |
|--|------------------|------------------|
| Budgeted production  | 6,500 units      | 4,200 units      |
| Standard machine hours allowed to process each product in the machining department | 4 hours          | 7 hours          |

The department's overhead is applied to production by means of a standard machine hour absorption rate and this is calculated at the beginning of each period. The variable element of the previous period's absorption rate was £1.50 per standard machine hour and the department's total overheads for that period were budgeted to

be £207,750. The budget assumes that one standard machine hour should be produced in one actual hour of machining time.

The actual results in the machining department for the previous period were:

|                                  |              |
|----------------------------------|--------------|
| Actual machining time            | 54,000 hours |
| Production: Product X            | 7,200 units  |
| Product Y                        | 4,000 units  |
| Actual overheads incurred: Fixed | £120,550     |
| Variable                         | £87,600      |

Required:

- (a) Calculate the following variances from standard/budgeted cost which occurred in the machining department during the previous period:
  - Fixed overhead volume variance.
  - Fixed overhead expenditure variance.
  - Variable overhead expenditure variance. (10 marks)
- (b) Discuss in detail the possible reasons for the fixed overhead volume variance. (7 marks)
- (c) Calculate the machining department's total flexed overhead budget for the actual level of production in the previous period and explain the difference between this total budgeted amount and the total production overhead absorbed by the department in the period. (5 marks)  
(22 marks)

3 The assistant management accountant of your company has been preparing the profit and loss statement for the week ended 31 October. Unfortunately, he has had a traffic accident and is now in hospital, so as senior cost analyst you have been asked to complete this statement. The uncompleted statement and relevant data are shown below:

*Week ended 31 October*

|                                 |                  |                  |       |
|---------------------------------|------------------|------------------|-------|
|                                 | £                | £                |       |
| Sales                           |                  | 50,000           |       |
| Standard cost: direct materials |                  |                  |       |
| direct wages                    |                  |                  |       |
| overhead                        |                  |                  |       |
|                                 | _____            |                  |       |
| Standard profit                 |                  |                  | _____ |
| Variances                       | <i>Fav/(Adv)</i> | <i>Fav/(Adv)</i> |       |
|                                 | £                | £                |       |
| Direct materials:               |                  |                  |       |
| price                           | (400)            |                  |       |
| usage                           | (300)            |                  |       |
| total                           | _____            | (700)            |       |

|                |  |       |  |  |         |
|----------------|--|-------|--|--|---------|
| Direct labour: |  |       |  |  |         |
| rate           |  |       |  |  |         |
| efficiency     |  |       |  |  |         |
| total          |  | _____ |  |  |         |
| Overhead:      |  |       |  |  |         |
| expenditure    |  |       |  |  |         |
| volume         |  |       |  |  |         |
| total          |  | _____ |  |  |         |
| Total variance |  |       |  |  | _____   |
| Actual profit  |  |       |  |  | £ _____ |

*Standard data:*

The standard price of direct material used is £600 per tonne. From each tonne of material it is expected that 2400 units will be produced.

A forty-hour week is operated.

Standard labour rate per hour is £4.

There are 60 employees working as direct labour.

The standard performance is that each employee should produce one unit of product in three minutes.

There are four working weeks in October.

The budgeted fixed overhead for October is £76,800.

*Actual data:*

Materials issued during the week were 20 tonnes @ £620 per tonne. During the week four employees were paid @ £4.20 per hour and six were paid @ £3.80 per hour. Remainder were paid at standard rate. Overhead incurred was £18,000.

You are required to complete the profit and loss statement for the week ended 31 October. (25 marks)

*CIMA CA2 November 1986*

4 Data relating to Period 4:

| Product    | Units produced | Standard time per unit, in hours |
|------------|----------------|----------------------------------|
| Tables     | 400            | 4.0                              |
| Chairs     | 1,000          | 1.2                              |
| Wall units | 200            | 6.0                              |

|                               |         |
|-------------------------------|---------|
| Actual hours worked           | 5,600   |
| Standard wages rate, per hour | £4      |
| Actual wages incurred         | £20,160 |

You are required to:

- (a) Explain the term 'standard hour' stating why it is used and to illustrate its use by showing the total standard hours produced in Period 4.
- (b) Calculate, using the information in the data and, where appropriate, the figure from your answer to (a) above, the following variances:
- (i) Direct labour total variance.
  - (ii) Direct labour rate variance.
  - (iii) Direct labour efficiency variance.
- (c) State *two* possible causes for your answer to (b) (ii) above.
- (d) State *two* possible causes for your answer to (b) (iii) above.
- (20 marks)

*CIMA CA May 1984*

- 5 (a) A company manufactures a food product, data for which for one week have been analysed as follows:

|                                       |            |
|---------------------------------------|------------|
| Standard cost data:                   | £          |
| Direct materials: 10 units at £.150   | 15         |
| Direct wages: 5 hours at £4.00        | 20         |
| Production overhead: 5 hours at £5.00 | 25         |
|                                       | <u>£60</u> |

Other overhead may be ignored.

Profit margin is 20% of sales price.

Budgeted sales are £30,000 per week.

*Actual data:*

|                  |         |
|------------------|---------|
| Sales            | £29,880 |
| Direct materials | £6,435  |
| Direct wages     | £8,162  |

*Analysis of variances:*

|                      | <i>Adverse</i> | <i>Favourable</i> |
|----------------------|----------------|-------------------|
| Direct materials:    |                |                   |
| price                | 585            |                   |
| usage                |                | 375               |
| Direct labour:       |                |                   |
| rate                 |                | 318               |
| efficiency           | 180            |                   |
| Production overhead: |                |                   |
| expenditure          |                | 200               |
| volume               |                | 375               |

It can be assumed that the production and sales achieved resulted in no changes of stock.

You are required, from the data given, to calculate:

- (i) The actual output.
- (ii) The actual profit.
- (iii) The actual price per unit of material.

- (iv) The actual rate per labour hour.
  - (v) The amount of production overhead incurred.
  - (vi) The amount of production overhead absorbed.
  - (vii) The production overhead efficiency variance.
  - (viii) The selling price variance.
  - (ix) The sales volume profit variance.
- (b) In analysing variances, it is found frequently that an adverse variance from one standard is related directly to a favourable variance from another.

Give *two* examples of such a situation and comment briefly on each. (35 marks)

*CIMA CA2 May 1984*

- 6 A company manufactures a number of products, data for one of which are shown below:

*Standard cost:*

|                                      |                                     |
|--------------------------------------|-------------------------------------|
| Direct materials:                    | 8 units @ £2 per unit               |
| Direct labour:                       | 4 hours @ £5 per hour               |
| Production overhead:                 | 4 hours @ £6 per hour               |
| Administration and selling overhead: | 50% of production cost              |
| Profit:                              | 16 $\frac{2}{3}$ % of selling price |

*Budget for April:*

|             |            |
|-------------|------------|
| Sales:      | 5000 units |
| Production: | 5200 units |

*Actual results during April:*

|                               |                               |
|-------------------------------|-------------------------------|
| Sales:                        | 5150 units valued at £566,500 |
| Direct materials used:        | £77,040                       |
| Direct labour costs:          | £110,770                      |
| Production overhead incurred: | £122,800                      |

*Variances calculated in April:*

|                   |                                    |
|-------------------|------------------------------------|
| Direct materials: | price £8,560F<br>usage £800A       |
| Direct labour:    | rate £6,270A<br>efficiency £1,500F |

You are required to calculate:

- (a) Actual output. (8 marks)
- (b) Actual price per unit of direct material. (4 marks)
- (c) Actual rate per hour of direct labour. (4 marks)
- (d) Overhead expenditure variance. (2 marks)
- (e) Overhead volume variance. (4 marks)

(Total: 22 marks)

- 7 The analysis of cost variances brings with it the problem of deciding when to investigate a variance. Discuss this problem and describe and comment on some of the approaches that have been suggested. (10 marks)

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- 8 For a product the following data are given:

*Standards per unit of product:*

Direct material 4 kilogrammes at £0.75 per kilogramme  
Direct labour 2 hours at £1.60 per hour

*Actual details for given financial period:*

|                          |                         |         |
|--------------------------|-------------------------|---------|
| Output produced in units |                         | 38,000  |
| Direct materials:        |                         | £       |
| Purchased                | 180,000 kilogrammes for | 126,000 |
| Issued to production     | 154,000 kilogrammes     |         |
| Direct labour            | 78,000 hours worked for | 136,500 |

There was no work-in-progress at the beginning or end of the period.

You are required to:

- (a) Calculate the following variances:
- Direct materials cost.
  - Direct materials price, based on issues to production.
  - Direct materials usage.
  - Direct wages cost.
  - Direct wages rate.
  - Direct labour efficiency.
- (b) State whether in each of the following cases, the comment given and suggested as the possible reason for the variance, is *consistent* or *inconsistent* with the variance you have calculated in your answer to (a) above, supporting each of your conclusions with a brief explanatory comment.

Item in

- (a)
- Direct materials price variance: the procurement manager has ignored the economic order quantity and, by obtaining bulk quantities, has purchased material at less than the standard price.
  - Direct materials usage variance: material losses in production were less than had been allowed for in the standard.
  - Direct wages rate variance: the union negotiated wage increase was £0.15 per hour lower than expected.
  - Direct labour efficiency variance: the efficiency of labour was commendable. (25 marks)

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## References and further reading

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# 11 Cost accounting systems

## **Introduction**

In the reading of this book, we have explored the elements of cost, cost collection and absorption, traditional cost accounting methods, cost accounting for decision making and control. It is now timely to draw it all together. This is what separates the capable accountant from the incapable, the former is essentially the one who can master the techniques, but having done so, can relate and employ the techniques at the right time to particular situations. Figure 11.1 attempts to portray this visually.

Traditionally, the view of cost accounting has begun at the top of Figure 11.1, i.e. cost collection and recording. Much of what is still required on a fiscal and statutory basis still requires that approach. However, in approaching cost accounting and cost information within a working environment, what is now fundamental is to consider the essential question of what is actually required. This approach implies a need to consider what needs to be controlled and monitored, as well as what the organization is attempting to achieve. So straightaway we move into an environment of relating what is ostensibly elementary techniques to the managerial requirements of planning and control.

## **Objectives of a cost accounting system**

While Armand Layne lists the explicit features of cost accounting as 'planning, control and profitability', and doubtless the latter is really profitability identification, and all three are associated with the management function; Pravin P. Shah has gone one stage further by listing:

- 1 *Why?* A system must be designed to meet some predetermined objective or purpose, such as cost control or inventory valuation. (See Figure 11.1.)



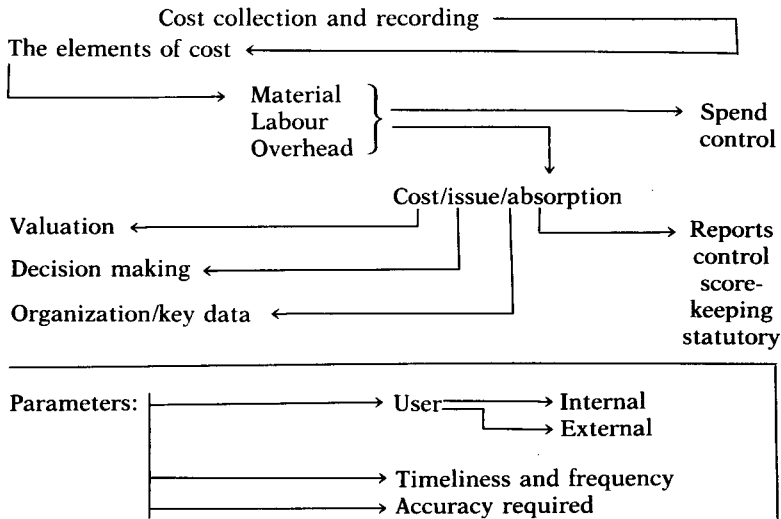


Figure 11.1

- 2 **What?** To satisfy the demand 'Why?', certain information is required. This is fundamental, since far too many systems grow 'like Topsy' with complete disregard for what is really required. Such situations frequently develop because there is no clear idea of objectives, and hence no targets or bench marks for control.
- 3 **Who?** All systems presuppose that the information is needed by a designated person. This implies a *hierarchy*, which presupposes that the 'designated person' needs the information because (a) it is essential for the performance of his job, (b) he/she is in a position to do something about the situation the information describes and (c) it is his/her responsibility to do what is required. As explained in more detail in Chapter 12, this will depend also on:
  - The recipient's position in the organizational hierarchy.
  - His/her span of control – one small unit or several large operations?
  - The amount of detail. Clearly the more areas he/she is responsible for, the less detail may be required.
  - The timing of events (4 below) and the action needed. A supervisor will need information quickly, because he/she will have to act upon it. The manager will be one or more steps back, and will want to know not just what happened, but what was done about it and what were the final implications. Too many information systems fail to meet this criterion and degenerate into ho-hum reports that are for statistical information only.
- 4 **Time period:** The information must relate to a specified time period, past, present or future, such as a week, month or quarter.
- 5 **Timing:** Control information is required on a regular basis, at a specified time, and as such must be geared to timely presentation.

- 6 *Accuracy*: The extent of the degree of accuracy will vary from information to information. Information is very costly, and also highly perishable, and as such Sir Douglas Morpeth's famous maxim about being 'nearly right rather than precisely wrong' must always be borne in mind. Information that is accurate to the *n*th degree is certainly in keeping with the high technical standards of the profession, but in the rapidly changing world of commerce and industry, may be an unaffordable luxury.
- 7 *Form and mode*: The information is required to be presented in some recognizable format. This is discussed at length in Chapter 12 on presenting information to non-financial management.

### **Determining the cost accounting system**

Before any system is established, Shah advocates three essential preliminary steps.

- 1 Define the system objectives. This requires consideration of its relevance to corporate objectives, but also to the required needs. Hicks (1986) (among others) recognizes objectives as embracing decision making, summarizing, medium and long range, periodic and predicting and control orientated.
- 2 Conduct some sort of survey of the business organization, to identify its major activities, how it is organized, and the areas where costs are incurred.
- 3 Gain an understanding of the present system in whatever form that may exist. This may include not just the simple reports that are prepared, but identifying what raw data is available, and how it is used for whatever task. This is vitally important, since although refining may be a prerequisite, it is essential that systems suit the business, and not businesses suit the system.

### **Tasks involved**

#### *1 Refine system objectives*

This is not a prescription for continual change. Rather this is for refining the objectives in more detail as one progresses. Going back to the checklist above, cost control information can initially be considered to embrace all three cost elements. However, the procurement officer will only really be interested in the cost of material, not so much what was paid for it, because that is already known, but what it has cost to use.

#### *2 Analyse background information*

This requires a two stage analysis. From the objective standpoint, the organization will identify major profit centres and cost centres, which in themselves may or may not be appropriate. In addition, the background information will reveal major decision areas and problem areas.

At the same time, organizational inadequacies may preclude the identification of these problem areas. For example, a strongly manufacturing orientated organization may well have set up its cost centres for control based on traditional production units. While this in itself is fine, if the organization has to compete in a marketplace where product costs and profitability are vital, then such an approach may well be giving the wrong control and decision making information. Irrespective of how efficient in terms of internal cost control a factory might be, it is irrelevant if the products the organization is trying to sell are either not selling, or possibly selling at a loss. This approach may require going back to the very basics of the business and asking the fundamental question, 'What business are we in?' and perhaps, 'Should we be pinning our future on it?'

Second an analysis of what is available is required. All organizations have certain statutory requirements regarding records and the preparation of accounting information. Since this is a basic requirement, and as such, an essential fixed cost, it is only right that the information systems should be built on this framework. Obviously, there will be a purchase ledger, recording all purchases, and hence cost of purchases. Straightaway, this is the basis for material cost control, by identifying what is paid for both material and services, but also as the beginning of measuring it. Equally, there will be a payroll with all the necessary support records, again a vital starting point for analysis.

Other vital information under this heading will be:

- (a) Organization charts and the authority/responsibility manual to earmark who is specifically responsible for various activities, who can influence activities, and who ought to be interested in certain activities.
- (b) Catalogue of products and their specification (including product formula schedules). These can be vital. One major European building products manufacturer, recognizing that material price control is a function of market realities is rigorous in the control of its material usage. As a result, knowing the quantity of output, and knowing the specification of the product, they can readily identify what quantities of material should have been used.
- (c) Flowcharts of production processes. Again this is important in a way that the student reader may not fully appreciate. Returning to the building products producer, he recognizes that labour does not control output, but rather, the machines are purely minded by the labour. Consequently, all labour is treated as an indirect expense, and controlled against cost. Equally, the discerning reader will recognize that machine hours or product units are the way all conversion expenses will be absorbed into work-in-progress.

### *3 Determine system requirements*

The first question that needs to be answered here is, 'What information is needed to meet the objective?' To effectively answer that question

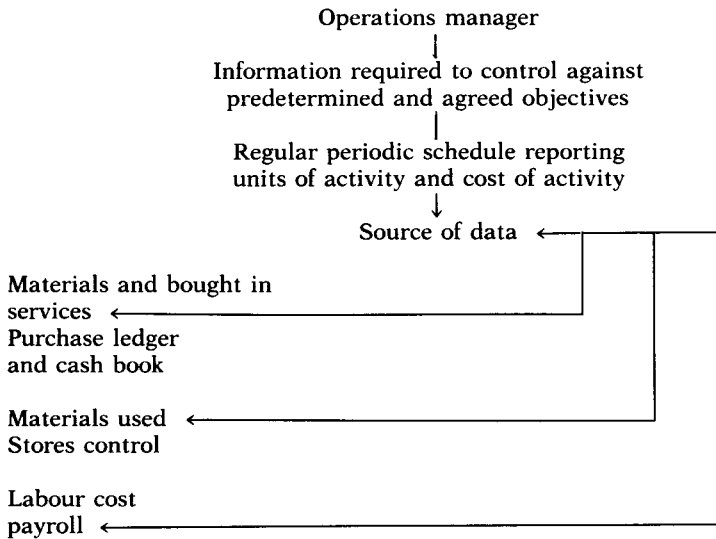


Figure 11.2 *Determining systems requirements*

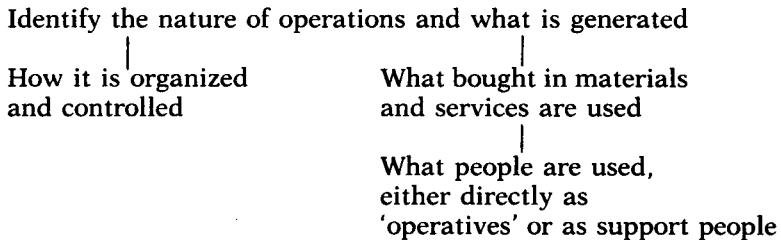
needs a readiness to step back from the drawing board. An operations manager, either in production or a service industry, will doubtless be monitored initially on the basis of his/her cost of operation. His/her objective is to produce or operate to a predetermined level. Thus the first objective is to produce the good or service to that requisite level. The first stage of the cost accounting information system will give him/her details of numbers of transactions, completed operations, volume of output. However, given that he/she is operating in some form of competitive environment, the brief will have been issued with the additional rider, 'operate competitively, or cost efficiently'. Thus the information will need to be expressed in terms of:

- (a) Units of output
- (b) Cost of those units
- (c) Comparison of those unit costs with:
  - Other units
  - Rival operators
  - Previous performances
  - Predetermined targets framed from the initial objectives

This can be expressed as a diagram. (Figure 11.2.)

Three further questions will help to develop the ideas further. Clearly, we have answered the question as to what is being reported in terms of transactions (numbers) and results (cost/profit/loss). Second, in dealing with the operations manager, the information should relate to the responsibility of the operations manager. In essence, this means that

only the operations information should be prepared for the operations manager. He/she will not be more than casually interested in the marketing information beyond how it might affect his/her next operating period, any more than the personnel information beyond their usual excuses for not supplying him/her with the labour he/she needs! This situation immediately presupposes that the core information extracted from the basic ledgers requires analysis. Thus in developing the cost accounting system we need to:



Thus if we turn to people for a moment, the essential wages department will have to analyse the people paid into individual cost centres for control purposes.

The third question is how the information should be reported. Essentially, this implies a form or schedule, and to this end, the reader is referred to Chapter 12 on the presentation of costing information. Nonetheless, it is worth reiterating that cognisance should be given to:

- (a) The nature of the user. It cannot be stated often enough that the user of cost accounting information is usually not an accountant, nor is he/she necessarily numerate.
- (b) The frequency of the information and hence the duration of the period that should be covered (this may be dictated by the nature of the report and its recipient and the particular priorities of the business).
- (c) The degree of accuracy required.

From comparison with Figure 1.1 at the beginning of this chapter, we have briefly considered the parameters involved in setting up a cost accounting system which will record information. The ledgers record this information anyway and these essential ledgers generate cost accounting information for scorekeeping, control and statutory data.

In addition consideration should be given to absorption, decision making, valuation, audit and any modifications.

## Absorption

From the chapters covering the initial elements of cost, we identified the need to transfer conversion expenses to work-in-progress. There were two basic reasons for this, the valuation of the inventory being produced,

and the control aspect of absorption. To that end, therefore absorption should reflect the nature of the activity and the effective control of the operation. In general, this means applying machine hours produced, labour hours produced, units produced and perhaps standard materials. Irrespective of methods chosen, the end result should be an equitable apportionment of conversion overhead, which will provide a reasonable and accurate product cost, and be simple and economic to use. Equity in application presupposes the selection of the most appropriate method i.e. the one that is likely to reflect the most activity. It goes without saying that the method should always be based on activity generated, rather than hours clocked or even worked, since that is likely to compound the inefficiency generated, or merely transfer losses due to operator inefficiency into work-in-progress via the overhead expense and absorption procedure.

To that end, care should be exercised in the treatment of direct material and labour excesses. A traditional viewpoint is to 'write them off to overhead' which merely moves the excesses, whatever they might be, into the conversion overhead expense control account. Operator overtime premium is an obvious example of this. The net result is an overspend on the overheads, and variances incorrectly calculated. The system should provide that all excesses are written off straight to the profit and loss account.

## **Valuation**

Requirements of SSAP9 even after ED40 will still require that all reasonable conversion overheads are absorbed on a normal basis into work-in-progress, i.e. favouring the total absorption costing system. In addition, material valuation must also comply with the provision to exclude LIFO as a means of inventory valuation in the British Isles. The cost accounting system, in its gearing up to provide for a correct valuation of inventory, will likewise have to comply with these parameters.

It is tempting to argue that since much of the control data is for internal use, the demands of external agencies could be considered irrelevant. That is a valid view, but an impractical one. All good cost accounting information systems must be cost effective in their operation, and there is little technical justification in adopting a system that is going to require costly and time consuming, complicated reconciliations and revaluations when year end valuations and statutory reports are required.

## **Audit requirements**

It is a requirement of the Auditors' Standard that he/she appraises the systems of control and reporting, as an integral part of confirming the

truth and fairness of the accounts. In developing such cost accounting information systems, cognisance must be given to the fact that the information will be used in both inventory valuation and in the computation of the profit and loss account. These figures will have to be verified and must be easy to trace from the original source data. A complicated system that is difficult to follow through will at best increase the cost of the audit, create difficulties in identifying problems, but at worst, cause the auditor to consider the possibility of a qualified audit report because he/she cannot verify certain aspects of the accounts. This point should be particularly remembered when the cost accounting information system moves over from being manually operated to a computer based system.

### **Decision making**

If the student reader recalls the chapter on marginal costing and the implications it has for decision making, he/she will note that much of the decision making process needed to exclude the time related or fixed cost elements, since they were usually incurred irrespective of the decisions taken. Equally, under that heading, we should have noted that there was a means of valuing inventory which likewise excluded these time related costs which was unacceptable under SSAP9. This introduces an extra parameter to the information system equation, that of information that is required on demand.

This will require identifying information from the basic cost data that is likely to be relevant to the decision making process. In the traditional marginal costing scenario, the situation is envisaged where there are direct costs, usually materials and labour, but also expenses. Two characteristics will be evident in these expenses:

- 1 They will be analysed between variable or activity related, and fixed or time related.
- 2 The expenses will go beyond the boundaries of conversion costs, into marketing and administration.

Thus the decision making and demand reporting will make different demands upon the information system when compared with that of the control, reporting and scorekeeping roles.

To ensure that this vital role is adequately satisfied, the initial overview exercise must include it. In stating the objectives of the costing system, the priority for use of cost data in preparing quotations, decision making must be included. If the cost accountant sees his/her role as part of the management team, providing the navigational information to direct the business in its decision making, then this aspect will be picked up. However, the pure bean counter, or the controller/accountant who is treated like a bean counter may miss it.

Essentially what is required is to build into the system two essential parameters:

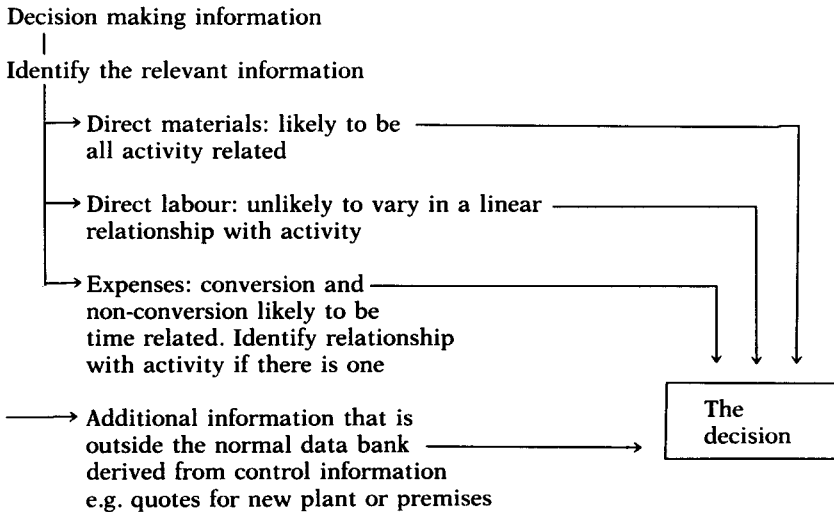


Figure 11.3 *Decision making*

- 1 The basic provision for getting information out on a decision making on demand or ad hoc basis.
- 2 At the very outset, when the initial systems questions are being tackled, to clearly attempt to identify what costs within a cost structure are activity related, and if they are, what relationship they have to the activity.

This will have some interesting consequences. Obviously, in a traditional manufacturing environment, direct materials will vary with activity. However, direct labour, unless it is paid purely on a piece work basis will not. Rather, direct labour is usually paid on an hourly rate basis, and it should be assumed that a certain number of man hours at a certain rate will be required if a decision is taken. In many Western countries, traditional direct labour is so cosseted that it has become a fixed expense, and if when setting up the system this situation pervades, then it must be recognized that the only decision related information about labour that is relevant might be the possibility of overtime.

Very few expenses, conversion or otherwise, materially relate to activity on a linear basis. Indeed, some may even have an inverse relationship. Selling expenses will usually fall into this category. It will probably come as a considerable surprise, and possible shock to management to realize just how much of their cost structure is in fact fixed or time related, often as a result of the pressures of the external environment.

These thoughts can be expressed diagrammatically. (Figure 11.3.)

The latter point on Figure 11.3 will emphasize that decision making



information will need to draw on both the in-house reporting systems and the relevant material from outside.

### **Predictive information**

The *Terminology* defines forecasting as 'the prediction of relevant future factors affecting an entity...'. The explicit reference to planning in the definitions relating to budgets implies that forecasting and crystal ball gazing are bound to be involved.

For any document that looks forward into the future to have any credibility, it must link into the present day data, if only as a starting point, and the information system must then be extended by adding inputs.

Thus the cost accounting information system must become a data bank, which provides relevant data to enable management to ask it questions, such as the implication of a 15 per cent pay claim, or the impact of a drop in product volume. This will require all the costs, and the recoveries to be made accessible, since a loss in volume will mean a loss of overhead absorbed, so not only will the gross trading profit be eroded, but manufacturing losses could increase as well, requiring decisions to be taken about cost cutting and possible rationalization.

### **Appraising the information system**

The obvious yardstick must be the somewhat qualitative measure of compliance with the objective(s). For example, information about material costs concern the purchasing and production management. The test of the effectiveness in information reporting systems is that the information reaches the individual on time, in a manner that is correct and understandable, and enables them to take the correct decision. Their superiors will also need to know the data, so that they can ask the question, 'What have you resolved about...?'

An information system fails when it is not timely, and presents the wrong information. Deliveries of finished goods are not the responsibility of the production operations managers, so it is facile to send him and his superior a delivery report. Output is what the production operations manager is responsible for. If the system does not deliver information to the correct recipient, then it must be reviewed.

### **Modifying the cost accounting system**

This may be required for two reasons:

- 1 Monitoring of the first attempts to set up a system reveals that there just might be a better way of doing things, and changes will be required.

- 2 Changes may have occurred that require system development or extension. Facts or circumstances may have changed in the period while the system was being developed. Shah suggests that a new product line might have been added, but that seems symptomatic of very poor planning that the systems accountant was not made aware of it. Certain facts may have been overlooked, or perhaps priorities changed. Raw materials subject to the vagaries of oil prices tend to fluctuate wildly, and the attention demanded obviously changes in priority. The priority over energy costs may have also changed, causing the expense schedule to have a different mix of importance.

The final system may be too vast. There is always a danger, as Chapter 12 suggests, of an over-proliferation of detail, creating an enormous burden on the cost accounting function. This is neither cost effective, nor is it good stewardship of technical ability, and consideration may have to be given to reducing the detail required, the easing of deadlines, or rationalizing the reports.

Before any modification is made, it must be cleared with senior management, and it must avoid creating a situation where the rule of consistency is broken. No change of reporting system can be permitted which effectively breaks this rule.

### **The use of computers in cost accounting**

The development of cost accounting and control in recent years has been in parallel with developments in computer applications technology. While it is beyond the scope of this text to go into detail on computer applications and cost accounting, it is felt that a brief introduction to the terms used and some outline examples, will help the student reader to relate his/her cost accounting studies and practice to the environment of the computer.

#### **Relevant terms**

##### *Codes and coding*

The *Terminology* defines a code as 'a system of symbols designed to be applied to a classified set of items, to give brief and accurate reference facilitating entry, collation and analysis within the cost accounting system'.

Most cost accounting systems contain a system of codes for categories of expense and cost centres, which can be readily translated to a computer system. For example, in a production expense code numbered from 300–349, in departments numbered from 4000–4009, fuel oil for the heating of the production area might be categorized as 320/4001, while fuel used to heat a furnace in the same production department might be 321/4001. By the same token, the system will permit materials to be analysed by category and job they have been issued to. Such a system can be operated entirely manually, but it lends itself readily to computerization.

### *Data base*

Data base is defined by Bhaskar and Housden as 'a collection of data files integrated and organized into a single comprehensive file system. The data is organized to minimize redundant duplication and to provide convenient access to data within the system to satisfy a wide variety of user needs'.

They illustrate this by showing how a single piece of information about the sale of an individual product can be the integral part of a data base by being analysed under:

- Customer order
- Order number
- Order date
- Salesman/sales outlet/customer/market type
- Product code
- Quantity ordered
- Sales value

In a traditional cost accounting context, a data base can reveal:

- Details of (say) a component ordered
- Purchase order number data
- Usage levels and reorder level
- On which product(s) or customer(s)
- Standard price and variance analysis

A data base should be carefully managed. The size of it suggests that it should be stored away from the mainstream operational hardware. Everest (1974) has identified four essential objectives that should be achieved in a successful data base operation.

- 1 The data base should be shared, enabling different users to obtain the same data. This eliminates the need to duplicate files and saves space. However, it means that careful control on the access into the files should be operated. Clearly, basic cost data will be required by the cost accountant, by sales estimators, by the budgetary and planning department, by the development function and by the organization and methods department.
- 2 The integrity of the data base should be protected. Auditing Guideline 3.407 emphasizes the need for controls over the entire computer operation, and Everest merely reinforces the rubric that no one user must be permitted to make alterations to data which would at least impair the other applications.
- 3 The data base management system must be responsive to a diverse environment of users who, in turn, will have a diversity of needs and require a diversity of modes of access.
- 4 The system must be dynamic and evolve to adapt itself to the changing environment.

### *Processing*

This is the processing of data within the computer itself. This can be the simple entry of batches of pre-coded purchase invoices which will simultaneously:

- Update the purchase ledger
- Update the stock ledger
- Update a work in progress ledger where items were bought against specific orders
- Analyse material price variances

#### *Storage of data*

This is defined as 'a device or medium that can accept and hold data, and deliver them on demand at a later time'. The storage area is frequently described as the computer memory.

In the context of cost accounting, this can be the stock ledger, which will give a print-out of levels of stock, or individual product variances from the purchase ledger/stock ledger input which can then be used in establishing standards based on purchase and usage patterns, and establish criteria for future investigation of standards.

#### *Reporting*

One of the essential functions of cost accounting is to generate reports that direct management attention to recent events. In the context of control, this is the feedback process, which will highlight either major deviations from standard or shortfalls in activity. Computers can provide much of this data. For example, the simple stock analysis from purchased invoices could be programmed to provide a weekly report on material price variances, highlight major variances, and select those which should be investigated.

The essential characteristics of computerized cost accounting data are unchanged from the essential criteria laid down for a costing system. It is, however, worth revising the essential rubrics, albeit in a computing context.

- 1 Prompt information. The computer has the advantage that it speeds up much of the repetitious computational work, thus shortening the lead time between processing and presenting information. In an environment where information is both costly and highly perishable, this is an important advantage.
- 2 The information must be accurate. Computer systems per se are only as accurate as the human developed systems and the human operators. However, with adequate accuracy controls, they can combine speed with accuracy.
- 3 The information they produce must be tailored to the user.
- 4 They can be tailored to produce exception reports so that attention is rapidly directed to the areas where it is required to enable correct and rapid management action.
- 5 The information must have a value.

#### ***Examples of computer applications***

Figures 11.4–11.6 are flow charts of simple computer applications to cost accounting procedures.

1 Payroll

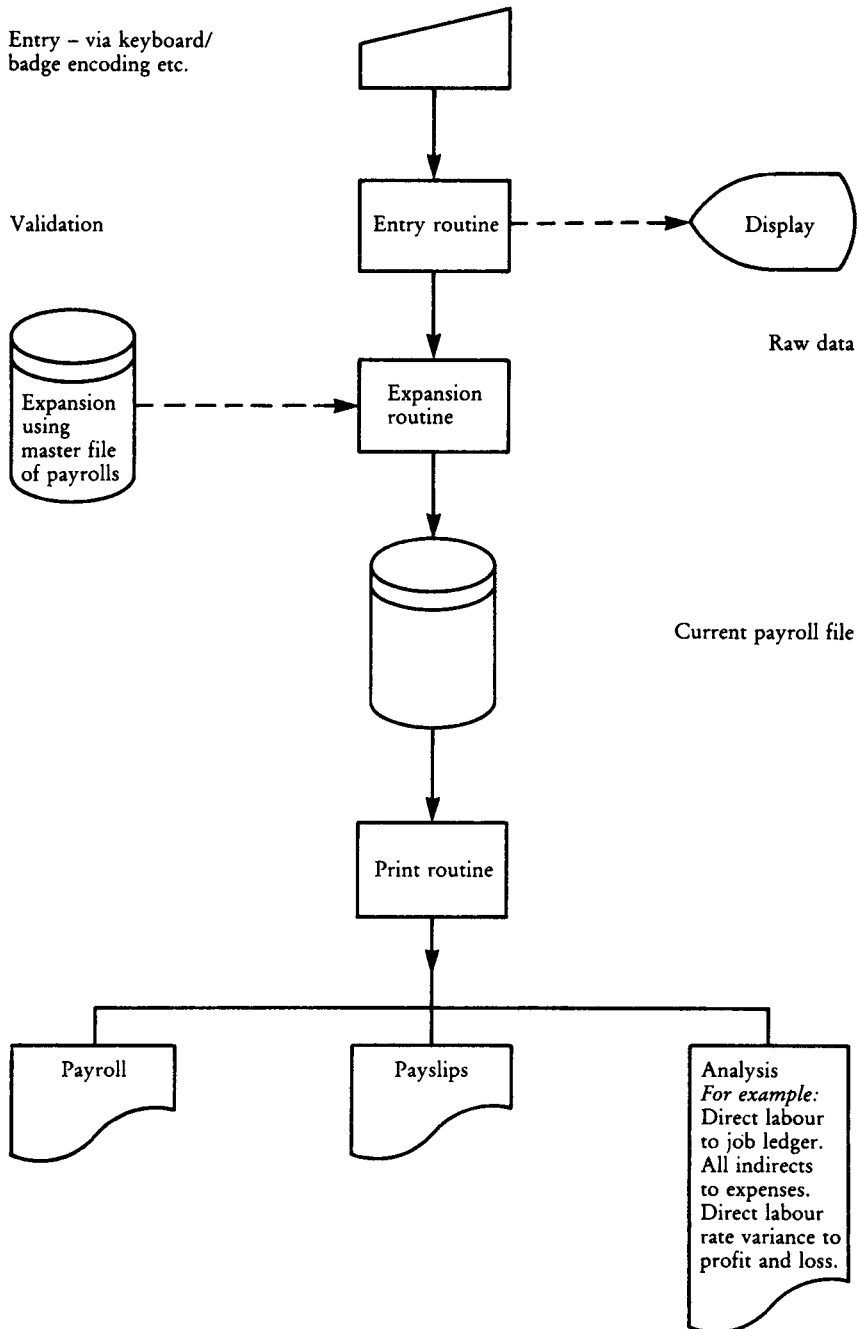


Figure 11.4 Computer application – payroll

2 Material

Obviously, this can embrace the ordering procedures as well as the receipt payment and analysis.

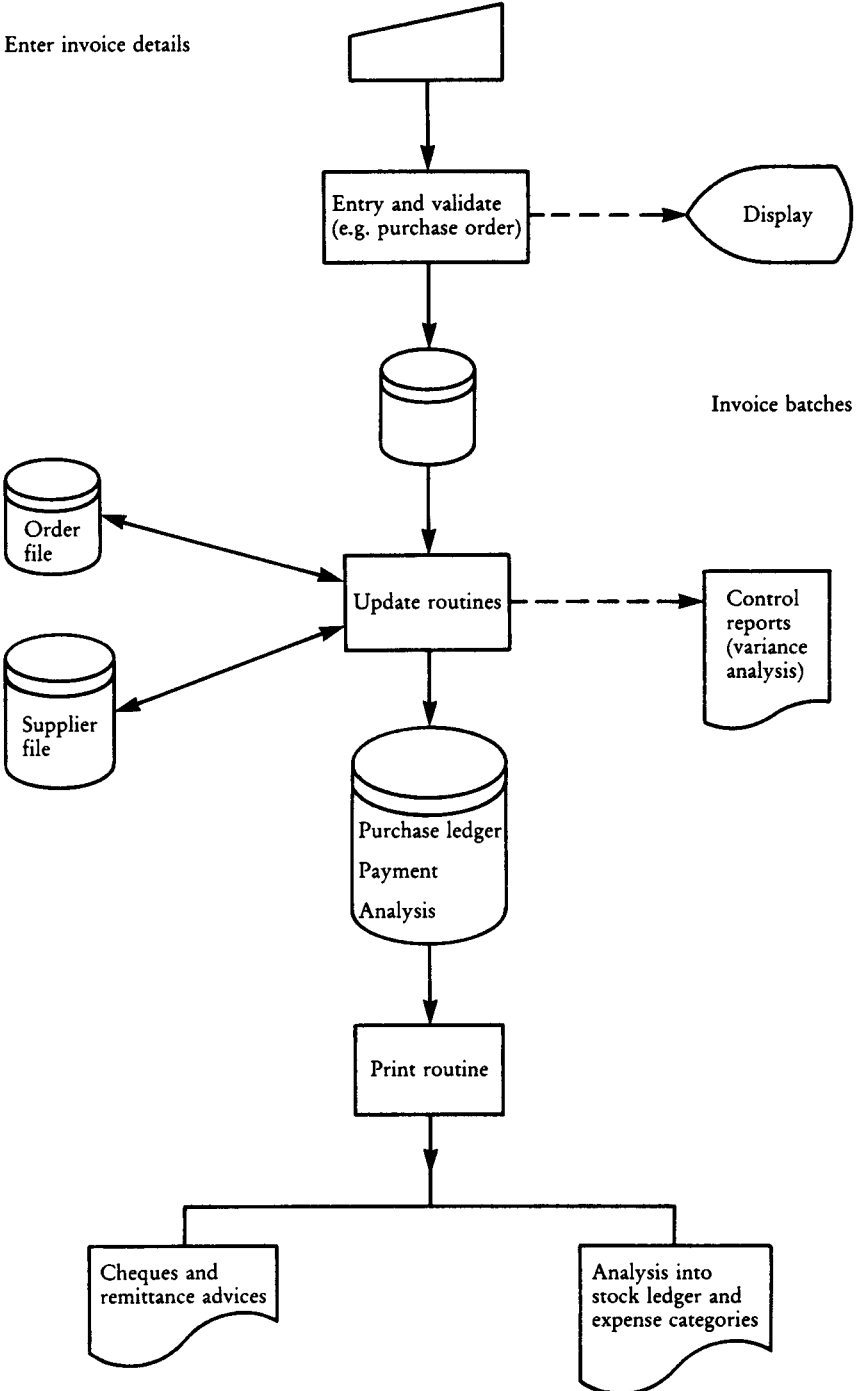


Figure 11.5 Computer application – material

3 Work-in-progress listing and variance analysis

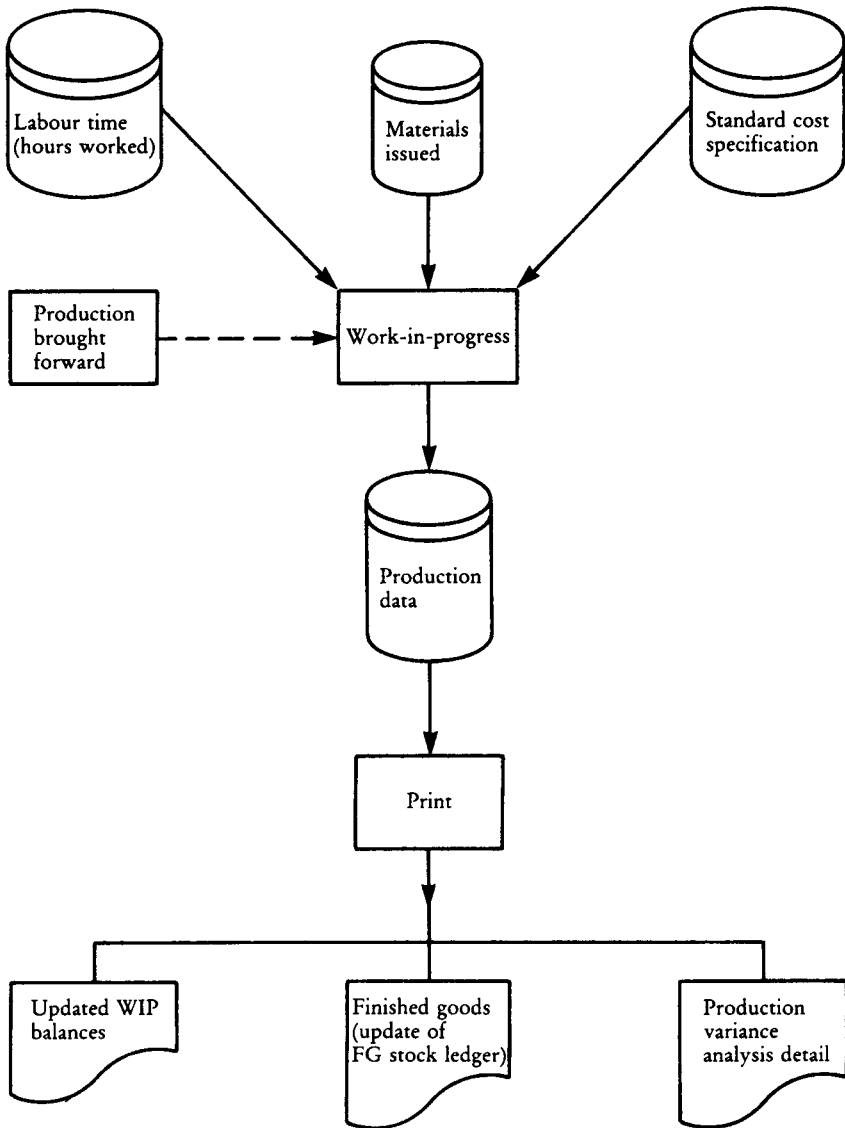


Figure 11.6 Computer application – work-in-progress and variance analysis

From these simple examples, the student will readily see other applications. Clearly, the system illustrated in Figure 11.6 above can be applied to any form of production activity. Other more specialist applications would be on inventory ledger control, expense ledger control, purchase procedures, budget preparation and control and forecasting.

### Questions

- 1 (a) Angus Menzies and Company is investigating the possibility of using a standard costing system for the process. The standards are to be based on the following information:

The joint process optimally requires equal quantities of A and B. The normal output from an input of 500 litres of A and 500 litres of B is:

500 litres of C,  
250 litres of D  
and 250 litres of waste.

The waste has a saleable value of 5p per litre.

The purchasing department considers that the normal raw material prices are:

£0.66 per litre for A  
and £0.33 per litre for B.

The production manager considers that 1000 litres of good output should take one hour to process. The costing department gives the processing costs as £1,240 per hour.

On the basis of this information and retaining the physical units basis for the apportionment of joint costs, you are required to calculate the standard cost of 1000 litres of C and 1000 litres of D. (5 marks)

- (b) Write a short report to the management of Angus Menzies and Company explaining the usefulness of standard costing and any special considerations and limitations that should be noted when considering its introduction for the process described in part (a) of this question. (5 marks)

(Total: 10 marks)

*CACA 1.2 November 1985*

- 2 An international airline has a catering division responsible for the provision of catering services on its aircraft.

The company, in preparing its budget for the next year, is examining very carefully the cost effectiveness of each of its divisions. The catering division, in which an absorption costing system is operated, is under particular scrutiny.

You are required, as recently-appointed management accountant, to prepare a report on the catering division for the managing director, which should include specific comments on:

- (a) Problems that are apparent in operating an absorption costing system in this environment. (5 marks)  
(b) The merits of introducing a marginal costing system. (5 marks)



- (c) The factors to be considered in deciding whether or not the company should use the services of a catering specialist available on a contract basis. (10 marks)  
(Total: 20 marks)

*CIMA CA2 November 1986*

- 3 (a) Discuss the proposition that interest (paid and/or imputed) should be regarded as a cost:  
(i) In a conventional cost accounting system. (8 marks)  
(ii) In a divisional performance evaluation system. (9 marks)  
(b) 'If the management accountant searches for a system that will provide the "true cost" of each type of good or service produced by his firm, he is attempting the impossible.' Comment. (5 marks)

*CACA 2.4 November 1985*

- 4 (a) Outline the organizational and behavioural factors that you consider to be particularly important in making certain that budgeting and standard costing systems are effective. (8 marks)  
(b) Discuss the main techniques that have been suggested for the evaluation of the financial aspects of the performance of  
(i) cost centres, and  
(ii) profit centres. (9 marks)  
(Total: 17 marks)

*CACA 2.4 November 1985*

- 5 (a) Describe the role of the cost accountant in a manufacturing organization. (8 marks)  
(b) Explain whether you agree with each of the following statements:  
(i) 'All direct costs are variable.'  
(ii) 'Variable costs are controllable and fixed costs are not.'  
(iii) 'Sunk costs are irrelevant when providing decision making information.' (9 marks)  
(Total 17 marks)

## References and further reading

- 1 Bhaskar, K. N. and Housden R. J. W., *Accounting Information Systems and Data Processing*, Heinemann, 1985.
- 2 Everest, G. C., 'The Objectives of Database Management' in Tou, J. T. (ed.), *Information Systems: Coins IV*, 1974.
- 3 Hicks, J. O., *Information Systems in Business*, St Paul, 1986, (particularly Chapter 3).
- 4 Roche, A., *Accountancy Control Systems*, 1982.
- 5 Shah, P. P., *Cost Control and Information Systems*, 1981 (particular reference to Chapters 4–6).

# 12 Integrated accounts

## **Introduction**

Cost book-keeping is essentially the bringing of the cost accounts into the double entry system. Just as in financial accounting, every entry made in the cost ledger must have another entry in some other part of the cost ledger. In this chapter therefore, we will see:

- 1 How the cost accounts link together.
- 2 How the cost accounts relate to the financial accounts of an organization.
- 3 How these techniques relate to the control and reporting systems of the organization. It is this latter point that is the essence of integrated accounts.

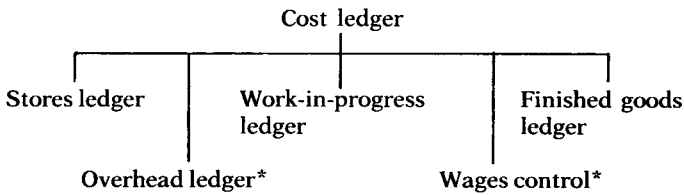
The problem will be tackled in three stages. First, we will look at the ledgers and books of account. Second, we will consider elementary cost accounting in the preparation of the cost accounts. Third, we will consider the development of cost accounting methods, from completely separate systems through to completely integrated financial and cost accounts.

It should be added that although a basic 'quill pen' approach has been outlined, this could just as easily be related to a spreadsheet system.

## **The ledgers and books of account**

The cost accounts are kept in a cost ledger which consists of a number of subsidiary ledgers as shown in Figure 12.1.

A word of explanation about each of the ledgers in Figure 12.1 is necessary.



\* The student should recall that a *control* or *summary account* is a sub-total of a number of individual small accounts. For example, the *overhead control* will be a summary of the expenses incurred for indirect wages and salaries, rent and rates, energy, plant depreciation and communications.

Figure 12.1 *The ledgers*

### **Stores ledger**

This contains the stock accounts, and there is an account for each separately identifiable class of material or component or bought in subassembly handled by the stores. The entries are made from the goods received notes and material requisitions.

### **Work-in-progress ledger**

This ledger contains the accounts of jobs, contracts or processes, depending on the method of costing employed. Each account is debited with materials issued from the stores, direct labour booked to each job, and overhead recovered and absorbed into the work. Since SSAP9 requires inventories to be valued on a total absorption basis, it is essential that the conversion or production overhead is brought into the work-in-progress.

### **Finished goods ledger**

When the product or service is completed, based on the documentation that authorizes the movement of finished products out of the production area, the work-in-progress ledger is credited and the finished goods ledger debited. Like the work-in-progress ledger, the finished goods ledger contains individual accounts for each individual job or class of product. When goods are delivered or sold, then there is a credit entry from the finished goods ledger to the cost of sales account.

### **Overhead ledger**

This may be known as the overhead control account, and it summarizes the various overhead expenses incurred. The obvious categories of expenditure that are included in this ledger are indirect production labour, e.g. storekeepers, cleaners, maintenance workers, the production salaried staff, electricity to drive the equipment, heat and light, telephone, relevant computer costs, and the charge for plant and equipment depreciation. These costs are transferred to the work-in-progress ledger via the production overhead absorption rate.

**Wages control**

The student will be all too aware from his or her own pay cheque that the wages procedure is quite complicated. Wages control will be credited as a liability with the direct wages payable plus the deductions, and employees' contributions (which will be a debit to overhead). The opposite entry for the original amount credited to wages control will be work-in-progress, (work produced) labour variances, and any expenses codes where direct labour has been charged.

To help the student appreciate the double entry implications of what has just been discussed, we now present a list of the typical entries that may be encountered.

*Material ledger:*

| <i>Transaction</i>                     | <i>Debit</i>  | <i>Credit</i>            |
|--|---|--------------------------|
| Purchase of materials<br>or components | Stores  | Purchases<br>(creditors) |
| Materials issued                       | Work-in-progress<br>* Maintenance<br>* Capital Work | Stores                   |

\* These may be referred to as indirect materials or consumables.

*Wages*

|  |                                     |                          |
|--|-------------------------------------|--------------------------|
| Direct wages                             | Work-in-progress<br>(work produced) | Wages/payroll<br>control |
| Indirect wages and<br>salaries           | Conversion<br>overhead              |                          |
| Idle time, or any<br>non-productive time | Conversion<br>overhead              |                          |
| Maintenance                              | Conversion<br>overhead              |                          |
| Capital work                             | Capital cost<br>of project          |                          |

*Overhead*

|                   |                        |                           |
|-------------------|------------------------|---------------------------|
| Expenses incurred | Conversion<br>overhead | Cash book or<br>creditors |
| Overhead absorbed | Work-in-progress       | Overhead Expense          |

*In addition there will be:*

|                 |                 |                  |
|-----------------|-----------------|------------------|
| Goods scrapped  | Profit and loss | Work-in-progress |
| Goods completed | Finished goods  | Work-in-progress |

To help the student absorb what has already been covered, here is a simple example.

*Example 12.1*

During the month of November, Ivatt Ltd incurred the following costs:

|                               |         |
|-------------------------------|---------|
| Materials purchased on credit | £46,521 |
| Wages paid to direct workers  | £15,768 |
| Indirect wages and salaries   | £17,304 |
| Sundry production expenses    | £30,913 |
| Depreciation charge           | £6,652  |

In addition the following took place:

|  |         |
|--|---------|
| Materials issued to work-in-progress         | £42,305 |
| Material scrapped due to defective work      | £690    |
| Material returned to supplier as substandard | £2,213  |

Of the direct wages paid, 5 per cent was for idle time.

Finished goods to the value of £110,000 were completed during the month. Goods costing £92,250 were sold. There was no opening stocks of finished goods.

Completed goods to the value of £2,516 were used in a capital project, as were raw materials to the value of £1,000. Finished goods to the value of £913 were damaged during the month, and had to be scrapped.

Production overhead is absorbed on the basis of 400 per cent of direct wages expended on good production.

You are required to write up:

- 1 The raw materials ledger.
- 2 The work-in-progress ledger.
- 3 The finished goods ledger.
- 4 The overhead expense ledger.
- 5 The wages control account.

*Approach:*

All that is really required is five 'T' accounts with clear indications in the 'T' accounts as to what the opposite entries are.

Costing questions often have the irritating habit of having to be attempted from the 'bottom up', and the student may find it easier to start with Part 5.

*Wages (or payroll) control account*

|           |                |                   |                 |
|-----------|----------------|-------------------|-----------------|
|           | £              |                   | £               |
| Cash book | 33,072         | Work-in-progress  | 14,980          |
|           |                | Overhead expense: |                 |
|           |                | Indirect wages    | 17,304          |
|           |                | Idle time         | 788             |
|           | <u>£33,072</u> |                   | <u>£33,072*</u> |

\* This will have been built up from the original gross wages calculations and gross to net analysis.

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*Overhead expense account*

|                     | £              |                     | £              |
|---------------------|----------------|---------------------|----------------|
| Wages and salaries  | 17,304         | Work-in-progress*** | 59,920         |
| Idle time           | 788            |                     |                |
| Production expenses | 30,913         |                     |                |
| Depreciation        | 6,652          |                     |                |
| Overabsorption*     | 4,263          |                     |                |
|                     | <u>£59,920</u> |                     | <u>£59,920</u> |

*Raw materials*

|           | £              |                      | £              |
|-----------|----------------|----------------------|----------------|
| Creditors | 46,521         | Work-in-progress     | 42,305         |
|           |                | Returned to supplier | 2,213          |
|           |                | Scrapped*            | 690            |
|           |                | Capital project**    | 1,000          |
|           |                | Closing stock**      | 313            |
|           | <u>£46,521</u> |                      | <u>£46,521</u> |

*Work-in-progress*

|                   | £               |                | £               |
|-------------------|-----------------|----------------|-----------------|
| Wages control     | 14,980          | Finished goods | 110,000         |
| Overhead absorbed | 59,920          |                |                 |
| Raw materials     | 42,305          | Closing WIP**  | 7,205           |
|                   | <u>£117,205</u> |                | <u>£117,205</u> |

*Finished goods*

|                  | £               |                   | £               |
|------------------|-----------------|-------------------|-----------------|
| Work-in-progress | 110,000         | Capital project** | 2,516           |
|                  |                 | Scrap*            | 913             |
|                  |                 | Cost of sales     | 92,250          |
|                  |                 | Closing stock**   | 14,321          |
|                  | <u>£110,000</u> |                   | <u>£110,000</u> |

*Notes:*

\* These items will appear on the profit and loss account.

\*\* These items would appear on the balance sheet.

\*\*\* Calculation of overhead absorbed  $\text{£}14,980 \times 400\% = \text{£}59,920$

To help the student see the complete picture, the profit and loss account would appear like this:

*Ivatt Ltd*

*Profit and loss account November 19X6*

|                        |           |
|------------------------|-----------|
| Turnover               |           |
| Cost of goods sold     | £(92,250) |
| Gross profit           |           |
| Production profit/loss | 2,660     |

*Expenses*

|                                      |               |
|--------------------------------------|---------------|
| The production profit is made up of: |               |
| Raw materials scrapped               | (690)         |
| Finished goods scrapped              | (913)         |
| Overabsorption of overheads          | <u>4,263</u>  |
| Production profit                    | <u>£2,660</u> |

**Costing profit and loss accounts**

The student will notice that the expenses incurred in operating a production department are absorbed into the work-in-progress through the system of overhead absorption. This provides not just a means whereby conversion costs can be readily absorbed into inventory valuation, but also the means of controlling the performance of the production operations department. The net result of this can be the production or manufacturing profit and loss account.

The way this works can again be demonstrated by a simple example.

*Example 12.2*

Penny Limited is a small manufacturing organization, where the production operation is a separate cost centre for control purposes. During the month of May, it incurs the following costs:

|                      |                  |
|----------------------|------------------|
| Material             | £5,000 purchased |
| Wages paid           | £6,000           |
| Conversion overheads | £12,000          |

During the month of May, it was found that the quantity of material purchased had a standard cost of £4,500, that some £250 of material had been lost through wastage and rectification, labour costs included £150 of overtime premium not included in the standard rate, and that there were hours lost at standard rate amounting to £350.

Good production amounted to 1950 standard hours at an absorption rate of £7.50 per hour. On the assumption that there are no opening or closing stocks of materials or work-in-progress, prepare a manufacturing profit and loss account.

*Approach:*

Here, the first thing the student should note is that we have inadequate information to prepare the traditional variances in a mechanical fashion. Indeed, we are given most of the variances. What is in fact required is to write up and balance off the appropriate 'T' accounts, and then prepare the costing trial balance and the profit and loss account.

*Material*

|           |               |                |               |
|-----------|---------------|----------------|---------------|
|           | £             |                | £             |
| Purchases | 5,000         | Price variance | 500*          |
|           |               | Material lost  | 250*          |
|           |               | Charge to WIP  | <u>4,250</u>  |
|           | <u>£5,000</u> |                | <u>£5,000</u> |

*Work-in-progress*

|          |                |                    |                |
|----------|----------------|--------------------|----------------|
|          | £              |                    | £              |
| Material | 4,250          | c/f Finished goods | 24,375         |
| Labour   | 5,500          |                    |                |
| Overhead | 14,625         |                    |                |
|          | <u>£24,375</u> |                    | <u>£24,375</u> |

*Labour*

|            |               |                  |               |
|------------|---------------|------------------|---------------|
|            | £             |                  | £             |
| Wages paid | 6,000         | Overtime premium | 150*          |
|            |               | Efficiency       | 350*          |
|            |               | Work-in-progress | 5,500         |
|            | <u>£6,000</u> |                  | <u>£6,000</u> |

*Conversion overhead*

|             |                |                  |                |
|-------------|----------------|------------------|----------------|
|             | £              |                  | £              |
| Expenses    | 12,000         | Absorption to    |                |
| Profit/loss | 2,625*         | work-in-progress | 14,625         |
|             | <u>£14,625</u> |                  | <u>£14,625</u> |

The figures marked with an asterisk (\*) are the ones that are written off to the manufacturing profit and loss account. Setting these out in a simple trial balance format, they would appear as below:

|                      | <i>Debit</i>  | <i>Credit</i> |
|----------------------|---------------|---------------|
|                      | £             | £             |
| Overhead absorbed    |               | 2,625         |
| Material price       | 500           |               |
| Material usage       | 250           |               |
| Labour rate          |               |               |
| (Overtime premium)   | 150           |               |
| Labour efficiency    | 350           |               |
| Manufacturing profit | 1,375         |               |
|                      | <u>£2,625</u> | <u>£2,625</u> |

**Towards a non-integrated system**

The student should be prepared for the rare situation where there are separate cost accounts and financial accounts. Undoubtedly, the situation has changed since Brian Bishop made his observations about integrated accounts in the 1950s, and the writer made his comments in *Accountants Weekly* in 1981, and in *Management Accounting* in 1983.

Traditional costing textbooks would suggest that the following items might be excluded from the cost accounts:

- 1 Profits and losses on the sale of assets (treated as an exceptional or extraordinary item under SSAP6).



- 2 Expenditure incurred in raising finance.
- 3 Interest paid or received.
- 4 Rent receivable.
- 5 Any normal financial write offs. (The textbooks cite goodwill as an example, this would now be treated under SSAP22.)
- 6 Fines.

It is debated that the charge for interest should be included. There is provision in SSAP9 for it to be included if justified. For example, in a contract situation, the company may have to borrow money to finance the contract, so the inclusion of interest in the cost accounts would be acceptable. Dividends are always excluded. The debate tends to centre around the problem of comparison. The answer is that only interest that can be actually attributed to the cost structure, as suggested above, should be included.

Similarly, it is suggested that there are certain items that might be exclusive to cost accounts. Traditionally it was argued that notional rent should be charged to the cost accounts where the buildings were owned. This has now been largely dispensed with by the requirement of SSAP12 for the freehold buildings to be depreciated. The only justification there might now be for notional rent is a situation where the depreciation charge would be substantially different from the rent charged on a similar building.

SSAP9 has also tightened up the treatment of certain items in the accounts, notably the absorption of overhead. SSAP9 requires that the absorption be on the basis of normal levels of output. Now, of course, the cost accounts will show the overhead absorbed as a credit to the control account, whereas the financial accounts will show the overhead expenses.

SSAP9 specifically excludes the introduction of any non-conversion overheads into the cost accounts and hence the stock valuation.

Depreciation may continue to be charged after the assets are fully depreciated. Curiously, this approach, by assuming that the asset is still in use, assumes that it has not fully worn out, and therefore the depreciation is still chargeable. This anticipates the recommendations of ED37, in its update of SSAP12. It should also be added, that there is no SSAP or guideline approved by the CCAB that instructs and enforces integrated accounting procedures upon the internal cost accounting systems of an organization (see note at end of chapter).

To that end, to help the student appreciate the problem of a question on non-integrated accounts and the need to do some form of reconciliation, or to appreciate a situation where an integrated system needs to be installed, an old question of this type has been resurrected.

### *Example 12.3*

Cornish plc operates a financial accounting system and a cost accounting system. Extracts from both the final accounts for the year are shown below, from which you are required to prepare a reconciliation statement or account.

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The financial accounts included the following:

|   |  |        |
|---|--|--------|
| Debenture interest paid                     |  | £2,000 |
| Interest received                           |  | 1,000  |
| Discount allowed                            |  | 8,000  |
| Discount received                           |  | 3,000  |
| Net profit (which included the above items) |  | 57,000 |

|                  | <i>Opening stock</i> | <i>Closing stock</i> |
|------------------|----------------------|----------------------|
| Raw materials    | £152,000             | £198,000             |
| Work-in-progress | 66,000               | 72,000               |
| Finished goods   | 84,000               | 87,000               |

The final cost accounts included the following:

|  |         |
|--|---------|
| Notional interest on capital                   | £30,000 |
| Notional rent on freehold building             | 20,000  |
| Administration overhead overabsorbed           | 10,000  |
| Production overhead underabsorbed              | 15,000  |
| Selling and distribution overhead overabsorbed | 14,000  |

*Stock valuations*

|                  | <i>Opening stock</i> | <i>Closing stock</i> |
|------------------|----------------------|----------------------|
| Raw materials    | £164,000             | £187,000             |
| Work-in-progress | 61,000               | 68,000               |
| Finished goods   | 90,000               | 94,000               |

*Approach:*

First, the initial answer assuming the traditional dichotomy between the financial and the cost or control accounts.

*Cornish plc*

*Reconciliation between cost and financial accounts*

---

|   |                 |          |
|---|-----------------|----------|
| Starting with financial accounts per question                           | £57,000         |          |
| <i>Add back:</i>  |                 | (Note 1) |
| Discount allowed  | 8,000           |          |
| <i>Add back: CA 85 line 10/12 items</i><br>(Interest received and paid) | <u>1,000</u>    |          |
| Trading profit  | 66,000          |          |
| Overcharges   |                 |          |
| Administration overhead   | 10,000          |          |
| Selling and distribution overhead                                       | <u>14,000</u>   | (Note 2) |
|   | £90,000         |          |
| <i>Deduct:</i>  |                 |          |
| Notional expense items<br>(Rent and Interest)                           | (50,000)        |          |
| Underabsorption of production overhead                                  | (15,000)        |          |
| Difference in stock valuation   | <u>(21,000)</u> | (Note 3) |
| 'Costing profit'  | £4,000          | (Note 4) |

Notes:

- 1 Discount allowed is now treated as part of the turnover, and SSAP2 requires a statement of accounting policies, which will include a definition of how the turnover is made up.
- 2 For control purposes, some organizations relate these overheads to the level of sales, and recover the expenses by deducting a percentage of the sales which they consider appropriate. It does provide a measure of how the two categories of expenditure are relating to the level of deliveries. Clearly, if it is 'overabsorbed', then it indicates that deliveries, and as such sales, are ahead of the levels that the budgeted expenditure originally anticipated.
- 3 This is an anathema. This figure is made up of the differences between book stock valuations in the financial accounts, and the inventory valuation following the stock take. Differences on the closing stock are unfortunate, but are a fact of life. However, here the dichotomy is so wide, that there are unadjusted opening figures!

This figure is made up of:

| <i>Stock differences</i> | <i>Opening</i> | <i>Closing</i> | <i>Total</i> |
|--------------------------|----------------|----------------|--------------|
| Raw materials            | (12,000)       | (11,000)       | (23,000)     |
| Work-in-progress         | 5,000          | (4,000)        | 1,000        |
| Finished goods           | (6,000)        | 7,000          | 1,000        |
| Total                    | (13,000)       | (8,000)        | (21,000)     |

Clearly, no auditor, coming in to do the interim, would allow unadjusted opening figures to be carried forward. Indeed, he or she would have raised this at the previous final, and such a situation would warrant a strongly worded management letter.

- 4 Discount received should be included in the stock ledger and valuation. SSAP9 insists that the cost of material should include discounts. Thus the closing raw material stock figure should reflect this.

*Revised answer:*

Let us now do the question again, bringing in current accounting developments. To comply with SSAP12, let us assume a depreciation charge on the freehold building of £20,000, and this will have the effect of, all other things being equal, increasing the underabsorption of production overhead.

In view of the comments about discount allowed made above, it is pointless to bring this into the revised reconciliation. (Turnover, is after all, turnover. It is what has been obtained in the marketplace.)

|   |         |
|---|---------|
| Financial accounts trading profit   | £57,000 |
| Add back net non-trading income   | 1,000   |
|   | 58,000  |
| Overcharges on selling and administration expenses retained for reasons cited above | 24,000  |
|   | 82,000  |

*Deduct:*

|   |                |
|---|----------------|
| Revised under absorption of production overhead | (35,000)       |
| Difference in closing stock (book/physical)     | (8,000)        |
| Corrected 'costing' profit                      | <u>£39,000</u> |

Lest the reader is sceptical, and feels that this is little more than legalized 'cooking the books', the reconciliation between the original costing profit and the corrected figure is shown.

|                                       |               |
|---------------------------------------|---------------|
| Initial costing profit                | £4,000        |
| <i>Add back:</i>                      |               |
| Opening stock difference (irrelevant) | 13,000        |
| Notional expense items                | <u>50,000</u> |
|                                       | 67,000        |

*Deduct:*

|  |                |
|--|----------------|
| Charge for depreciation on buildings                           | (20,000)       |
| Discount received which reduced the value of the closing stock | (8,000)        |
|  | <u>£39,000</u> |

**A comment about 'interlocking accounts'**

*Interlocking accounts* are defined in the *Terminology* as 'a system in which the cost accounts are distinct from the financial accounts, the two sets of accounts being kept continuously in agreement by the use of control accounts or made readily reconcilable by other means'.

The student will recognize a compromise between the totally separate situation discussed and illustrated above, and the totally integrated situation described below.

The way these accounts work may be best illustrated by means of the use of a flow chart. (See Figure 12.2.)

From the flowchart in Figure 12.2, the student will readily see that the financial ledger control account is critical to the whole process. Essentially, it is the control or summary account for such financial ledgers as the debtors, creditors, and cash book. It provides the opposite entry for the items that are posted to the various accounts shown in the flowchart.

Thus purchases will credit the financial control account, and debit the material control account. Likewise expenses will credit the financial ledger control account via the cash book and the creditors, and debit the production overhead control account.

Sales, by contrast, will credit the sales control, and debit the debtors and cashbook as appropriate.

Although the administration and selling/distribution control accounts do not go through the work-in-progress account to comply with SSAP9, there remains the decision as to whether the costing profit and loss account agrees with the gross profit as defined by the *Companies Act*,

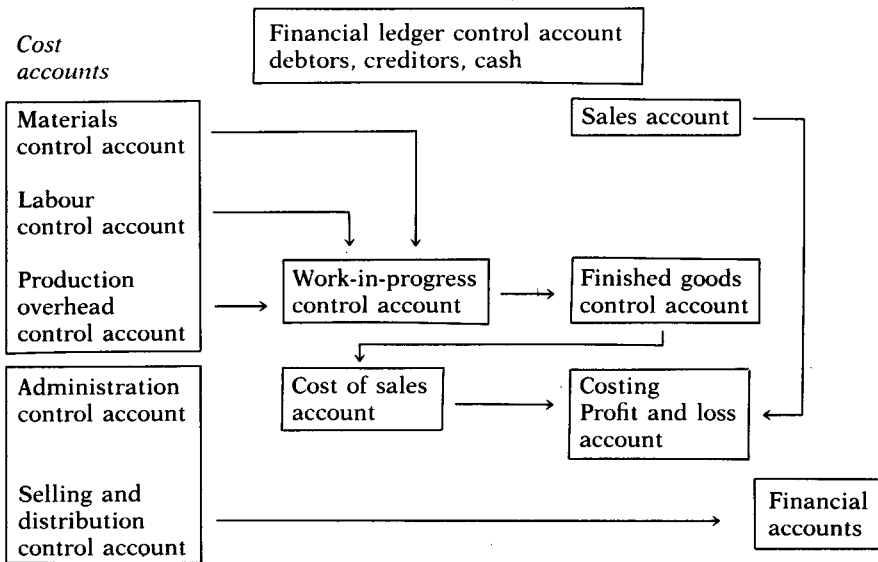


Figure 12.2 Interlocking accounts – flow chart

1985, or the profit before other operating income, i.e. after Line 5 on the CA 85 presentation.

With that point clarified, an interlocking system becomes a virtually self-contained system as far as the gross profit is concerned, and any reconciliation between the costing profit and a financial profit would largely involve items that would go into the accounts below Line 6 anyway.

One final point which should be added is the possible existence of a contra account in the financial accounting books. This is purely memoranda, and unlike the control account in the cost accounts, is not part of the double entry.

### Fully integrated accounting systems

These are defined in the *Terminology* as 'A set of accounting records which provides financial and cost accounts using a common input of data for all accounting purposes'.

To that end, the records generate one profit figure, thus eliminating the need for detailed reconciliations between the two systems, and more important, the confusion generated when two sets of figures are likely to be circulated.

The advantages are:

- 1 Easier to maintain.
- 2 Quicker in the production of results, and because there is only one system, easy to operate and manage.

- 3 Elimination of the dichotomy between 'costing' and 'financial' accounting.
- 4 Costly and time consuming reconciliations are dispensed with.

It is alleged that there are disadvantages, but the case for them is not very strong:

- 1 No independent check of accounting records. Repetition on a different basis is hardly a check. Auditors would look for independent evidence, such as physical stock check and valuations.
- 2 Two bases for stock valuation cannot be employed. Whatever the drawbacks of SSAP9 might be, there is only one basis for stock valuation, and little merit in having two. Any doubts about the valuation can always be discussed between management and the auditors.
- 3 Lack of detail for complex production processes. Any information system will produce as much detail as is required, and an integrated system can readily analyse all transactions through a multitude of separate job orders if required.
- 4 Only one classification of costs available. Again, as many classifications can be developed as required, and seen to be relevant.
- 5 No scope for notional charges. If there is a need for such charges, they can be put through the double entry. The writer has experienced one system where the depreciation was put through on a replacement cost basis for management accounting purposes, and adjusted to historical for financial accounting by simple double entry. Likewise, if the company feels that some form of CCA accounts is useful for control, then the integrated system can be suitably modified.

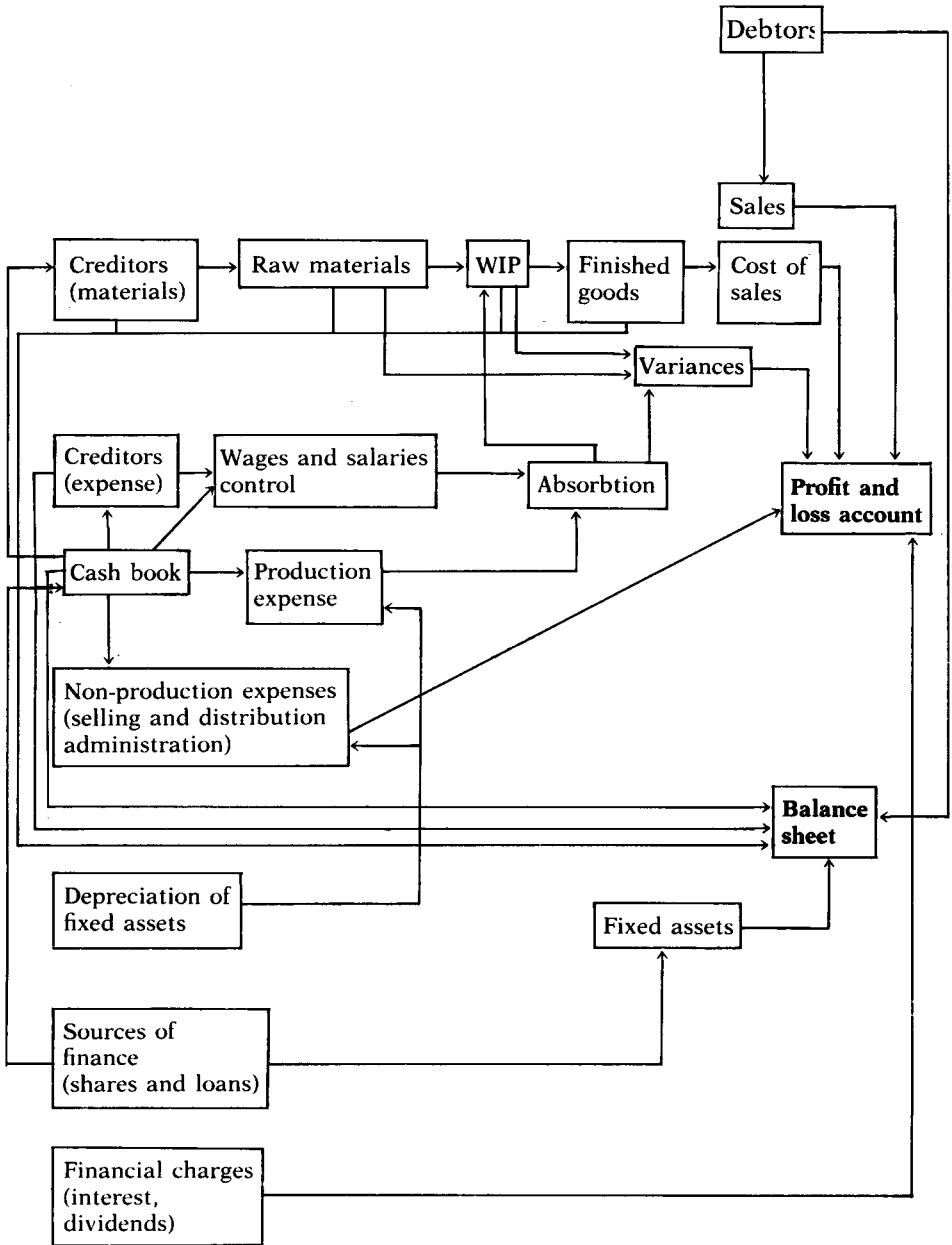
Having, therefore examined the advantages, and dismissed the disadvantages, we can now turn to the practical implications for the student of integrated accounts.

#### ***Approach to questions***

- 1 The starting point is always the opening balances for the year.
- 2 The accounts are written up with each item going into the double entry, so it is unlikely that there will be any notional entries.
- 3 At the end of the period, the accounts are all balanced off, a trial balance taken out, and a profit and loss account and balance sheet produced.

The student will readily appreciate that there will be a large number of 'T' accounts required, creating the inevitable minefield of entries getting missed, and the resultant panic arising because the trial balance does not balance. Consequently, the student should fall back on the extended trial balance approach to such a question, and utilize the self-balancing columnar ledger.

**Flowchart for cost accounts and their relationship with the financial accounts**



From a practical standpoint, in the examination, the student should therefore open out his or her answer book to A3 (double page) size, and work from left to right. He or she will find, that if time runs out, there will be the makings of an answer automatically produced, thus gaining him or her most of the marks.

Let us now turn to an example.

*Example 12.4*

Churchward plc operates an integrated cost accounting system. Below is the balance sheet as at 1 July 19X6 and a summary of the transactions passed through the accounts for the year to 30 June 19X7.

You are required to:

- 1 Write up the accounts for the year to 30 June.
- 2 Take out a trial balance.
- 3 Present a profit and loss account and balance sheet.

*Balance sheet 1 July 19X6*

|  |              |                |
|--|--------------|----------------|
| Fixed assets at cost                   |              | £50,000        |
| Depreciation                           |              | (10,000)       |
| Net book value                         |              | 40,000         |
| Current assets                         |              |                |
| Stocks                                 |              |                |
| Raw materials                          | 6,000        |                |
| Work-in-progress                       | 8,000        |                |
| Finished goods                         | <u>9,000</u> | 23,000         |
| Cash                                   |              | <u>4,000</u>   |
|  |              | <u>27,000</u>  |
| Current liabilities                    |              |                |
| Trade creditors                        |              | (6,000)        |
| Accrual for PAYE                       |              | <u>(1,000)</u> |
|  |              | <u>(7,000)</u> |
| Net current assets                     |              | <u>20,000</u>  |
| Total net assets                       |              | <u>£60,000</u> |
| Financed by:                           |              |                |
| Capital brought forward                |              | <u>£60,000</u> |
| Transaction data for the year:         |              |                |
| Materials purchased                    |              | £48,000        |
| Issued to production                   |              | 44,000         |
| Net wages and salaries paid            |              | 60,000         |
| PAYE paid                              |              | 8,000          |
| Production wages (direct)              |              | 40,000         |
| Indirect production wages and salaries |              | 17,000         |
| Non-production wages and salaries      |              | 12,000         |
| Deductions for PAYE                    |              | 9,000          |
| Depreciation charge                    |              | 13,000         |



|                                       |          |
|---------------------------------------|----------|
| Indirect production expenses          | 14,000   |
| Non-production expenses               | 60,000   |
| Purchase of additional fixed assets   | 80,000   |
| Actual payments for overhead expenses | 39,000   |
| Production overhead absorbed          | 40,000   |
| Cost of completed production          | 122,000  |
| Factory cost of sales                 | 125,000  |
| Loan raised from Standard Bank 1/7/8X | (25,000) |
| Loan interest                         | 4,500    |
| Cash sales                            | 250,000  |
| Closing trade creditors               | (5,000)  |

Applying the columnar ledger approach write up the opening figures on the extreme left, adding whatever headings may prove necessary and make sure that the opening figures balance! Post each of the transactions. Total across to obtain a closing trial balance.

Analyse the trial balance into profit and loss and balance sheet.

| Opening figures | Transactions |           |           |            |          | Closing TB** |
|-----------------|--------------|-----------|-----------|------------|----------|--------------|
| Details:        | Purch.       | Sales/c/s | Issues    |            |          |              |
|                 | Depreciation | Expenses  | Other*    | PAYE (***) |          |              |
| Fixed assets    | 50,000       | 80,000    |           |            |          | 130,000 B    |
| Depreciation    | (10,000)     | (13,000)  |           |            |          | (23,000) B   |
| Raw materials   | 6,000        | 48,000    |           | (44,000)   |          | 10,000 B     |
| WIP             | 8,000        |           |           | 2,000      |          | 10,000 B     |
| F goods         | 9,000        |           | (125,000) | 122,000    |          | 6,000 B      |
| Cash            | 4,000        | (128,000) | 275,000   | (135,000)  | (12,500) | 3,500 B      |
| Creditors       | (6,000)      |           | (74,000)  | 75,000     |          | (5,000) B    |
| PAYE            | (1,000)      |           |           | (9,000)    | 8,000    | (2,000) B    |
| Capital         | (60,000)     |           |           |            |          | (60,000) B   |
| Wages etc       |              |           |           | 9,000      | (9,000)  |              |
| Overheads       |              | 13,000    | 14,000    | (20,000)   | 9,000    | 16,000 P     |
| Expenses        |              |           | 60,000    |            |          | 60,000 P     |
| Cost of sales   |              |           | 125,000   |            |          | 125,000 P    |
| Sales           |              |           | (250,000) |            |          | (250,000) P  |
| Loan            |              |           | (25,000)  |            |          | (25,000) B   |
| Loan interest   |              |           |           |            | 4,500    | 4,500 P      |

\* These have been netted off because of the space requirement.

\*\* As already intimated, if pushed for time, the extended trial balance will get the student most of the marks for the question.

\*\*\* The student will recall from Linda Defriez's *Elementary Techniques*, that the use of B and P is a good way of identifying which TB items go to the balance sheet and which to the profit and loss.

*Churchward plc*  
*Trading profit and loss account 30 June 19X6*

|               |           |
|---------------|-----------|
| Turnover      | 250,000   |
| Cost of sales | (125,000) |

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|                    |                |
|--------------------|----------------|
| Manufacturing loss | (16,000)       |
| Gross profit       | <u>109,000</u> |
| Expenses           | (60,000)       |
| Loan interest      | (4,500)        |
| Net profit         | <u>44,500</u>  |

*Balance sheet as at 30 June 19X6*

---

|                                 |                 |                |
|---------------------------------|-----------------|----------------|
| Fixed assets at cost            | £130,000        |                |
| Depreciation                    | <u>(23,000)</u> |                |
| Net book value                  | 107,000         |                |
| <i>Current assets:</i>          |                 |                |
| Stocks                          |                 |                |
| Raw materials                   | 10,000          |                |
| Work-in-progress                | 10,000          |                |
| Finished goods                  | 6,000           |                |
| Cash                            | <u>3,500</u>    |                |
| Total                           | 29,500          |                |
| <i>Current liabilities:</i>     |                 |                |
| Creditors                       | (5,000)         |                |
| PAYE                            | <u>(2,000)</u>  |                |
| Net current assets              |                 | 22,500         |
| Total net assets                |                 | 129,500        |
| Loan                            |                 | (25,000)       |
| Total capital employed          |                 | <u>104,500</u> |
| <i>Financed by:</i>             |                 |                |
| Opening capital                 |                 | 60,000         |
| Profit                          |                 | 44,500         |
| Closing capital carried forward |                 | <u>104,500</u> |

Now let us consider a much larger question.

*Example 12.5*

Maunsell plc operates an integrated accounting system and the following details given relate to the year to 31 December 19X6.

From the details given below, for the year to 31 December 19X6, you are required to:

- 1 Write up the appropriate ledger accounts recording the transactions for the year.
- 2 Prepare a profit and loss account for the year.
- 3 Prepare a balance sheet as at the end of the year.

*Opening trial balance: 1 January 19X6*

---

|                        |         |
|------------------------|---------|
|                        | £k      |
| Ordinary share capital | (1,000) |
| Reserves               | (200)   |
| Creditors              | (150)   |
| Expense creditors      | (20)    |

|  |            |
|--|------------|
| Freehold buildings (acquired 1 January 19X0) (at cost) | 500        |
| Plant and machinery (at cost)                          | 300        |
| Provision for depreciation:                            |            |
| Freehold buildings                                     | (50)       |
| Plant and machinery                                    | (100)      |
| Stocks: Raw materials                                  | 220        |
| Work-in-progress                                       | 40         |
| Finished goods   | 60         |
| Debtors  | 200        |
| Bank   | <u>200</u> |

Transactions for the year:

|   |       |
|---|-------|
| Materials: purchased on credit  | 990   |
| returned to suppliers   | 40    |
| issued to work-in-progress  | 850   |
| Production: direct wages incurred                                       | 250   |
| salaries  | 60    |
| expenses incurred   | 320   |
| Carriage inwards  | 45    |
| Depreciation: plant and machinery                                       | 150   |
| buildings   | 10    |
| Production overhead absorbed  | 560   |
| Production: standard cost   | 1,720 |
| Administration  | 360   |
| Selling and distribution  | 200   |
| Finished goods sold   | 2,000 |
| Sales (on credit)   | 2,500 |
| Sales returns   | £60k  |
| Cash sales  | 300   |
| Variances: material price (adverse)                                     | 35    |
| usage (favourable)  | 20    |
| direct wages rate (favourable)  | 15    |
| efficiency (favourable)   | 30    |
| production overhead expense (adverse)                                   | 25    |
| efficiency (favourable)   | 40    |
| Abnormal loss of raw material stock, cash received from insurance claim | 60    |
| New machinery purchased by cheque                                       | 600   |
| New buildings purchased by cheque                                       | 250   |
| Paid: creditors   | 895   |
| expense creditors   | 730   |
| Cash discount received from trade creditors                             | 50    |
| Paid wages and salaries   | 425   |
| Deductions from wages and salaries                                      | 50    |
| Received from debtors   | 2,350 |
| Cash discount allowed   | 35    |
| Bad debts written off   | 25    |

In addition:

- 1 During the year there was a one for four rights issue of share capital, raising £300k.
- 2 The existing freehold buildings were professionally revalued up to £1,000k. The depreciation charge for the year has to include this.
- 3 The charge for depreciation on plant and machinery includes the equipment bought during the year. Provision needs to be made for the depreciation of the new freehold building.
- 4 On the 1st January 19X6 the company negotiated a loan of £100k at 15%. One year's interest needs to be provided.
- 5 Provide for a dividend of 4.5p per share. The shares issued during the year do not rank for dividend.

*Approach:*

There are some nasty twists in this question. Almost deliberately, there are some points that tempt the student to scream, 'Hey! That is financial accounting!' That is the whole point of the question, rightly or wrongly, to remove the dichotomy between cost and financial accounting.

Once again, the student should open out his or her examination book to an A3 sheet, and start by putting the opening trial balance down the extreme left hand side. Then each of the transactions listed above should be passed through the double entry system. Some of the more complicated entries will also be shown as journal entries for the benefit of the student.

| <i>Opening TB</i> | <i>Transactions</i>           |                  |       |       |         |         | <i>Closing</i> |           |  |
|-------------------|-------------------------------|------------------|-------|-------|---------|---------|----------------|-----------|--|
|                   | 1                             | 2                | 3     | 4     | 5       | 6       |                |           |  |
| Ords              | (1,000)                       |                  |       |       |         |         | (250)          | (1,250) B |  |
| Res               | (200)                         |                  |       |       |         |         |                | (200) B   |  |
| Cred              | (150)                         | (990)            | 40    | 895   |         |         | 5              | (200) B   |  |
| ExCred            | (20)                          |                  |       |       |         |         | 15             | (5) B     |  |
| Fbldg             | 500                           |                  | 250   |       |         |         | 500            | 1,250 B   |  |
| P & M             | 300                           |                  | 600   |       |         |         |                | 900 B     |  |
| Depn              | (50)                          |                  | (25)  |       |         |         | (50)           | (125) B   |  |
| Depn              | (100)                         |                  | (150) |       |         |         |                | (250) B   |  |
| RMat              | 220                           | 990              | (40)  | (850) |         |         | (100)          | 220 B     |  |
| WIP               | 40                            |                  |       | 850   | (1,720) |         | 885            | 55 B      |  |
| FGood             | 60                            |                  |       |       | 1,720   | (1,760) | 40             | 60 B      |  |
| Debt              | 200                           | (2,350)          |       |       | (60)    | 2,500   | (60)           | 230 B     |  |
| Bank              | 200                           | 1,600            | (100) | (895) | 300     | 400     | (1,090)        | 410 B     |  |
| W + S             | (All conveniently netted off) |                  |       |       |         |         |                |           |  |
| Expe              | 155                           | (See note below) |       |       |         |         | (155)          |           |  |
| Admin             |                               |                  |       |       |         |         | 360            | 360 P     |  |
| S + D             |                               |                  |       |       |         |         | 200            | 200 P     |  |
| COS               |                               |                  |       |       | 1,760   |         | (40)           | 1,720 P   |  |
| Sales             |                               |                  | (300) | 60    | (2,500) |         | (35)           | (2,705) P |  |
| Vars              | (See note below)              |                  |       |       |         |         | (45)           | (45) P    |  |
| Accl              |                               |                  |       |       |         |         | (60)           | (60) B    |  |
| Abnm              | (This will net out)           |                  |       |       |         |         |                |           |  |
| PAYE              |                               |                  |       |       |         |         | (50)           | (50) B    |  |
| BDeb              |                               |                  |       |       |         |         | 25             | 25 P      |  |
| SPrem             |                               |                  |       |       |         |         | (50)           | (50) B    |  |
| Revn              |                               |                  |       |       |         |         | (450)          | (450) B   |  |
| Loan              |                               |                  |       |       |         |         | (100)          | (100) B   |  |
| Lint              |                               |                  |       |       |         |         | 15             | 15 P      |  |
| Divi              |                               |                  |       |       |         |         | 45             | 45 P      |  |

Journal entry details:

|                                   | DR    | CR    |
|-----------------------------------|-------|-------|
| 1 Raw materials                   | 990   |       |
| Creditors                         |       | 990   |
| Debtors                           |       | 2,350 |
| Bank                              | 2,350 |       |
| <hr/>                             |       |       |
| 2 Purchase of plant               | 600   |       |
| Purchase of new freehold building |       | 250   |
| Bank                              |       | 850   |
| Discount received (creditors)     | 40    |       |
| Raw materials                     |       | 40    |
| Depreciation provision            |       | 25    |
|                                   |       | 150   |
| Production expense                | 175   |       |
| <hr/>                             |       |       |
| 3 Issue of materials to WIP       | 850   |       |
| Raw materials                     |       | 850   |
| Bank                              |       | 895   |
| Creditors                         | 895   |       |
| <hr/>                             |       |       |
| 4 Transfer to F goods             | 1,720 |       |
| WIP                               |       | 1,720 |
| Sales returns                     | 60    |       |
| Debtors                           |       | 60    |
| Cash sales                        |       | 300   |
| Bank                              | 300   |       |
| <hr/>                             |       |       |
| 5 Credit sales                    |       | 2,500 |
| Debtors                           | 2,500 |       |
| Cost of sales (F goods)           |       | 1,760 |
| Cost of sales                     | 1,760 |       |
| <hr/>                             |       |       |
| 6 New share issue                 |       | 250   |
| Share premium                     |       | 50    |
| Cash                              | 400   |       |
| Loan                              |       | 100   |
| Accruals                          |       | 60    |
| Interest                          | 15    |       |
| Dividend                          | 45    |       |
| Revaluation (net)                 |       | 450   |
| Additional depreciation           |       | 50    |
| Freehold buildings                | 500   |       |
| <hr/>                             |       |       |

Notes about specific items:

Wages and salaries

Entries:

Wages incurred 250

|  | DR  | CR              |
|--|-----|-----------------|
| Employment costs (PAYE)  | 50  |                 |
| Absorbed into work-in-progress   |     | 335             |
| Variances (favourable so debit to the wages and salaries account, credit to profit and loss) |     |                 |
| rate   | 20  |                 |
| efficiency   | 15  |                 |
| Production salaries  | 60  |                 |
| Expenses   | 320 |                 |
| Depreciation buildings   | 25  |                 |
| plant  | 130 |                 |
| Variances expenses   |     | 25 (DR to P/L)  |
| efficiency   | 40  | (CR to P/L)     |
| Absorbed into WIP  |     | 550             |
| Abnormal material loss   |     |                 |
| Credit raw materials   |     | 60              |
| Debit abnormal material loss account   | 60  |                 |
| Debit cash received  | 60  |                 |
| Credit abnormal material loss account.   |     | 60              |
| Analysis of the variances  |     |                 |
| Direct material price  | 35  | (CR raw mat)    |
| Direct material usage  |     | 20 (DR WIP)     |
| Direct wages rate  | 15  |                 |
| Direct wages efficiency  | 30  | (DR WIP)        |
| Production overhead expense  | 25  |                 |
| Prod overhead efficiency   |     | 40 (net to WIP) |

As in the previous example, it will help the student to indicate which items go to profit and loss (P) and which to the balance sheet.

Now to the actual answer.

*Solution:*

*Maunsell plc*

*Profit and loss account 31 December 19X6*

|                             |              |
|-----------------------------|--------------|
| Turnover                    | £2,750k      |
| Cost of sales               | (1,720)      |
| Manufacturing variances     | 45           |
| Gross profit                | <u>1,030</u> |
| Expenses                    |              |
| Administration              | £(360)       |
| Selling and distribution    | (200)        |
| Bad debt written off        | (25)         |
| Provision for loan interest | (15)         |
| Provision for dividend      | (45)         |
| Total expenses              | <u>(645)</u> |
| Net profit retained         | <u>£385k</u> |

| <i>Balance sheet</i>            | <i>Cost/Revenue</i> | <i>Depreciation</i> | <i>Net</i>     |
|---------------------------------|---------------------|---------------------|----------------|
| Freehold buildings              | £1,250              | (125)               | £1,125k        |
| Plant and machinery             | 900                 | (250)               | <u>650</u>     |
|                                 |                     |                     | <u>£1,775</u>  |
| <i>Current assets:</i>          |                     |                     |                |
| Stocks raw materials            |                     | 220                 |                |
| Work-in-progress                |                     | 55                  |                |
| Finished goods                  |                     | 60                  |                |
| Debtors                         |                     | 230                 |                |
| Cash                            |                     | <u>410</u>          |                |
|                                 |                     | 975                 |                |
| <i>Current liabilities:</i>     |                     |                     |                |
| Creditors                       |                     | (200)               |                |
| Expenses creditors              |                     | (5)                 |                |
| PAYE                            |                     | (50)                |                |
| Accruals: Interest on loan      |                     | (15)                |                |
| Dividend                        |                     | <u>(45)</u>         |                |
|                                 |                     | (315)               |                |
| Net current assets              |                     |                     | 660            |
| Total net assets                |                     |                     | <u>2,435</u>   |
| Loan                            |                     |                     | <u>(100)</u>   |
| Net capital employed            |                     |                     | <u>£2,335k</u> |
| <i>Financed by:</i>             |                     |                     | £k             |
| Ordinary share capital          |                     |                     | 1,250          |
| Share premium                   |                     |                     | 50             |
| Revaluation reserve             |                     |                     | 450            |
| Retained profit brought forward |                     |                     | 200            |
| Current year                    |                     |                     | <u>385</u>     |
|                                 |                     |                     | <u>£2,335k</u> |

## Questions

1 K Limited operates separate cost accounting and financial accounting systems. The following manufacturing and trading statement has been prepared from the financial accounts for the quarter ended 31 March:

|                | £              | £ |
|----------------|----------------|---|
| Raw materials: |                |   |
| Opening stock  | 48,000         |   |
| Purchases      | <u>108,800</u> |   |
|                | 156,800        |   |
| Closing stock  | <u>52,000</u>  |   |

|                                     |                |                |
|-------------------------------------|----------------|----------------|
| Raw materials consumed              |                | 104,800        |
| Direct wages                        |                | 40,200         |
| Production overhead                 |                | 60,900         |
| Production cost incurred            |                | <u>205,900</u> |
| Work-in-progress:                   |                |                |
| Opening stock                       | 64,000         |                |
| Closing stock                       | <u>58,000</u>  |                |
|                                     |                | 6,000          |
| Cost of goods produced carried down |                | <u>211,900</u> |
| Sales                               |                | <u>440,000</u> |
| Finished goods:                     |                |                |
| Opening stock                       | 120,000        |                |
| Cost of goods produced brought down | <u>211,900</u> |                |
|                                     |                | <u>331,900</u> |
| Closing stock                       | <u>121,900</u> |                |
| Cost of goods sold                  |                | <u>210,000</u> |
| Gross profit                        |                | <u>230,000</u> |

From the cost accounts, the following information has been extracted:

|   |         |
|---|---------|
| Control account balances at 1st January:                        | £       |
| Raw material stores   | 49,500  |
| Work-in-progress  | 60,100  |
| Finished goods  | 115,400 |
| Transactions for the quarter:                                   | £       |
| Raw materials issued  | 104,800 |
| Cost of goods produced  | 222,500 |
| Cost of goods sold  | 212,100 |
| Loss of materials damaged by flood<br>(insurance claim pending) | 2,400   |

A notional rent of £4,000 *per month* has been charged in the accounts. Production overhead was absorbed at the rate of 185 per cent of direct wages.

You are required to:

- Prepare the following control accounts in the cost ledger:
  - raw materials stores
  - work-in-progress
  - finished goods
  - production overhead (10 marks)
- Prepare a statement reconciling the gross profit as per the cost accounts and the financial accounts. (11 marks)
- Comment on the possible accounting treatment(s) of the under or over absorption of production overhead, assuming that the financial year of the company is 1 January to 31 December. (4 marks)





Production overhead: absorbed at 150 per cent of direct wages  
 Gross profit: calculated at  $16\frac{2}{3}$  per cent of selling price  
 Budgeted output: 10,000 units per week.

You are required to:

- (a) Calculate the appropriate variances for October; (16 marks)
  - (b) Show the accounts for October as they would be expected to appear in the ledger; (16 marks)
  - (c) Prepare a profit and loss statement for October, together with a balance sheet as at the end of that month. (8 marks)
- (Total: 40 marks)

*CIMA CA2*

- 3 You are required, using the information given below for the month of April, in respect of D Manufacturing Company Limited to:
- (a) Write up the integrated accounts.
  - (b) Prepare a trading and profit and loss account for April.
  - (c) Compile a trial balance as at 30 April.

*List of balances as at 1 April:*

|   |             |
|---|-------------|
|   | <i>£000</i> |
| Land and buildings  | 500         |
| Plant, machinery and office equipment                             | 800         |
| Provision for depreciation, plant, machinery and office equipment | 200         |
| Material stores   | 80          |
| Work-in-progress  | 40          |
| Finished goods stock  | 20          |
| Debtors   | 260         |
| Creditors   | 100         |
| Bank overdrawn  | 50          |
| Share capital   | 1,100       |
| Share premium   | 200         |
| Profit and loss, appropriation: credit balance                    | 35          |
| Creditor for PAYE and national insurance                          | 15          |

*Transactions for the month of April:*

|                            |             |
|----------------------------|-------------|
|                            | <i>£000</i> |
| Cash received from debtors | 190         |
| Cash paid to creditors     | 70          |

|                                    | <i>Gross wages<br/>£000</i> | <i>PAYE and national insurance<br/>£000</i> |    |
|------------------------------------|-----------------------------|---|----|
| Direct wages paid                  | 40                          | 10  | 30 |
| Indirect wages paid                | 20                          | 5   | 15 |
| Administrative staff salaries paid | 30                          | 10  | 20 |



# 13 Presentation of cost accounting information

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## **Introduction**

We have now reviewed all the techniques essential to obtaining a grounding in cost accounting. Consequently, the purpose of this final chapter is to help the student reader to develop that most vital of all accounting skills – the ability to communicate the technical knowledge and understanding he or she has of the business to the other members of the management team. This chapter will thus have two distinct halves. In the first half we will review the communications constraints and desires put upon the accountant. Secondly, we will go into the mechanics of report writing in some detail.

## **Accountancy is a communications discipline**

All accountants must be able to communicate. This means possessing:

- 1 The relevant technical knowledge.
- 2 The ability to prepare detailed quantitative data about the past or future of the organization.
- 3 The ability to prepare the required reports and schedules.
- 4 The ability to use the information and reports that are prepared.

Since no accountant works in isolation, but rather as part of a team, it is this latter point that in many ways is the most vital. The prepared information must be presented to other members of the team in a way that is readily understandable. In achieving this degree of intelligibility, recognition must be given to the nature of the users. As a starting point, the list presented by Carsberg, Hope and Scapens, (1974) includes shareholders, creditors, employees, managers, and representatives of society. The significant feature of this group is that none may have much more than a common sense knowledge of the machinations of

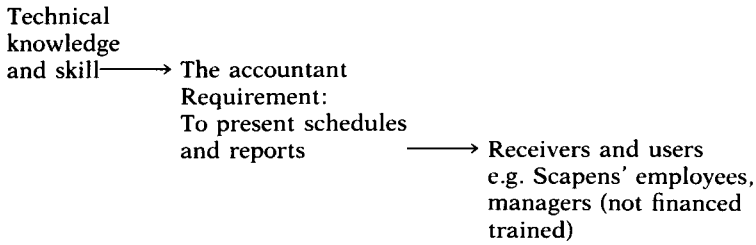


Figure 13.1 *Communication in accountancy*

accounting and finance. To aid our own communication, let us consider this as a diagram. (See Figure 13.1.)

### Primary rubric

Students are primed for just such a situation. Examiners repeatedly remind them that one of the objectives of the written papers is to assist the student in developing the skill of effective written communication *often to non-financial management*. This training is further developed on the computational papers by including questions that require the student to write a report about what he or she has just done as part of the answer.

Many students fail examinations not because of technical inability, but because of a failure to relate and communicate in the written part of their papers. The purpose of this chapter is to help the student attempt to rectify this problem.

### Some essential rubrics

Traditional textbooks give little advice on how reports should be structured and written. It is therefore necessary to move across into the realm of management studies, and for clarity we tabulate the essential rubrics that must be followed. (See Table 13.1.)

### Extensions and contrasting viewpoints

Hofstede (1968) makes the following useful comments:

- 1 How and by whom is the decision made to publish a periodic report? For many companies, and this is implied by the comments above, written reports proliferate so quickly, that managers soon start to complain about information 'noise'. (Too much information

Table 13.1

| <i>Rubric</i>  | <i>Example/comment</i>   |
|--|--|
| 1 Reports must be timely.  | A weekly report for week-ending Friday should be available by the mid-morning of the Monday of the following week.   |
| 2 Should report the facts and be relevant.   | Horngren's attention-directing criterion, with consideration of the causes, and capable of influencing the users' behaviour by reducing their uncertainty and aiding their decisions.  |
| 3 Must be material.  | Not contain trivia.  |
| 4 Must be fair (as in true and fair).  | Objective, neutral, supported by verifiable evidence and bias free.  |
| 5 Must be understandable by its potential users, (user friendly).  | Remember the users may not be as well trained as you.  |
| 6 Must be comparable/consistent.   | Townsend points out that the quickest way to do a 'snow job' is to change one aspect of the information prepared each month to destroy the effective comparability of the information.   |
| 7 Must not be the end in itself.   | Do not let the accounting run away with the company. Rather, give management what is required to run the organization.   |
| 8 Guard against proliferation.   | A regular review of the reports should be undertaken, covering content, relevance, accuracy, value and if they are still required. (Also control rigorously procedures for creating new reports.)  |
| 9 Ensure that all the reports are prepared on the same base, and that the data presented relates to what the user manager can control. | It makes a nonsense of control and reporting systems if a production manager is presented with a report that tells him that his output is only 50 per cent of what he knows he produced, the discrepancy coming from the fact that what was being reported was deliveries, and not production. |

obscuring the understanding of the main message.) This is not a new phenomenon, arising from the universal computer age, but was observed in the early 1960s.

- 2 Information should fall into three categories (c/f Horngren):
  - (a) Information required to make decisions.
  - (b) Information which does not lead to immediate decisions, but which gives useful background data and influences the general

attitude and *esprit de corps* of the reader. (People do like to be kept informed.)

- (c) All other information. The third category of information is superfluous and acts as 'noise' which may damage the effect of communicating other types of information.
- 3 How much self-help is needed from the receiver of the report? Convictions and practices differ widely here. One view advocates that the budget department should report detailed explanations of variances, based on consultation with the operations area, in the report. This is what usually happens in English or American companies, who see the accounting function as a service to production/operations, adding a new dimension to the production/operations data already available, by combining it with data unavailable to individual functions to provide a total view.

In addition, it is further argued that only finance have the time as well as the ability to do the analysis. The opposing view is that reports should just give the figures, and that interpretation is a line task. This view presupposes that the line operations management have the time and the ability to perform such exercises. One possible solution is for the budget department to prepare the schedules and reports, but the production and updating of graphs is deliberately left to the line manager. This is designed to stimulate the involvement of line management in the figures. Whatever the viewpoint, a report of some kind has to be prepared by the finance function for ultimate use by non-finance trained managers or supervision.

The ideas suggested by Hofstede have been developed by others. T. A. Lee cites other contemporary research into the actual users of accounting information. In essence this means that the accountant must consider:

- 1 What a user is willing to perceive. In the context of managers, this may mean a need to educate beyond the traditional 'rule of thumb' methods that are rigidly adhered to.
- 2 The general level of perception and education of the users. This may well surprise many students. British management has been described in comparison to its European, American and Japanese counterparts as a 'bunch of thickies' and this implies that accountants must assess the ability of their users to identify what is truly material, comprehensible and relevant to the decision making and control processes.
- 3 Human attitudes. Traditionally, operations managers are suspicious, if not frightened of accountants, believing that they are natural 'fiddlers'. Effective reporting has to conquer this particular problem if it is to have any meaningful credibility at all.

In addition, there are precepts laid down by the FASB.

- 1 Identify the objectives of the financial reports to be presented.
- 2 Specify the characteristics of the information required.

- 3 A set of definitions of the elements of financial statements.
- 4 A set of measurement rules.

From this the FASB have established a hierarchy of accounting qualities. Although initially geared to external reporting, the principles can be readily related to internal reporting procedures. These have already been readily implied in the rubrics above, but are worth highlighting again:

- 1 Benefits greater than costs.
- 2 Understandability.
- 3 Use/value and relevance reliability.
- 4 Timeliness with both predictive and feedback value.
- 5 Verifiable, neutral, comparable and material.

Having thus gone through the rubrics and some of the surrounding debates, we should have a clear idea of the constraints that impinge upon the accountant as he or she contemplates the preparation of reports and schedules.

### **The methodology of report writing**

Let us start by briefly revising the mechanics of report writing. A five stage approach is recommended.

- 1 The object of the report.
- 2 Preparation-method of investigation, area etc.
- 3 Collecting information.
- 4 Collating the report.
- 5 Revision.

#### ***Object***

Make sure that the aim of the report is perfectly clear. Any ambiguity or uncertainty in the terms of reference should be clarified before proceeding further. The terms of reference must give sufficient detail to establish accurately:

- 1 the topic of investigation.
- 2 the limitations, if any, of the enquiry.
- 3 the purpose of the report.

#### ***Preparation***

Before enquiries and the collection of information commence, it is essential to prepare a framework of investigation. Work can then proceed to a flexible plan which may be revised as necessary when fresh information becomes available. The plan should be based upon such factors as assessment of the likely difficulties, the time factor, amount of



cooperation from employees or other managers, degree of confidentiality, possible repercussions from certain individuals or unions, and any special requirements of the report, such as legal or 'political' implications.

In the context of accounting reports, the information is derived from the accounting and book-keeping system, and the emphasis should be on the basis of ensuring that the information 'drops out' readily with minimal need for reconciliations or analysis. To that end, therefore, consideration should be given to designing an accounting system such that it provides a usable, readily understandable, conservative notation system that will provide user management information that permits them to take the correct action towards their goals, and measure their progress.

As suggested by Hofstede, the reader must be considered when planning the report. This will dictate the degree of detail, the style of presentation, and possibly the behavioural consequences. At the risk of sounding repetitious, students should never lose sight of the fact that much of their information is likely to be placed in the hands of people who are not numerate, nor as well trained.

### ***Collecting information***

Obviously, this is likely to come from the accounting systems, statistical data such as units of production or units sold or delivered, and evaluated in terms of the costing systems as appropriate. Adequate working papers, properly headed up, should be used in case it is necessary to refer back to any of the material after the report is presented.

### ***Collating the report***

Seven useful points need to be remembered:

- 1 *The subject* should be clearly displayed on the title page. The data is important, so that if the report is a regular one, the time period referred to should be readily discernable.
- 2 *Introduction*: This should include the method used in conducting the investigation, any major difficulties, any gaps, any background information required. For the accountant an audit report will illustrate what is implied here. The ICAEW Auditing Standard No 3.103 describes the situation where there might be a qualified audit report presented. Qualifications usually arise from uncertainty or disagreements, and in the report, the auditor will insert a disclaimer referring to (say) limitations in the scope of the audit, due to non-availability of information or accounting records, or (say) inherent uncertainties, possibly over the treatment of a contingent liability under SSAP18.
- 3 *Findings*: This is the main body of the report. In an accounting context, this could be the profit and loss account, balance sheet,

schedule of variances, analysis of inventory levels, each schedule following on logically, and 'locking in' to the summaries. It goes without saying that expense analyses should balance back to the appropriate lines on the profit and loss account. The date(s) at which the information was collected is critical, since it may well be some time before the report is published.

- 4 *Conclusions* that can be drawn from the investigation, such as causes of variances investigated.
- 5 *Recommendations* based upon the findings and conclusions should be included as appropriate. If there is a range of options, then they should be included with the arguments for and against each one. Such options or variable factors may include cost, time, potential disruption of operations, human problems, availability of supplies and space. Likewise, if there are further investigations required, this should be clearly brought out.
- 6 *References*: Two things come under this heading. First, a citation to any documents or books used should be included. This is important for easy reference back if required. Secondly, if the report is very long, a good index should be incorporated, so that any specific topic can be readily found.
- 7 *Summary*: A brief outline of the report is essential for some people who have insufficient time to read the full story. Care is however, needed to ensure that the correct meaning is not lost in the précis exercise. Opinion is divided as to where this summary should be inserted, but clearly it ought to be at the front of the report. In the context of accounting, the use of a 'highlights report' or 'key data sheet' containing the most important topics such as turnover, gross profit/contribution, net profit before tax, capital employed, head-count etc, is ideal for non-financial managers, who can easily be directed to the part of the report that is particularly relevant to them.

### ***Revision of the report***

A revision of the report may be required in the light of new information or changing circumstances. In any case, all written reports will need first draft reading and editing. Any revisions should always be made after some time has elapsed after completing the first draft. In addition, the report should be tested for readability. One measure for this is called the '*Fog Index*', which is a measure of the clarity of reports. In essence, the higher the fog index number is, the more difficult the report is to read and comprehend. It is worth spending time considering how the index is calculated.

To calculate the index:

- 1 Evaluate the average number of words in each sentence in a passage of about 100 words by dividing the total number of words by the number of sentences. There are 92 words in the above paragraph, and six sentences, giving a simple average of 15.3.

- 2 Count the words containing three or more syllables in the passage. Exclude all proper nouns and easy compound words such as past participles like 'extended'. Again, from the above paragraph, the answer comes out at 11.
- 3 By adding 1 and 2 together, and multiplying by a constant 0.4 the fog index is produced.  
Thus  $(15.3 + 11) 0.4 = 10.5$

A passage with an index of 6 is very easy to read, while 17 is extremely difficult. Any figure above 12 is deemed to be difficult to read, so the paragraph above with its fog index of 10.5 is moving towards the area of difficult. In defence, the writer would argue that this article is written for students who are two years into an accountancy training course, and therefore are at least 20 years of age, and have been educated to at least A level standard if not degree level.

Essentially, sentences should be short, contain no more than two ideas, linked with short conjunctions [joining words!] rather than long multi-syllable adverbs piled one on top of the other. To reinforce these principles to the student, and translate them into the context of accountants reporting to their non-financial colleagues, we will now talk through some examples.

*Example 13.1*

Let us begin with something that is fairly familiar, the typical marginal costing type of question where ostensibly, some part of the organization is losing money, and closure is being considered. A company is considering the closure of one of their departments and have obtained the following report from the finance function:

|                 | <i>Dept 1</i> | <i>Dept 2</i> | <i>Dept 3</i> | <i>Total</i> |
|-----------------|---------------|---------------|---------------|--------------|
| Sales (units)   | 5,000         | 6,000         | 2,000         | 13,000       |
| Sales (£)       | 150,000       | 240,000       | 24,000        | 414,000      |
| Cost of sales   |               |               |               |              |
| Direct material | 75,000        | 150,000       | 10,000        | 235,000      |
| Direct labour   | 25,000        | 30,000        | 8,000         | 63,000       |
| Overhead        | 5,000         | 6,000         | 2,000         | 13,000       |
| Total cost      | £(105,000)    | (186,000)     | (20,000)      | (311,000)    |
| Gross profit    | 45,000        | 54,000        | 4,000         | 103,000      |
| Expenses        | (15,000)      | (18,000)      | (6,000)       | (39,000)     |
| Net profit      | £30,000       | 36,000        | (2,000)       | 64,000       |

We are told in addition to the material supplied above, that:

- 1 Production fixed overheads of £13,000 are allocated to the three departments on the basis of unit sales volume.
- 2 Expenses are head office overhead, again allocated to departments on sales volume.

Required:

A report for management, including a restatement of the financial position in terms of contribution made by each department and making a clear recommendation.

*Approach:*

First of all we are required to restate the figures in such a way that they present the situation in its true light. This will enable each department to be readily evaluated on its locally controllable performance. (See Table 13.1.)

Table 13.1 *Revised statement*

|                            | <i>Dept 1</i> | <i>Dept 2</i> | <i>Dept 3</i> |                |
|----------------------------|---------------|---------------|---------------|----------------|
| Sales volume (units)       | 5,000         | 6,000         | 2,000         |                |
| Sales (£)                  | 150,000       | 240,000       | 24,000        |                |
| Direct costs               |               |               |               |                |
| Material (£)               | 75,000        | 150,000       | 10,000        |                |
| Labour (£)                 | 25,000        | 30,000        | 8,000         |                |
| Contribution               | 50,000        | 60,000        | 6,000         | £116,000       |
| Production fixed overheads |               |               |               | (13,000)       |
| Head office expenses       |               |               |               | (39,000)       |
| Net profit                 |               |               |               | <u>£64,000</u> |

### **Report to management on the advisability of closing Department 3**

#### **Introduction**

In response to management's request to appraise the advisability of closing Department 3, we have conducted the following investigation. The method chosen was to first consider the way financial control information was presented. This was found to be misleading, since the figures included allocated fixed overheads over which the operational managers had no control. Indeed, the method of allocation was such as to penalize the successful manager, especially if his or her department unit sales were considerably higher than those of his or her colleagues.

Consequently, we have restated the figures without the non-controllable items allocated out to the operating departments, in order to identify the contribution each unit makes to the corporate entity. You will notice that this in no way changes the profit total on the bottom line.

#### **Findings**

From the restated figures you will see that Department 3 is making a contribution of £6,000 to the overall profit of the business. The apparent loss arises from the unfair allocation of fixed production and administrative overheads.

On this basis, if Department 3 were closed, there would be a loss of contribution of £6,000, and since there would be no saving in fixed

costs, the net profit figure would be reduced to £58,000 from the current £64,000. (See Table 13.2.)

Table 13.2 Revised profit figures assuming Department 3 was closed

|   |                 |
|---|-----------------|
| Contribution as per Table 13.1 above          | £116,000        |
| Delete contribution from Department 3         | (6,000)         |
| Revised contribution from Departments 1 and 2 | <u>£110,000</u> |
| Deduct fixed production overheads*            | (13,000)        |
| Deduct fixed head office overhead             | (39,000)        |
| Revised net profit                            | <u>£58,000</u>  |

\* This assumes that there is no saving achieved in fixed production costs hitherto allocated to Department 3. It should be added that these calculations make no allowance for (a) the additional fixed extraordinary costs of closing Department 3 due to redundancy and losses on any equipment disposals or (b) the possible loss of business from the other Departments because of the non-availability of Department 3's product.

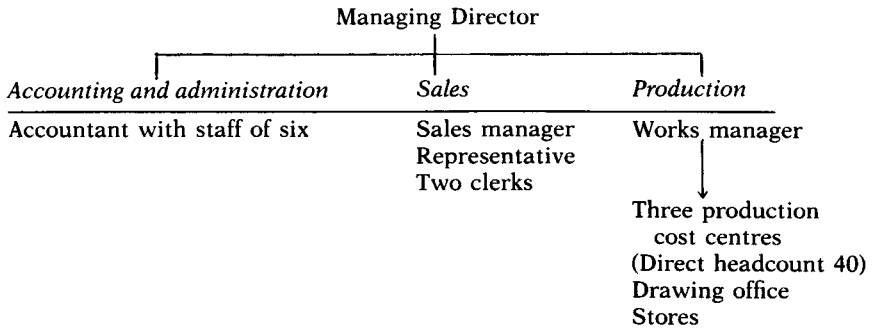
### Conclusions and recommendations

- 1 Department 3 should be kept open since it makes a useful contribution to the profit of the business.
- 2 Consideration should be given to the effectiveness of the reporting methodology and cost allocation procedures, since they are likely to mislead management in their present form. To that end, two alternatives should be considered:
  - (a) Control reporting should be carried out on a marginal costing basis, with operations management assessed for effectiveness on sales and the costs for which they are responsible and can control.
  - (b) Since the requirements of SSAP9 are for inventories to be valued on the basis of total absorption costing, and our auditors require us to comply with that ruling, a method should be found to allocate production fixed costs that does not penalize operations management or distort the figures for decision making purposes.

### Example 13.2

At times, the student is required to prepare a report as to how he/she might formulate a control and reporting system. In this case we will consider a small traditional manufacturing company. It is organized as shown in Figure 13.2.

The company has recently introduced a system of budgetary control and standard costing and, using this system, the board of directors has agreed a profit plan for the year ending 31 August 19X7. The board considers that the most important factors influencing its attainment are associated with capacity sold in terms of productive hours, selling price and standard costs. Costs are classified under the headings of material, labour and fixed overheads. In addition, it is also recognized that payments for materials and wages are the largest recurring cash outlays.



*Figure 13.2 Organization of a small traditional manufacturing company*

You are asked to advise the company about the nature, form and frequency of the main control reports to be introduced in order to monitor adherence to the plan. The works manager is responsible for the buying and as soon as he orders production to begin on a job, the appropriate quantities of material, as contained in the production specifications are immediately issued from stores. The cost centre supervisors are responsible for labour and performance and for excess material usage.

You are required to draft suitable forms of report for the information of, and use by, the supervisor of each cost centre, the works manager and the managing director respectively, indicating the frequency with which each should be prepared. Each report should deal only with the factors to be controlled.

*Approach:*

What is required here is a series of control reports or forms, that will be used on a regular basis for control. While detailed forms design and control is essentially the function of the organization and methods department, the accountant should be aware of what is wanted in order to ensure that the forms and reports prepared give the correct information and stimulate the correct decisions. In this particular situation, we can see clearly who is in control of what, and therefore who is responsible for each item of expenditure or level of activity.

In establishing the reporting system, it is essential for the accountant to list what is required first.

*Cost supervisor:* labour hours worked and produced,  
material usage

*Works manager:* the cost supervisors,  
purchase of materials,  
the drawing office,  
the stores,

*Managing director:* the works manager,  
accounting and administration,  
sales,

This little exercise has been carried out to highlight the inherent danger in this situation, that is to omit any control references to the stores, drawing office and the non-production activities.

Since a profit plan has been prepared and agreed, details of the cost likely to be incurred are also available.

We can now turn to the three individuals concerned.

**Cost centre supervisor:**

Since he is closest to the operation, and as such able to take action upon unfavourable variances quickly, should the need arise, he needs reports on a daily basis. The report should take the following format:

*Production cost centre: Daily control report*

| <i>Budget</i>               | <i>Actual</i>         |
|-----------------------------|-----------------------|
| Hours clocked               |                       |
| Hours worked                | (Idle time)           |
| Hours produced              | (Efficiency variance) |
| -----                       |                       |
| Wages paid                  | (Rate variance)       |
| Material issued             | (Usage variance)      |
| ----- ('Capacity variance') |                       |

*Source documents:*

Hours clocked – the clock cards

Hours worked – the job cards on to which the workers are booked as they start a job.

Hours produced – the completed signed off job cards, indicating that a job is complete. The job itself will have already been timed or at least estimated to compute its value in produced hours.

Wages paid – from the gross wages summary.

Material issued – signed approvals for issue from stores by the works manager.

Supporting this schedule will be a brief outline of the reasons for the variances, although it is likely that a perceptive supervisor will already be expecting them, since he will know already if the variances were due to downtime because of a breakdown or non-arrival of materials.

In addition we add some notes for the student's guidance, especially where terms used may be unfamiliar.

Hours clocked are the hours the direct operatives spend on the site in the plant. Hours worked is the time they spend actually booked on to production activity. In terms of the budget, unless it is known that there will be a period of enforced production idleness, and it is deemed desirable to keep the workforce together, rather than lay them off, these

two figures will be the same. In terms of the actual figures, however, the difference will be the familiar *idle time variance*. Since the company has expressed concern about produced hours the idle time variance will be an important figure to highlight. Produced hours are a measure of what the labour force actually makes expressed in terms of standard hours. The budget will be based on the capacity to be used, based on the budgeted forward load, of each cost centre, possibly with an allowance for essential breaks. The actual will be what has actually been produced. Obviously, the difference between hours worked and hours produced will be the labour efficiency variance. The capacity variance is the difference between budgeted hours produced, based on the capacity of the plant and what has actually been utilized.

The rate variance will be calculated on the basis of actual hours worked at the standard rate, and the actual wages paid. It is unlikely that this will differ much since the standard or budgeted rate should be the rate agreed with the unions. Consequently, this will basically pick up any overtime premium that has not been budgeted for. Again, this will depend on whether or not the capacity usage targets included in the profit plan assumed that overtime was to be worked.

Finally, the difference between material that should have been issued, and what was used will give the material usage variance. It appears that there are two controls over this. Ostensibly the cost centre supervisor is responsible for material usage, based on what is issued to him on the authority of the works manager. However, in the event of material proving defective, or being wasted for whatever reason, there must be a procedure for getting more from the stores. If this requires the approval of the works manager, then he will automatically be advised of any adverse material usage.

One of the biggest problems that the student should be aware of in this context is that there might be a mix of materials and products. We are not told if the company is a single product, single raw material production outfit, or uses a variety of raw materials and/or components to produce a variety of products. If the former is the case, then there is no problem about ascertaining the usage variance, from the budget. However, if there is a variety of materials, and no prior knowledge of what is required to be produced until the week under review, then the variance must be based on the actual standard cost of materials that should have been used compared with the quantity that was actually used.

### **Works manager**

While he will undoubtedly be in touch with what is going on daily, there is a likelihood that there will be a weekly manufacturing cost control meeting at which the works manager will meet his supervisors, relevant service managers and the cost accountant.

The student will notice that the suggested form will include the consolidation of the data presented to the cost centre supervisors on the daily basis. It has been assumed that each of the five schedules pre-



sent to each cost centre supervisor includes a set of data cumulative for the week to date, so that the first part of the works manager's summary is merely a consolidation of the three cumulative forms for the week just elapsed. Equally, as a month or four week production period progresses, there will be the need to produce cumulative data.

*Works manager weekly performance control report*

|  | Budget  | Actual      |                           |
|--|---------|-------------|---------------------------|
| Hours clocked                                      |         |             |                           |
| Hours worked                                       |         |             |                           |
| Hours produced                                     |         |             |                           |
| Hours paid   |         |             |                           |
| Material issued (£)                                |         |             |                           |
| Material purchased (£)                             |         |             | (Material price variance) |
| <i>Expenses:</i>                                   |         |             |                           |
| Headcount  |         |             |                           |
| Production indirects                               |         |             |                           |
| Stores   |         |             |                           |
| Drawing office                                     |         |             |                           |
| Other expenses                                     |         |             |                           |
| Production   |         |             |                           |
| Stores   |         |             |                           |
| Drawing office                                     |         |             |                           |
| Additional analysis:                               | Current | Last period | Movement                  |
| Inventory: Committed                               |         |             |                           |
| Uncommitted  |         |             |                           |
| Order book   |         |             |                           |
| Backlog situation (over 3 weeks/over 6 weeks etc.) |         |             |                           |
| Creditors  |         |             |                           |
| Cash balance                                       |         |             |                           |
| Cash needs (and details of cash level variances)   |         |             |                           |

*Guidance notes*

Some of this information, such as the production statistics, and if cash was really tight, cash levels and needs, could be circulated daily. Expense details, other than pay roll, since they are of secondary importance, might need to be reported only monthly, along with the details of the inventory, and the order book. In the context of labour cost control however, a daily absentee report needs to be circulated.

**Managing director**

Probably two forms would suit the MD best. From the initial scenario, there is obvious data that could be described as 'key'. Since the key factors affecting the achieving of the goals, have been identified, it is probable that the MD would need a daily progress report.

*Daily progress report*

|   | <i>Budget</i> | <i>Actual</i> |
|---|---------------|---------------|
| Orders received (£)   |               |               |
| Deliveries (£)  |               |               |
| -----   |               |               |
| Order book status (produced hours)  |               |               |
| Opening   |               |               |
| Orders received   |               |               |
| Deliveries  |               |               |
| Closing   |               |               |
| (This would be compared against budget)   |               |               |
| -----   |               |               |
| Cash book movement  |               |               |
| Opening   |               |               |
| Received  |               |               |
| Paid out  |               |               |
| Closing   |               |               |
| (This could usefully be compared against budget or continually updated forecasts) |               |               |

In addition, the MD would receive copies of the weekly reports submitted to the works manager. These would consist of a summary of any daily reports submitted. Depending on the priorities as envisaged by the organization, some key information is supplied to the MD on a daily basis. An example of this is the daily divisional cashflow reporting within GEC.

On a monthly basis, the MD would need to receive a set of accounts, i.e. profit and loss account, balance sheet and sources and application of funds statement.

These could take the following form:

*Profit and loss account*

|                           | <i>Budget</i> | <i>Actual*</i> |
|---------------------------|---------------|----------------|
| <b>Sales (deliveries)</b> |               |                |
| <b>Contribution</b>       |               |                |
| Manufacturing variances   |               |                |
| -----                     |               |                |

Gross profit  
 Non-production expenses  
 Sales  
 Administration

---

**Net profit**

---

\* Month and cumulative would be prepared

*Balance sheet*

---

Fixed assets  
 Current assets:  
**Stock**  
 Debtors  
**Cash**

Current liabilities:

**Trade creditors**

Other creditors \_\_\_\_\_

Net current assets \_\_\_\_\_

Total capital employed \_\_\_\_\_

*Financed by*

Capital

Reserves

Retained profit

---

*Sources and application of funds*

|  | Budget | Actual | (month and cumulative) |
|--|--------|--------|------------------------|
|--|--------|--------|------------------------|

---

Sources

Profit

Add back depreciation \_\_\_\_\_

Applications

Movement of

working capital

On each schedule, the items shown in bold type, are those key items which could be circulated separately on a key data or highlights sheet.

If the nature of the product is such that budgeting is likely to be based on guess work, i.e. orders hoped for rather than actually received then one of two strategies could be adopted for control purposes.

- 1 Use the somewhat pragmatic philosophy that, given the agreed profit plan, this is what has to be accomplished each month for it to be achieved. This could be reviewed by a system of forecasts during the year.
- 2 Use probability budgeting, order book based on actual orders

received, probable orders loaded on the basis of the probability that they will be received, and possible orders, similarly loaded for the probability of such orders being received.

## Conclusion

This has been an attempt to relate three things. First there is the essential role of the accountant in his or her organization, or even to his other clients, in the problem of communicating technical knowledge, in a manner that is useable. Secondly, in doing this, the student must be aware of the research and evidence available as to the progress being made in the problem of communicating this information. In this, the student may have to relate across to knowledge acquired through other studies. Thirdly, we have tried to create an essentially practical situation, to give guidelines as to how to at least approach an answer to a question on reporting by taking cognisance of the many constraints and requirements that effective reporting to non-financial management demands.

## Questions

- 1 (a) Describe the role of the cost accountant in a manufacturing organization. (8 marks)
- (b) Explain whether you agree with each of the following statements:
  - (i) 'All direct costs are variable.'
  - (ii) 'Variable costs are controllable and fixed costs are not.'
  - (iii) 'Sunk costs are irrelevant when providing decision making information.' (9 marks)
 (17 marks)

### CACA 1.2

- 2 The managing director of a company manufacturing and selling a range of goods has been looking through the previous period's accounts and has noted that the cost of direct materials purchased, expressed as a percentage of sales, is higher than the budgeted material cost of sales, expressed as a percentage of sales. He concludes from this comparison that the company has been wasting or losing significant amounts of material.

Required:

- (a) Provide *four* reasons why the managing director's conclusions regarding material waste/losses could be incorrect. (6 marks)
- (b) Assuming that the managing director is correct, identify *three* points where material waste/losses could have occurred, and for

each point you have identified, outline a control procedure which could assist in reducing the material waste or losses.

(11 marks)

(17 marks)

*CACA 1.2*

- 3 How can the cost accountant help to control labour costs in an organization? What are the problems that he or she is likely to face in controlling labour costs? (17 marks)

*CACA 1.2*

- 4 You have applied for the position of assistant accountant in a company manufacturing a range of products with a sales turnover of £12 million per annum and employing approximately 300 employees. As part of the selection process you are asked to spend half an hour preparing a report, to be addressed to the managing director, on the topic of 'cost control'.

You are required to write the report which should deal with what is meant by 'cost control', its purpose and the techniques which you believe would be useful within this particular company. (20 marks)

- 5 You are required to:
- (a) Explain what is meant by 'idle time' and state the accounting entries which ought to be made in respect of idle time relating to direct production personnel. (5 marks)
- (b) Draft, for the production manager, an idle time report form incorporating six possible reasons for the idle time occurring. (10 marks)

(Total: 15 marks)

*CIMA CA1*

- 6 (a) Identify and explain the essential elements of an effective cost control system. (13 marks)
- (b) Outline possible problems which may be encountered as a result of the introduction of a system of cost control into an organization. (7 marks)

(20 marks)

(You are required to answer this question as though responding to a request from your non-financial colleague.)

*CACA 1.2 June 1984 (with modified emphasis)*

- 7 (a) Outline how you would explain to your production operations manager the process of charging indirect costs to cost units. (10 marks)
- (b) What are the factors which would influence how the costs of common-used facilities in an organization are passed on to the users of these services? Illustrate your answer from an industry with which you are familiar. (10 marks)

(20 marks)

*CACA 1.2 November 1985*

- 8 The management of a company manufacturing electrical components is considering introducing an historic batch costing system into their factory.

You are required to:

- (a) Outline the information and procedures required in order to obtain the actual direct material cost of each batch of components manufactured. (7 marks)
- (b) Identify the elements which could make up a direct operative's gross wage and for each element explain, with supporting reasons, whether it should be regarded as part of the prime cost of the components manufactured. (10 marks)  
(17 marks)

*CACA 1.2 June 1984*

### **References and further reading**

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- 3 Horngren, C. T., *Cost Accounting*, Prentice Hall, Englewood Cliffs NJ, 1982.
- 4 Townsend, R. C., *Further Up the Organisation*, 1984. Note particularly the reference to Accounting and Reporting (p. 1) and Controllers and Accounting (p. 43).
- 5 Cited by Underwood, B. and Taylor, P. J., *Accounting Theory and Policy Making*, Heinemann, 1985.

The essential framework for this chapter appeared in the Certified Accountants' *Student's Newsletter*, under the heading 'Reporting to Non-Financial Managers' in February 1987. The author gratefully acknowledges permission to use the material here.

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