CONTENTS

1 Introduction

Learning outcomes of Chapter 1

At the end of this chapter, you will be able to:

- understand the principles of management accounting and its position in the organisation
- explain the differences between management and financial accounting
- discuss the history and development of management accounting
- discuss the changing role of management accounting
- explain the need to allocate costs
- classify costs into direct and indirect costs; period and product costs; variable, fixed, semi-variable and stepped costs; decision-making costs and non-manufacturing costs

Introduction

In this chapter the term 'management accounting' will be explained and the role of the management accountant will be defined. The differences between management and financial accounting will be discussed.

You will learn about the history of management accounting and how this has developed to fit the needs of strategic decision-making in businesses.

Management accounting terminology, which will be used throughout the book, will be defined.

The principles of management accounting

CIMA Official Terminology defines management accounting as:

> … the application of the principles of accounting and financial management to create, protect, preserve and increase value for the stakeholders of for-profit and not-for-profit enterprises in the public and private sector.
> Management Accounting is an integral part of management. It requires the identification, generation, presentation, interpretation and use of relevant information to:

- Inform strategic decisions and formulate business strategy
- Plan long, medium and short-run operations
- Determine capital structure and fund that structure
- Design reward strategies for executives and shareholders
- Inform operational decisions
- Control operations and ensure the efficient use of resources
- Measure and report financial and non-financial performance to management and other stakeholders
- Safeguard tangible and intangible assets
- Implement corporate governance procedures, risk management and internal controls.

The definition of management accounting is a long one, but its position in the organisation can be summarised into the following areas:

(a) Planning

Management accounting is concerned with achieving the objectives of the organisation. The objectives should stem from the mission statement and strategies of the organisation, which are then translated into budgets. Budgets set a benchmark from which the organisation can measure whether it is achieving its objectives. **Chapter 6: Budgetary Planning and Control** will cover planning in an organisation.

(b) Decision-making

Management accounting provides detailed and timely information which enables managers to make decisions. The management accountant needs to discern which information is relevant to the decision. **Chapter 10: Relevant Costing and Decision-Making** will cover the decision-making process from a quantitative perspective. Marginal costing information is used to make short-term decisions and this is covered in **Chapter 8: Marginal and Absorption Costing** and **Chapter 9: Cost Volume Profit Analysis**. **Chapter 11: Capital Investment Decisions** sets out appraisal techniques which can be used to make decisions which affect the medium- to long-term future of the organisation.

(c) Reporting

Management accounting is concerned with reporting information for internal use in the organisation. This allows managers to set objectives, control activities, measure performance and make decisions. In profit-making organisations, management accounting is used to report on the main objective of the organisation, i.e., to make profit. In not-for-profit organisations and the public sector, management accounting is used to measure performance and to see if the objectives are being met.

Chapter 7: Standard Costing and Variance Analysis provides a means of measuring actual outcomes against budget and analysing results. This allows managers to take corrective action to ensure the organisation will achieve its stated objectives.

(d) Performance measurement

Management accounting is used to measure performance. In profit-making organisations this is easy as the aim is to make a profit. Quantitative analysis using standard costing will allow measurement of actual costs, revenues and profit against budgets.

In more recent times there has been a move to measure performance not only in terms of quantitative performance but also in terms of qualitative performance. Customer satisfaction, research and development, and employee skills are important for the continued growth of organisations. Qualitative measures have been incorporated into performance reports using the balanced scorecard.

Performance measurement in not-for-profit organisations and the public sector measures whether objectives have been achieved and whether there is value for money. Economy, efficiency and effectiveness are important performance measurement criteria.

All these issues are discussed in **Chapter 12: Performance Measurement and Issues in Accounting**.

(e) Control of operations and efficient use of resources

Management accounting is used to control operations and ensure efficient use of resources. **Chapter 2: Product Costing – Materials and Labour**, **Chapter 3: Product Costing – Overheads** and **Chapter 5: Process Costing** provide a means of costing products, services and inventories.

Chapter 4: Activity-Based Costing provides a more modern approach to product costing which results in more accurate product costing.

Differences between management accounting and financial accounting

Most organisations provide management accounting and financial accounting information. Both sets of accounting systems rely on the same basic financial data. Management accounting is concerned with the provision of detailed accounting information on all aspects of the organisation, e.g., sales by product, sales by regions, sales by employee and sales by customer. Management accounting information contains both quantitative and qualitative information. Financial accounting information is summarised and reports on the organisation as a whole, e.g., sales are reported in total. It mainly contains quantitative information.

Management accounting information is used to make decisions which affect the short-, medium- and long-term future of the organisation. It is used to measure performance and to control different aspects of the organisation. Management accounting uses past information or historic information as well as estimates of future costs and revenues to make decisions. Financial accounting reports on the financial consequences of past activities, usually over the last financial year. The information contained in financial accounts is historic information and is standard in its format.

The systems used to gather information and report information in a management accounting system are more informal than those in a financial accounting system, which are regulated by the International Accounting Standards Board (IASB) and which are highly standardised. This is to ensure that all financial regulations have been complied with and compliance can be easily verified.

Management accounting information is reported on regularly and in as much detail as required. Timeliness is of the essence as decisions may need to be made quickly. Managers might decide to make decisions based on estimates rather than wait for more precise figures. Financial accounting information is usually reported only once a year as part of the year-end accounts but it must be precise as information must be verifiable.

Management accounting information is sensitive and organisations would not want it to get into the hands of competitors, so it is kept within the organisation and is not publicly available. Organisations may be obliged to publish financial information as it is necessary for outside parties such as the Revenue Commissioners, banks and the Companies Registration Office.

Summary of the differences between management accounting and financial accounting

	MANAGEMENT ACCOUNTING	FINANCIAL ACCOUNTING
Level of detail:	Provides detailed information – quantitative and qualitative	Provides high-level information – quantitative
Use of historic and future information:	Uses historic and future estimates	Uses only historic information
Estimates v precise data:	Uses estimates to assist decision-making	Uses precise data to prepare financial reports
Accounting systems:	Informal non-regulated accounting systems	Formal standardised accounting systems regulated by International Financial Reporting Standards (IFRSs)
Timing:	Regular reporting, usually every month or more frequently if required	Annual reporting
Sensitivity of information:	Very detailed and highly sensitive information	Less detailed information which is published in the public domain

The history and development of management accounting

Management accounting came about before financial accounting, according to Grahame Steven (2002). It became more organised during the Industrial Revolution. Johnson and Kaplan (1987) write that in the early 19th century, accountants were concerned with the cost of labour. In pre-factory times, workers were paid 'piece rates' for work carried out at home. This changed when workers were centralised in factories. Work contracts were substituted for piece rates and overhead items such as hauling and repair work began to be supplied internally, not subcontracted.

Johnson and Kaplan (1987) write that the first American business organisations to develop management accounting systems were the mechanised integrated cotton textile factories that appeared after 1812. They used cost accounts to ascertain the direct labour and overhead costs of converting raw material into finished yarn and fabric.

Andrew Carnegie of the Carnegie Steel Company between 1872 and 1902 stated that his operating strategy was to push his own direct costs below those of his competitors. This was to enable him to charge prices that would always ensure enough demand to keep his plants running at full capacity. This required frequent information showing his direct costs relative to those of his competitors.

The development of railroads in the 19th century led to internal accounting systems designed to provide information and control. The railroad companies devised cost accounting systems to evaluate and control the internal processes by which resources were converted into the transport service. A basic measurement of performance developed was the 'ton-mile'. Another measurement of performance developed was the 'operating ratio'. This is a ratio of operating expenses to revenues that railroad companies studied, indicating how variations in the business of diverse sub-units would affect the railroad companies' total performance.

In the last quarter of the 19th century, the American economy witnessed an incredible outpouring of standardised, mass-produced goods. Marshall Fields in Chicago collected departmental accounting information on both gross margins and inventory turnover.

Macintosh (1994) uses the following definition to describe management accounting:

> … the process of identification, measurement, accumulation, analysis, preparation, interpretation and communication of information that assists executives in fulfilling organisational objectives ... a formal mechanism for gathering and communicating data for the ends of aiding and co-ordinating collective decisions in light of the overall goals or objectives of an organization.

Steven (2002) states that there was little need for external reporting and financial accounting until the mid-19th century as there was little or no legal

requirement about what should be provided and when it should be issued.

In summary, the Industrial Revolution brought about a need for a more formal accounting approach to assist managers to plan and make decisions. This developed into the management accounting practices that exist today.

Changing role of management accounting

Johnson and Kaplan stated as far back as 1987 in 'Relevance Lost' that management accounting systems were no longer serving the information needs of managers. When managers are no longer receiving accurate information on the efficiency and effectiveness of internal operations, the business becomes vulnerable to outside competition.

Johnson and Kaplan state that the obsolescence of management accounting information came about due to:

(1) Total quality control

Traditionally manufacturing accepted a level of defects and rejected units and strived to limit this level by focusing on inspection. The availability of new technology in manufacturing and innovative practices developed by Japanese manufacturers in the 1970s led to a practice of 'total quality manufacturing'. Johnson and Kaplan state that with total quality, the only acceptable quality level was zero defects. In the 1980s, US manufacturers found that adopting a zero defect policy enabled them to gain competitive advantage.

(2) Just-in-time inventory systems

Traditionally manufacturing adopted economic order quantity (EOQ) as a means of inventory control. Japanese manufacturing developed a system of inventory control called just-in-time (JIT). This reduced factory set-up times, developed relationships with suppliers, reduced inventory holding levels and improved factory layouts. JIT resulted in great improvements in productivity.

(3) Computer-integrated manufacturing systems

Developments in production technology such as robots and computer-aided manufacturing have resulted in improved quality and reliability.

(4) High-technology products: short product life cycles

Many products have a very short product life cycle and companies compete in these industries by being product innovators. Their goals are continually to introduce high-performance products, products delivered in a timely fashion, customised or niche products.

(5) Deregulation: competition in transportation and service industries

Deregulation of transport and service industries in the 1980s resulted in increased competition in these sectors. Organisations that traditionally were never concerned about product profitability or customer service had to respond to competition. They state that deregulation will lead to an increased demand for excellent cost measurement and management systems.

In **Chapter 12: Performance Measurement and Issues in Accounting**, we will discuss how developments in management accounting have strived to cope with these changes.

Why do we need to allocate costs?

Management accounting attributes costs to cost objects, i.e., the item being costed, be it a product or service. This is necessary for inventory valuation, insurance valuation, setting prices which are based on cost, planning and control, performance evaluation and decision-making.

Costing systems allocate costs to cost objects. Upchurch in *Cost Accounting Principles and Practice* (2002) states that allocating costs to products falls into two categories: (1) specific order costing and (2) continuous operation costing. This topic is discussed in detail in **Chapter 2: Product Costing – Materials and Labour**.

Cost classification

The aim of classifying costs is to impose an ordered structure on an organisation's costs. Cost classification is about grouping together costs that have the same attributes. This should be relevant to managers' information needs. For example, in **Chapter 10: Relevant Costing and Decision-Making**, costs are classified into relevant and irrelevant costs, and in **Chapter 9: Cost Volume Profit Analysis**, costs are classified into variable costs, fixed costs and semi-variable costs.

Grouping costs according to attributes is a subjective process and may change from organisation to organisation. The following list is by no means exhaustive but attempts to classify costs according to their use in this book.

(1) Cost classification: direct and indirect costs

A direct cost is directly and exclusively related to the cost object, for example the raw material costs incurred in making a chair. Direct costs are further classified as direct materials, direct labour and direct expenses. The sum of all direct costs is called 'prime cost'.

An indirect cost, also known as an overhead, cannot be directly or exclusively related to the cost object, e.g., the salary of the supervisor in the factory where the chair is made. In production, indirect costs are referred to as production or manufacturing overheads. Indirect costs are further classified as indirect materials, indirect labour and indirect expenses. This topic is discussed further in **Chapter 2: Product Costing – Materials and Labour** and **Chapter 3: Product Costing – Overheads**.

(2) Cost classification: product cost and period cost

A product cost is the cost of making a product or service. It will contain both direct and indirect costs. For example, the product cost of the chair will include direct costs, e.g., raw materials, and some indirect costs, e.g., part of the supervisor's salary. Unsold finished goods inventory will be valued at the product cost and listed on the balance sheet. When the finished goods are sold, they are released as an expense in the income statement and matched against sales revenue.

A period cost is any cost other than a product cost which is incurred during the accounting period. An example would be selling and distribution overheads and administration overheads. They are treated as an expense in the income statement in the period in which they are incurred. This topic is covered in **Chapter 8: Marginal and Absorption Costing**.

(3) Cost classification: variable, fixed, semi-variable and stepped costs

This topic is covered in **Chapter 9: Cost Volume Profit Analysis**.

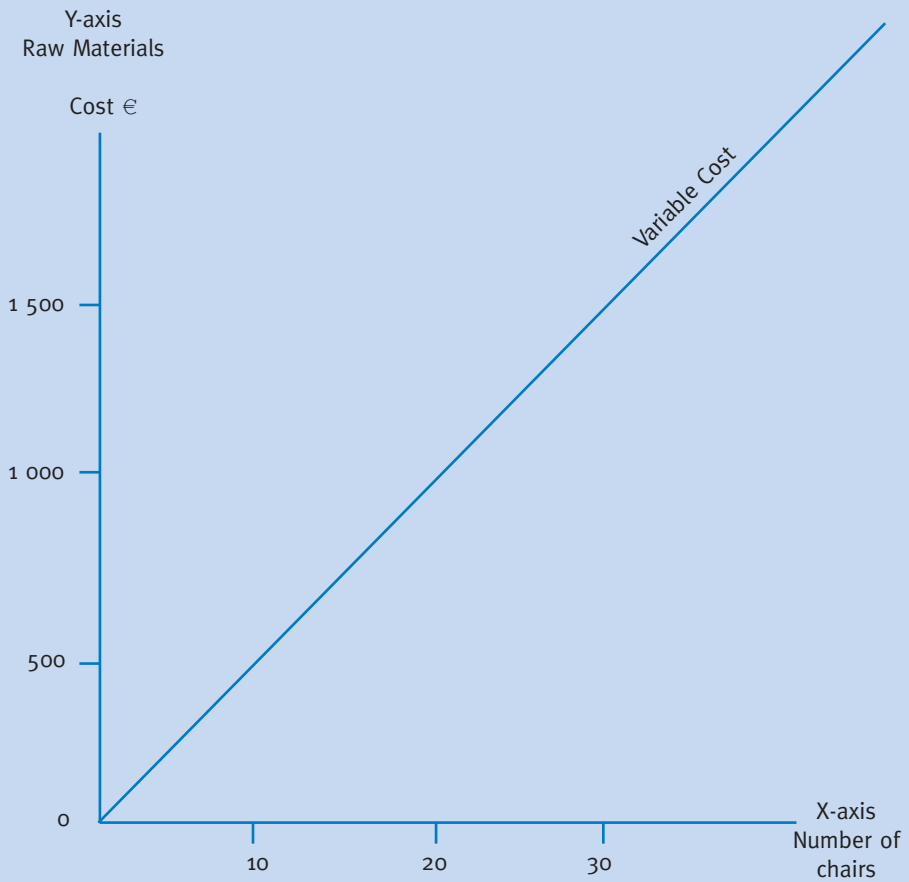
Variable cost

A variable cost varies with the level of activity. For example, if we produce a chair, the more chairs we produce, the more raw materials we will have to purchase. If we do not produce any chairs, we will not incur any raw material costs. Raw materials are classified as a variable cost. If raw materials are €50 per chair, then:

NUMBER OF CHAIRS		€
Zero	0 x €50 =	0
10	10 x €50 =	500
20	20 x €50 =	1 000
30	30 x €50 =	1 500

This can be represented on a graph where the variable cost line is an upward sloping line as follows:

Figure 1.1: *Variable cost graph*

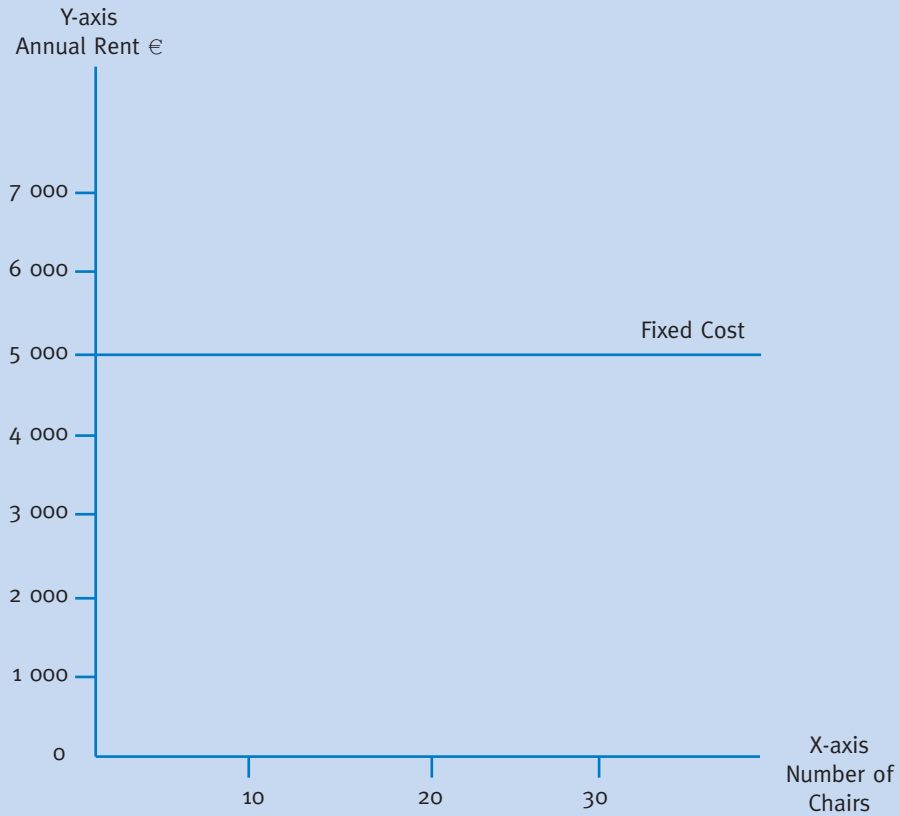


Fixed cost

A fixed cost remains the same or fixed regardless of the level of activity. For example, if the annual rent on the factory where the chairs are produced is €5 000, it will remain the same regardless of whether 10 chairs are produced or 10 000.

The fixed cost line is represented as a horizontal line on the graph:

Figure 1.2: *Fixed cost graph*



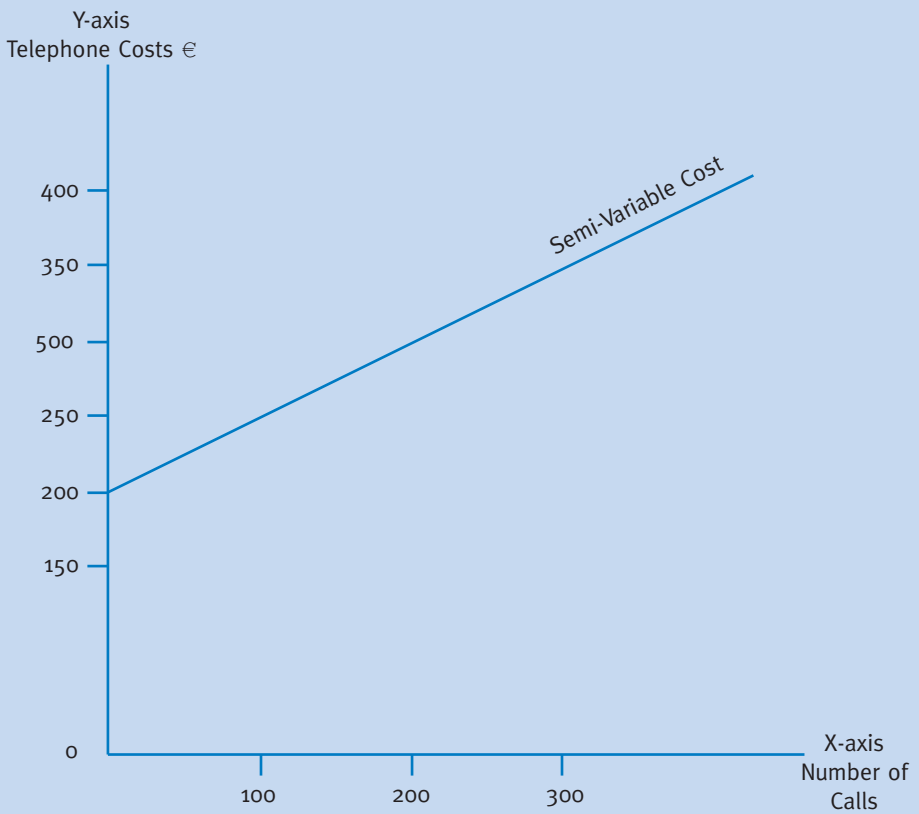
Semi-variable cost

A semi-variable cost contains both a fixed and a variable element. An example would be telephone costs. The telephone line rental is the fixed cost, and the cost of the calls made is the variable cost. The more calls that are made, the more variable cost there will be. If the line rental is €200 and the call cost is €0.50 per call, the semi-variable cost will be:

NUMBER OF CALLS	VARIABLE COST + FIXED COST	SEMI-VARIABLE COST €
Zero	(0 x €0.50) + €200 =	200
100	(100 x €0.50) + €200 =	250
200	(200 x €0.50) + €200 =	300
300	(300 x €0.50) + €200 =	350

The semi-variable line on a graph will be an upward sloping line. Even when the level of activity is zero, in this case when no calls are made, the semi-variable cost will be €200. The semi-variable line will start at €200 on the Y-axis and extend upwards as the number of calls made increases:

Figure 1.3: *Semi-variable cost graph*



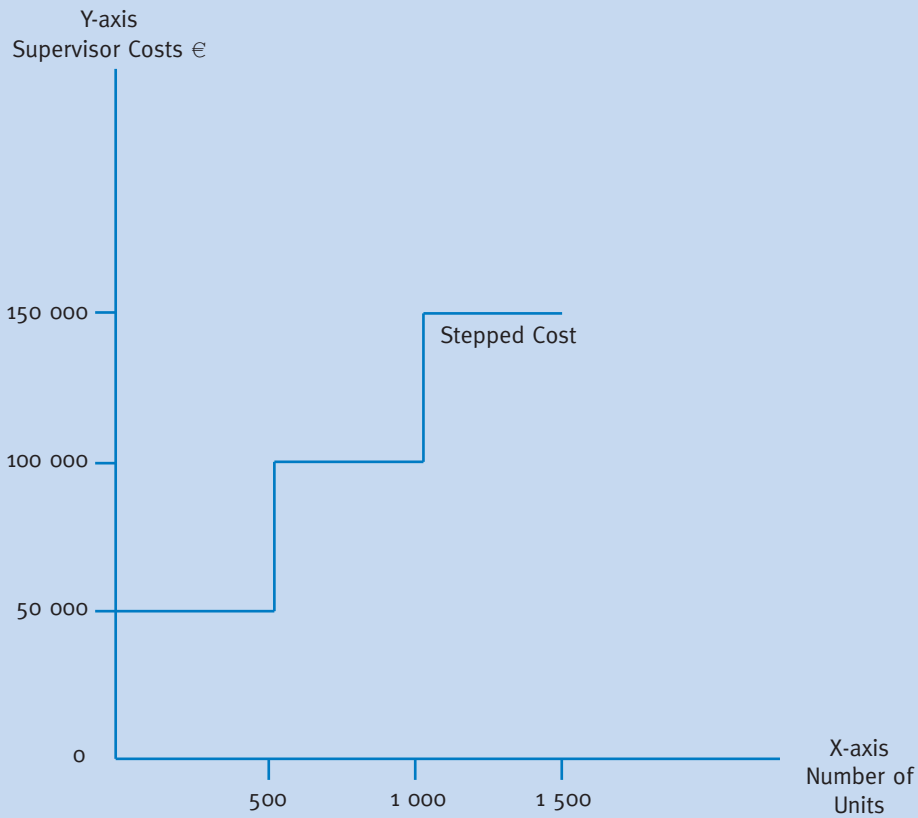
Stepped cost

We have assumed that fixed costs remain fixed at all levels of activity. But in fact fixed costs may increase when a certain level of activity is reached. This is referred to as a stepped cost. For example, if production activity decreases in a factory, a supervisor might continue to be employed in the hope that activity will pick up. If activity does not pick up, he or she may be made redundant. Similarly, if activity increases, an additional supervisor may have to be recruited, but this may take some time. The current supervisor may have to take on extra duties until this happens. When the new supervisor is recruited the fixed costs will suddenly increase.

For example, where a supervisor is paid €50 000 to supervise activity levels within the range of 0 to 500 units, if activity levels increase beyond 500 units, from 501 to 1 000 units, another supervisor will be hired and the total

supervisor costs will be €100 000 (€50 000 x 2). If activity levels increase beyond 1 000 units from 1 001 to 1 500 units, then a third supervisor will be hired and the supervisor costs will be €150 000 (€50 000 x 3). This can be represented on a graph as follows:

Figure 1.4: *Stepped cost graph*



(4) Cost classification: decision-making

In **Chapter 10: Relevant Costing and Decision-Making**, it is stated that decisions regarding the future of the organisation should be based on relevant information.

When deciding on whether a cost or revenue is relevant to the decision, the following question should be asked: if I go ahead with this decision, will I incur this cost or revenue? If the answer is yes, then the cost is considered to be an avoidable cost or avoidable revenue and is relevant to the decision. If the answer is no, then the cost or revenue is considered to be unavoidable – it will be incurred regardless of the decision made and is irrelevant to the decision.

Decisions which a business will make are based on future costs relevant to that decision. Past costs or 'historic costs' are not relevant as they have

occurred or are committed. Past costs are ignored in decision-making. Another name for a past cost is a 'sunk cost'.

Future decisions made by the organisation should include opportunity costs. An opportunity cost is the potential benefit that is forgone when one course of action is taken above another.

(5) Cost classification: non-manufacturing costs

In **Chapter 8: Marginal and Absorption Costing**, non-manufacturing or production costs are classified as:

1. Selling and distribution costs. Examples include sales commissions, sales salaries, shipping and advertising costs.
2. Administration expenses. Examples include clerical costs such as placing orders, secretarial, accounting and public relations costs.

Chapter summary

In this chapter the principles of management accounting and its position in the organisation were explained. The differences between management and financial accounting were discussed.

The student was introduced to the history and development of management accounting and how the role of management accounting has changed in recent times.

The need to allocate costs to cost objects was discussed and the student was introduced to different cost classifications which can assist the management accountant in the management of the organisation.

Test questions

Question 1

An office administrator in a theatre company is applying for an Arts Council grant for an upcoming performance. The performance will take place over two weeks and there will be 16 performances. The terms of the grant only cover direct costs associated with the performance. You are asked to assist the administrator in highlighting the direct costs and indirect costs from the following list of costs:

- Annual rent on office €5 000
- Hire of theatre for two weeks €1 000
- Hire of props assistant for the two weeks of the performance and one week of rehearsal €2 000
- Hire of costumes for performance €750

- Cost per programme printed €5
- Royalty payments €500 regardless of the number of performances
- Office administrator's salary for the two weeks €800

Question 2

Alan Arklow makes and sells clay pots. He is budgeted to produce 1 500 pots in February but he believes that he may receive a last-minute order which would increase this to 2 000 pots. The following costs are estimated:

- Clay for each pot costs €10
- Rent on the workshop is €500 per month
- Telephone line rental is €75 per month and each call made costs €0.10; Alan makes on average one call for each clay pot made
- Alan has one full-time apprentice working with him who earns a salary of €700 per month

Required

a Classify each of the above costs as fixed, variable or semi-variable
b Using your classification in (a) above, plot your results onto a fixed cost graph, variable cost graph and semi-variable cost graph

Question 3

The following are a list of costs which a hairdressing salon incurs. You are required to state whether they are variable, fixed or semi-variable costs:

- Salary of owner of the salon €50 000 per annum
- Hair colouring costs €35 per head
- Conditioning treatments cost €10 per head
- Rent on salon €1 500 per month
- Telephone costs of salon landline
- Salary of head stylist €1 000 per month plus bonus €10 per conditioning treatment sold

For answers and additional test questions, see www.gillmacmillan.ie. Search for Management Accounting and click on the link in the right-hand column.

2 Product Costing – Materials and Labour

Learning outcomes of Chapter 2

At the end of this chapter, you will be able to:

- explain the different costing methodologies
- discuss the components of product costing
- calculate the issues of inventory using FIFO, LIFO and weighted average pricing methods
- discuss and calculate the traditional approach to managing inventory – economic order quantity
- understand the modern approaches to managing inventory – just-in-time and materials requirement planning
- calculate labour costs in product costing

Introduction

Costs such as materials, labour and overheads need to be allocated to products in production in the business. This is necessary for inventory valuation and insurance purposes. Upchurch in *Cost Accounting Principles and Practice* (2002) states that allocating costs to products falls into two categories: (1) specific order costing and (2) continuous operation costing.

(1) Specific order costing

In specific order costing, usually a unique or one-off product is being produced for a customer so it is easier to track costs to products as they move through the manufacturing cycle. Examples of specific order costing are:

Job costing

This costing system applies to a single task, product or service charged to one customer. It is identifiable with and made to the specific requirements of a customer and priced accordingly. It is normally of a short duration and is

completed within one accounting period. Cost accumulation is straightforward as costs such as labour and materials are collected and allocated to the job as it progresses. Examples where job costing would be appropriate would be building work, e.g., an extension on a house, or printing of brochures by a printing company.

Batch costing

This is a variation of job costing. It occurs when units are batched into production runs where products share common attributes. For example, in the production of table lamps, the early part of the production process may be common but as the lamps enter the final production stages they may be batched into units which have a cream lampshade, a blue lampshade, etc. Costs are allocated to each batch or production run.

Contract costing

Contract costing is similar to job costing except that the work being carried out is of a much larger nature and of a longer duration. Contracts would normally span a number of accounting periods, progress payments would be made at different stages of the contract and this would require legal documents setting out details of the contract to be drawn up. Examples where contracts would be appropriate would be in large construction projects such as building a hospital or bridge. In this situation architects' certificates would be required as proof that work has been carried out before any payments are made.

(2) Continuous operation costing

In continuous operation costing similar products are produced on a mass scale. It is more difficult to allocate costs to cost objects as the individual objects or products may not be identifiable until the end of the manufacturing cycle. Examples of continuous operation costing are:

Process costing

Process costing involves the mass production of a single product. It is used in food processing and oil refining. It is uneconomical to trace the individual costs incurred in making a single product, so an average cost per unit is calculated instead and each individual product's cost is based on this average. Process costing is dealt with in Chapter 5.

Service costing

Products being made in manufacturing differ from a service provided by a service company. Take, for example, a loaf of bread made by a manufacturer:

the bread is a tangible product and all costs involved in its manufacture – direct materials, direct labour, direct expenses and overheads – form the basis of the product cost. The customer purchases the finished product (a tangible product).

Contrast this with a service provider, e.g., a hairdresser. A customer enters the hairdresser and asks for a service, e.g., a haircut. The product (haircut) is not a tangible product; it is a service rendered to the customer who partakes while the service is being provided. The customer pays for a service, e.g., cut and blow dry, blow dry, colour (an intangible product).

A hospital, for example, provides a service to the public, i.e., treating and curing patients. How would costs be allocated to these services and how would the performance of these services be measured? Perhaps the hospital would allocate costs per number of out-patient clinics or the number of operations carried out. This would allow it to measure performance over different periods and against different hospitals.

A law firm, for example, also provides a service to its clients. A case undertaken for a client would represent a 'job'. All costs associated with the case are gathered – the time lawyers spent on the case (direct labour cost), legal forms (direct material cost) and a portion of secretary salaries, rent, heat and light (overheads). This forms the cost of the job or case charged to the client.

Activity-based costing (ABC) can be used to allocate costs to services and the balanced scorecard can be used to measure performance. ABC will be dealt with in Chapter 4 and the balanced scorecard is discussed in Chapter 12.

The components of product costing

A cost will need to be established for products for inventory valuation purposes and also to establish a selling price. The product cost will contain the following components:

(1) Direct material costs

This is the cost of the raw materials used in making the product. Material costs are classified as a direct cost.

(2) Direct labour costs

This is the labour cost of staff used in making the product. Labour costs are classified as a direct cost.

(3) Direct expenses

A direct expense is any cost other than materials and labour which is directly related to the product being produced. An example would be the hire of special equipment for a specific job.

(4) Production overhead costs

Production or manufacturing overheads are classified as indirect costs. They may include the labour cost of the supervisor on the factory floor. He or she may supervise the production of many different products and his or her labour cost cannot be traced directly back to the product being produced. Production overheads can include indirect materials, indirect labour and indirect expenses.

(5) Non-manufacturing costs

Non-manufacturing or non-production costs are classified as indirect costs. They may include marketing, selling and administration costs which are necessary for the running of the business but are not directly related to production of products. Examples of marketing costs include the salaries and travel expenses of sales staff, and advertising costs. Examples of administration costs include general management salaries and costs of running the personnel and finance departments.

All of the costs incurred in producing a product are added together to arrive at the product cost:

Direct materials
+
Direct labour
+
Direct expenses
=
Prime cost
+
Production overhead costs
=
Production cost
+
Non-manufacturing costs
=
Total cost/full cost

The sum of all direct costs is called the prime cost.

In this chapter we will use methods to allocate materials and labour into products being costed. In Chapter 3 we use methods to allocate overheads into products being costed.

The traditional approach to accounting for inventory in product costing

In a manufacturing process raw materials are in constant use. There is a link between the purchasing department, the stores warehouse and the production department.

When inventory levels fall to their reorder level in the warehouse a **purchase requisition** for the reorder quantity is sent to the purchasing

department. A suitable supplier is selected and a **purchase order** for the reorder quantity is sent to the supplier and a copy to the warehouse.

When the materials are delivered, the warehouse receiving person checks the **delivery note** and the inventory against the purchase order to ensure the delivery is correct. **A goods received note** is signed by the warehouse receiving person and sent to the accounts department and a copy to the purchasing department. The **supplier's invoice** is checked against the goods received note to ensure the quantity and type of inventory received is correct. The supplier is then paid.

The inventory is coded in the warehouse and the inventory level on the stores accounts system is updated. When inventory is required in production, a **stores requisition order** is issued by the production department to the stores warehouse. The inventory is moved to production. The inventory code is scanned by a hand-held computer device and the inventory levels in the stores accounts system are updated.

Inventory levels are maintained to ensure there is no 'stock-out' in production whereby production is ready to receive inventory but the warehouse is awaiting a delivery of inventory from the supplier. Maintaining a minimum inventory level is very costly because inventory must be stored and staff must be employed to maintain the inventory, and it may need to be refrigerated or heated.

Stock-takes are carried out to ensure physical inventory levels match the inventory levels on the stores accounts system. Stock-takes can be carried out periodically. For example, once a year when the auditors are checking inventory levels, all the inventory is counted at one time, possibly in one day or over a weekend. Alternatively, stock-takes can be carried out continually, whereby different sections of inventory are counted on a regular basis – for example, daily or weekly – thus preventing a total shutdown of the warehouse.

Pricing the issues of inventories

A value needs to be placed on inventory when it is moved to production for the manufacture of products. Placing a value is also necessary for closing inventory valuation and insurance purposes. Inventory will also be moved from the warehouse to production in rotation, i.e., the oldest inventory will be moved first, then the next oldest and so on.

Inventory levels change constantly and inventory is replenished regularly. Inventory prices from suppliers will fluctuate as economic conditions change. At what price should we value inventory? The price at which we purchased the oldest inventory or the most recent price we paid for inventory?

There are three methods of valuing inventories:

1. First in, first out or FIFO
2. Last in, first out or LIFO
3. Weighted average

IAS 2 Inventories (*International GAAP 2009*) allows either a FIFO or a weighted average method to be used for financial reporting. The LIFO method is not an acceptable method under IAS 2. For management accounting purposes any of the three methods can be used for inventory valuation.

(1) First in, first out (FIFO)

IAS 2 states that 'the FIFO method probably gives the closest approximation to actual cost flows, since it is assumed that when inventories are sold or used in a production process, the oldest are sold or used first. Consequently the balance of inventory on hand at any point represents the most recent purchases or production.'

(2) Last in, first out (LIFO)

IAS 2 states that 'the most recent purchases or production are used first. It is an attempt to match current costs with current revenues so that the profit and loss account excludes the effects of holding gains. LIFO is no longer permitted for published accounts but it is allowable under US GAAP.'

(3) Weighted average

IAS 2 states that weighted average 'involves the computation of an average unit cost by dividing the total cost of units by the number of units. The average unit cost then has to be revised with every receipt of inventory or, alternatively, at the end of predetermined periods.'

Example 2.1

The following production and inventory information has been provided for Lily Ltd:

2 April	Issued to production	4 000 kg
7 April	Purchased	5 000 kg @ €20 per kg
10 April	Purchased	5 000 kg @ €18 per kg
15 April	Issued to production	4 000 kg
20 April	Issued to production	4 000 kg
24 April	Purchased	2 000 kg @ €21 per kg

The opening inventory on 1 April is 10 000 kg valued at €19 per kg.

Required

Prepare statements showing the amount charged to production and the value of inventory held after each inventory transaction using:

a The FIFO method
b The LIFO method
c The weighted average method

Solution to Example 2.1

a The FIFO method

	RECEIPTS			ISSUES			BALANCE		
Date	Kg	Price €	Value €	Kg	Price €	Value €	Kg	Price €	Value €
1 Apr							10 000	19.00	190 000
2 Apr				4 000	19.00	76 000	6 000	19.00	114 000
7 Apr	5 000	20.00	100 000				6 000	19.00	114 000
							5 000	20.00	100 000
							11 000		214 000
10 Apr	5 000	18.00	90 000				6 000	19.00	114 000
							5 000	20.00	100 000
							5 000	18.00	90 000
							16 000		304 000
15 Apr				4 000	19.00	76 000	2 000	19.00	38 000
							5 000	20.00	100 000
							5 000	18.00	90 000
							12 000		228 000
20 Apr				2 000	19.00	38 000	3 000	20.00	60 000
				2 000	20.00	40 000	5 000	18.00	90 000
				4 000		78 000	8 000		150 000
24 Apr	2 000	21.00	42 000				3 000	20.00	60 000
							5 000	18.00	90 000
							2 000	21.00	42 000
							10 000		192 000

Using FIFO the closing inventory value is €192 000 and closing inventory is 10 000 units. The value of inventory issued is:

	€
2 April	76 000
15 April	76 000
10 April	78 000
Total value of inventory issued	230 000

Drury (2008) states that during periods of inflation, using FIFO, the earliest inventories that have the lowest purchase price will be issued first. This assumption leads to a lower cost of sales calculation and therefore a higher profit than would be obtained by using either of the other methods.

b The LIFO method

	RECEIPTS			ISSUES			BALANCE		
Date	Kg	Price €	Value €	Kg	Price €	Value €	Kg	Price €	Value €
1 Apr							10 000	19.00	190 000
2 Apr				4 000	19.00	76 000	6 000	19.00	114 000
7 Apr	5 000	20.00	100 000				6 000	19.00	114 000
							5 000	20.00	100 000
							11 000		214 000
10 Apr	5 000	18.00	90 000				6 000	19.00	114 000
							5 000	20.00	100 000
							5 000	18.00	90 000
							16 000		304 000
15 Apr				4 000	18.00	72 000	6 000	19.00	114 000
							5 000	20.00	100 000
							1 000	18.00	18 000
							12 000		232 000
20 Apr				1 000	18.00	18 000	6 000	19.00	114 000
				3 000	20.00	60 000	2 000	20.00	40 000
				4 000		78 000	8 000		154 000
24 Apr	2 000	21.00	42 000				6 000	19.00	114 000
							2 000	20.00	40 000
							2 000	21.00	42 000
							10 000		196 000

Using LIFO the closing inventory value is €196 000 and closing inventory is 10 000 units. The value of inventory issued is:

	€
2 April	76 000
15 April	72 000
10 April	78 000
Total value of inventory issued	226 000

Drury (2008) states that during periods of inflation, using LIFO, the latest and higher prices are assigned to the cost of sales and therefore lower profits will be reported compared with using either FIFO or weighted average.

c The weighted average method

	RECEIPTS			ISSUES			BALANCE		
Date	Kg	Price €	Value €	Kg	Price €	Value €	Kg	Price €	Value €
1 Apr							10 000	19.00	190 000
2 Apr				4 000	19.00	76 000	6 000	19.00	114 000
7 Apr	5 000	20.00	100 000				6 000	19.00	114 000
							5 000	20.00	100 000
							11 000	19.454	214 000
10 Apr	5 000	18.00	90 000				11 000	19.454	214 000
							5 000	18.00	90 000
							16 000	19.00	304 000
15 Apr				4 000	19.00	76 000	12 000	19.00	228 000
20 Apr				4 000	19.00	76 000	8 000	19.00	152 000
24 Apr	2 000	21.00	42 000				8 000	19.00	152 000
							2 000	21.00	42 000
							10 000	19.40	194 000

The weighted average price will need to be recalculated every time inventory is purchased. In Example 2.1 part (c) above, new inventory was purchased on 7 April. The weighted average is calculated:

$$\frac{\text{Closing inventory value}}{\text{Closing inventory units}} \quad \frac{€214\,000}{11\,000 \text{ units}} = €19.454 \text{ per unit}$$

More inventory is purchased on 10 April and the weighted average is recalculated:

$$\frac{\text{Closing inventory value}}{\text{Closing inventory units}} \quad \frac{€304\,000}{16\,000 \text{ units}} = €19 \text{ per unit}$$

When inventory is next issued on 15 April it is issued at the most recent weighted average price, i.e., €19 per unit. Finally, on 24 April after more inventory is purchased, the weighted average is again recalculated:

$$\frac{\text{Closing inventory value}}{\text{Closing inventory units}} \quad \frac{€194\,000}{10\,000 \text{ units}} = €19.40 \text{ per unit}$$

Using weighted average, the closing inventory value is €194 000 and closing inventory is 10 000 units. The value of inventory issued is:

	€
2 April	76 000
15 April	76 000
10 April	76 000
Total value of inventory issued	228 000

Using weighted average, Drury (2008) states that during periods of inflation the cost of sales and the closing inventory will fall somewhere between the values recorded for the FIFO and LIFO methods.

Points to note about Example 2.1

- The number of units issued and the closing units will always be the same with the three methods.
- The profits of a company will be affected by the method of inventory valuation used during periods of inflation and deflation.
- FIFO and weighted average are acceptable under IAS 2 and LIFO is not.

Managing inventory levels using economic order quantity

The traditional approach to managing inventory levels has been to use the economic order quantity (EOQ) approach. There is a trade-off when managing inventory levels in a business between carrying too much inventory and incurring high inventory holding costs and carrying too little inventory and incurring high inventory ordering costs.

Inventory holding costs are costs associated with storing inventory, e.g., the cost of rent on the warehouse, the cost of heating or refrigerating inventory and the cost of the staff managing the warehouse.

Inventory ordering costs are costs associated with ordering inventory, e.g., the administration costs of placing orders with suppliers and the accounting costs of paying orders.

If a company decides to reduce the amount of inventory it stores, it will reduce its inventory holding costs. It will have to order inventory more frequently to prevent 'stock-outs' where production ceases when inventory runs out. Inventory ordering costs will increase.

Economic order quantity

The economic order quantity (EOQ) model is an attempt to set an order size which minimises the holding costs and ordering costs. It can be found by means of a formula:

$$EOQ = \sqrt{\frac{2 \times \text{total demand} \times \text{cost per order}}{\text{Holding cost per unit}}}$$

The total demand is the total demand for the period in question, be it annual demand, monthly demand, weekly demand or daily demand. It is calculated using the maximum usage per day.

An assumption built into the EOQ model is that the holding cost per unit will remain constant. Holding costs may increase as stock levels increase. It also assumes that the ordering cost is constant as is the cost per order. All of these costs can fluctuate.

Lead time

The lead time is the time that lapses between placing an order and receiving the inventory. If the rate of usage of inventory is constant in production, the lead time can be determined with reasonable certainty.

Reorder level

The reorder level is the point or level at which an order should be placed with the supplier to replenish inventory. It can be determined using the following formula:

Reorder level = maximum usage x maximum lead time

Maximum stock level

Storey in *Introduction to Cost and Management Accounting* (2002) states that the maximum stock level is calculated by reducing the reorder level to the least amount on the assumption that the supplier delivers the inventories in the quickest time. The EOQ is added to this. Holding excess inventories ties up working capital and is costly. Therefore the formula uses the minimum usage and minimum lead time. The formula is:

Maximum stock level = reorder level –
(minimum usage x minimum lead time) + EOQ

Minimum stock level (where there is no safety stock)

The reason for setting the minimum stock level is to prevent a stock-out where inventory is required in production but is not available in the warehouse. The formula uses the average usage and average lead time. If the minimum usage and minimum lead time were to be used the company might risk a stock-out. The formula is:

Minimum stock level = reorder level – (average usage x average lead time)

Safety stock

Where delivery of inventories is irregular or suppliers unreliable, a business may decide to keep a buffer stock or safety stock. Seal, Garrison and Noreen in *Management Accounting* (2008) state that the size of safety stock is determined by deducting average usage from the maximum usage that can reasonably be expected during the lead time.

Minimum stock level (where there is safety stock)

Storey in *Introduction to Cost and Management Accounting* (2002) states that where a safety stock level is to be maintained, the minimum stock level will be set higher. The formula is:

Minimum stock level = reorder level + safety stock
– (average usage x average lead time)

Example 2.2*

The following information is available for a company which holds inventories:

Cost per kg	€20
Holding costs per annum	8% of cost
Cost per order	€600
Average usage per day	400 kg
Maximum usage per day	800 kg
Minimum usage per day	200 kg
Maximum lead time	8 days
Minimum lead time	2 days

The company operates a five-day-week manufacturing cycle and operates for 50 weeks per year. Management are anxious about inventory holding costs and have asked you to calculate the following:

Required

a Economic order quantity
b Reorder level
c Minimum stock level assuming no safety stock
d Maximum stock level

* Based on question 3 in IATI Costing & Budgeting, Summer 2007.

Solution to Example 2.2

a Economic order quantity

$$EOQ = \sqrt{\frac{2 \times \text{total demand} \times \text{cost per order}}{\text{Holding cost per unit}}}$$

$$EOQ = \sqrt{\frac{2 \times (800\text{ kg} \times 5\text{ days} \times 50\text{ weeks}) \times €600}{8\% \times €20}}$$

$$= \sqrt{\frac{2 \times 200\,000\text{ kg} \times €600}{€1.6}}$$

$$= \sqrt{\frac{240\,000\,000}{€1.60}}$$

$$= 12\,247\text{ kg (to the nearest kg)}$$

b Reorder level

Reorder level = maximum usage x maximum lead time
= 800 kg x 8 days
= 6 400 kg

c Minimum stock level assuming no safety stock

Minimum stock level = reorder level – (average usage x average lead time)
= 6 400 kg – (400 kg x $\frac{(8 \text{ days} + 2 \text{ days})}{2}$)
= 4 400 kg

d Maximum stock level

Minimum stock level = reorder level – (minimum usage x minimum lead time) + EOQ
= 6 400 kg – (200 kg x 2 days) + 15 492 kg
= 21 492 kg

Managing inventory using just-in-time

Just-in-time (JIT) is a Japanese philosophy which states that inventory should not be held, as it is a cost burden, but should arrive from the supplier just as it is needed in production.

JIT endeavours to reduce holding costs and inward inspection costs, and to have zero defects in production. It operates a 'pull through' system where inventory is ordered only when it is required in production, and production occurs only in response to customer demand. This is in contrast to a 'push' system where inventory acts as a buffer between production, purchases and sales.

If suppliers do not deliver on time, production will halt and deadlines will not be met. The company will need to consider the location of the supplier, as frequent small deliveries are required. JIT relies on building relationships with a few reliable suppliers who deliver defect-free inventory.

JIT is suitable for production processes in which there are short set-up times, where customer demand is constant and there are no downtimes due to poor quality inventory.

Managing inventory using materials requirement planning

CIMA Official Terminology defines materials requirement planning (MRP) as 'a system that converts a production schedule into a listing of the materials and

components required to meet that schedule, so that adequate stock levels are maintained and items are available when needed'.

Materials requirement planning, now known as MRP I, originated in the 1960s. It is a computerised system which co-ordinates the planning of inventory used in production and the timing of inventory purchases. The components and sub-components of the finished product may take different lengths of time to produce and MRP takes account of this. The operation of an MRP system involves the following:

(1) A master production schedule

This schedule is produced from known customer orders and sets out how many units of each product are required from production and by when.

(2) A bill of materials

A bill of materials is produced for every product produced by the company. It lists the components, sub-components and raw materials which make up the product. The master production schedule uses the bill of materials to establish the timing for purchasing and production of these components, sub-components and raw materials.

(3) An inventory file

Inventory files will contain information on the availability of components, sub-components and raw materials.

MRP aims to produce a planned schedule of components, sub-components and raw materials required for production.

Material resource planning, or MRP II, is an extension of MRP I. *CIMA Official Terminology* defines MRP II as 'an expansion of materials requirement planning (MRP) to give a broader approach than MRP to the planning and scheduling of resources, embracing areas such as finance, logistics, engineering and marketing'.

MRP II systems aim to integrate purchases, planning, inventory control and accounting systems through a common computer system.

Accounting for labour costs in product costing

The labour costs incurred in manufacturing must be traced to the products being produced to determine the total product cost. Employees will record their working time on a time sheet or a clock card system. The time sheet will enable them to distinguish between productive hours, overtime hours and idle time hours, for example where a machine breaks down and production is suspended. The time sheet should also detail the job or products being produced. Once it has been signed off by a supervisor it will be used (i) to

generate the employees' pay slips and (ii) to form the basis of direct and indirect labour costs.

Basic pay

Basic pay is calculated by multiplying hours worked by rate per hour. In the past this was how businesses paid staff. There is now a tendency to provide a contract to staff and to pay them a salary. This provides job protection for staff and avoids the exploitation by employers of staff members. Staff remuneration now tends to be a fixed cost rather than a variable cost.

Idle time

Idle time occurs where staff are available and ready to work but cannot do so as a result of a machine breaking down, inventory being unavailable or a bottleneck in production. The cost of idle time is calculated by multiplying the idle time hours by the labour rate per hour. If the idle time is unexpected, e.g., owing to a machine breakdown, then it should be treated as an indirect labour cost charged to the idle time overhead account for the production department. If the idle time is expected, e.g., the time staff spend travelling to a job, then the cost of the idle time should be treated as a direct labour cost.

Overtime

Overtime occurs where work is performed outside normal working hours. An overtime premium is added to the normal hourly rate. The overtime premium is usually at 'time and a half', where the overtime premium is half that of the normal hourly rate, or at 'double time', where the overtime premium equals that of the normal hourly rate.

The normal time element of overtime is treated as direct labour and the overtime premium, if it is a result of lack of labour hours or machine hours, is treated as an overhead or indirect labour. The reason for this is that comparing the labour cost of work performed in overtime with similar work performed in normal time would give an artificially inflated view of labour cost. If the work is carried out in overtime as a request of the customer, the overtime premium would be charged as a direct cost to that customer's job.

Example 2.3*

An employee works a 40-hour week and earns €20 per labour hour. During week 5, because of a machine breakdown, 10 hours of overtime were worked by the employee at 'time and a half'. The machine was out of commission for eight hours and this has been recorded as idle time.

Required

a During week 5 calculate how much of the employee's wages would be classified as direct labour

b During week 5 calculate how much of the employee's wages would be classified as indirect labour

* Based on question 3 in CPA Professional 2 Management Accounting, April 2008.

Solution to Example 2.3

a During week 5 calculate how much of the employee's wages would be classified as direct labour. The direct labour cost would consist of the hours worked in normal time:

		€
Productive hours 32 hours x €20	=	640
Normal time element of overtime: 10 hours x €20	=	200
Total direct labour cost		840

b During week 5 calculate how much of the employee's wages would be classified as indirect labour. The indirect labour cost would consist of the overtime premium element of overtime and the idle time hours:

		€
Overtime premium: 10 hours x (€20 x 0.5)	=	100
Idle time hours: 8 hours x €20	=	160
Total indirect labour cost		260

Remuneration and labour incentive schemes

There are two approaches to remuneration: (1) a time-based system, and (2) an output-based system. Employers may decide to implement a labour incentive scheme to increase productivity, improve staff morale and attract more experienced staff to the business.

(1) Time-based system

Using a time-based scheme the employee is paid an hourly rate based on the number of hours worked. To increase productivity, management may introduce a premium bonus scheme as a way of rewarding more productive employees. Employees are awarded a bonus based on the time saved in completing a task:

Standard time to complete a task – actual time taken to complete the task
= time saved x premium bonus

Standard time is the time it should take to complete a task. Standards are discussed in Chapter 7. The details of the actual time taken to complete a task should be available on the employee's time sheet or clock card.

A time-based system is appropriate where activities vary and output is difficult to measure such as in an office. It is also appropriate where quality of output is important.

(2) Output-based system

Using an output-based scheme the employees are paid a rate per unit based on the number of units they produce:

Units produced x piecework rate

As an incentive the employees may be guaranteed a minimum percentage of their basic pay. This percentage will be negotiated between staff, unions and management.

An output-based system is appropriate where a series of repetitive tasks is carried out, such as on a production line. It is important to ensure quality controls are in place as quality can suffer if output increases.

Problems with labour incentive schemes

Labour incentive schemes encourage an increase in output, but as output increases quality can suffer, rejects can occur and re-works may need to take place. Businesses need to ensure they have quality control procedures in place, such as regular inspections, to counteract this.

Output in non-manufacturing departments, e.g., finance, may be difficult to quantify and labour incentive schemes may be subjective. This can result in employee dissatisfaction and loss of morale.

Labour incentive schemes may cause stress amongst employees where competition arises.

Example 2.4

Management are considering introducing an incentive scheme for staff working in production. Employees work a 40-hour week and are paid €12 per hour. Their output is as follows:

Staff member A:	325 units
Staff member B:	350 units
Staff member C:	475 units

Required

a Calculate the basic pay for each employee

b Calculate the wages paid to each employee if a piecework scheme is introduced. The piecework rate is €0.75 per unit and they are guaranteed 70% of their basic pay. State the amount each staff member will receive in wages

c Calculate the wages paid to each employee if a premium bonus scheme is introduced. The standard time taken to complete each unit is seven minutes and a bonus of 80% is paid on time saved

Solution to Example 2.4

a Calculate the basic pay for each employee:

Basic pay = hours worked x labour rate per hour
40 hours x €12 per hour = €480

Currently each employee receives €480 per week in basic pay regardless of their productivity.

b Calculate the wages paid to each employee if a piecework scheme is introduced and state the amount each staff member will receive in wages

Calculate the piecework amount by multiplying the units produced by the piecework rate per unit:

Staff member A: 325 units x €0.75 = €243.75
Staff member B: 350 units x €0.75 = €262.50
Staff member C: 475 units x €0.75 = €356.25

Staff are guaranteed a minimum of 70% of their basic pay which is:

70% x €480 = €336

Under the piecework scheme staff members A and B will be paid the guaranteed minimum pay of €336. Staff member C will be paid the piecework amount of €356.25.

c Calculate the wages paid to each employee if a premium bonus scheme is introduced

The standard time set to complete a unit is seven minutes. Calculate the standard time it should have taken to complete the actual units and compare it with the actual time taken to determine whether there was a saving:

	UNITS		STAND MINS		TOTAL STAND MINS		60 MINS		STAND HOURS	ACTUAL HOURS	SAVING IN HOURS
A	325	x	7	=	2 275	/	60	=	37.92	40	–
B	350	x	7	=	2 450	/	60	=	40.83	40	0.83
C	475	x	7	=	3 325	/	60	=	55.42	40	15.42

Staff member A will not receive a premium bonus as it should have taken him 37.92 hours to complete 325 units but it took him 40 hours. He will receive the basic pay of €480.

Staff members B and C will receive premium bonuses as they completed their units in less time than the standard hours allowed. The premium bonus is calculated as follows:

Time saved x labour rate per hour x 80%

The bonus is paid in addition to their basic pay.

Staff member B:			
Premium bonus:	0.83 hours x €12 x 80%	=	€ 7.97
Basic pay:			€480.00
Total wages paid:			€487.97
Staff member C:			
Premium bonus:	15.42 hours x €12 x 80%	=	€148.03
Basic pay:			€480.00
Total wages paid:			€628.03

Labour efficiency

The labour efficiency ratio indicates whether staff completed the work in less time or more time than anticipated. The ratio is calculated as follows:

$$\frac{\text{Standard hours taken to produce actual units}}{\text{Actual hours taken}} \times 100$$

If the ratio is greater than 100 then staff were more efficient than anticipated; if less than 100 they were less efficient than anticipated.

Labour turnover

Employees leave and new employees are recruited. It costs to recruit new employees and there are administration costs and disruption to the business when employees leave. Labour turnover is a measure of the number of employees leaving and being recruited in a period, expressed as a percentage of the total number of employees:

$$\frac{\text{Number of employees replaced during the period}}{\text{Total number of staff employed during the period}} \times \frac{100}{1}$$

The labour turnover percentage provides an insight into employee satisfaction and it can be compared with similar businesses in the same industry.

Chapter summary

This chapter began by introducing different costing methodologies that can be adopted by businesses. Two important elements of product costing were discussed – materials and labour.

The costing of materials was explained using the FIFO, LIFO and weighted average methods. The traditional approach to managing inventories was discussed under economic order quantity and more modern approaches to managing inventories were discussed under just-in-time and materials requirement planning.

The costing of labour and issues such as idle time, overtime, labour turnover and incentive schemes were discussed. Categorising labour costs into direct labour and indirect labour was also examined.

Test questions

Question 1

The following inventory and production information has been provided for Earley Ltd:

1 June	Opening inventory	1 000 kg	At €10 per kg
10 June	Bought	500 kg	At €12 per kg
12 June	Issued	800 kg	
15 June	Bought	700 kg	At €15 per kg
20 June	Issued	600 kg	
24 June	Bought	1 000 kg	At €14 per kg
26 June	Issued	900 kg	

Required

Prepare a statement showing the value of issues and the value of inventory using each of the following methods:

a First in, first out (FIFO)
b Last in, first out (LIFO)
c Weighted average

Question 2

A company has the following receipts and issues of inventory during the month of October:

1 Oct	Opening balance	100 litres	Valued at €5 per litre
11 Oct	Receipts	150 litres	At €5.50 per litre
12 Oct	Issued	100 litres	
17 Oct	Receipts	100 litres	At €6 per litre
22 Oct	Issued	75 litres	

Required

Prepare a statement showing the value of issues and the value of inventory using each of the following methods:

a First in, first out (FIFO)
b Last in, first out (LIFO)
c Weighted average

Question 3

The following information relates to two products produced by a company:

	IBOD	MPY
Cost per kg	€2.50	€1
Maximum usage per day	100 kg	2 500 kg
Minimum usage per day	25 kg	1 250 kg
Maximum lead time	15 days	6 days
Minimum lead time	5 days	3 days
Storage costs per annum	8% of cost	
Cost per order	€100	
Production period	125 days	

Required

You are required to calculate the following for each product:

a Economic order quantity
b Reorder level
c Minimum stock level
d Maximum stock level

Notes to students

1. Calculate each of the formulas for the two products.
2. The average usage and the average lead time will both need to be calculated as they are not given in the question.
3. The total demand in the EOQ formula should be based on maximum usage.
4. There is no mention of safety stock so the minimum stock level formula will be:

   Minimum stock level = reorder level – (average usage x average lead time)

For answers and additional test questions, see www.gillmacmillan.ie. Search for Management Accounting and click on the link in the right-hand column.