

Study Unit One

External Financial Statements

1.1	<i>Concepts of Financial Accounting</i>	2
1.2	<i>Statement of Financial Position (Balance Sheet)</i>	6
1.3	<i>Income Statement and Statement of Comprehensive Income</i>	12
1.4	<i>Statement of Changes in Equity and Equity Transactions</i>	18
1.5	<i>Statement of Cash Flows</i>	27
1.6	<i>Consolidation Accounting</i>	35

This study unit is the **first of six** on **external financial reporting decisions**. The relative weight assigned to this major topic in Part 1 of the exam is **15%**. The six study units are

- **Study Unit 1: External Financial Statements**
- Study Unit 2: Measurement, Valuation, and Disclosure: Assets -- Short-Term Items
- Study Unit 3: Measurement, Valuation, and Disclosure: Assets -- Long-Term Items
- Study Unit 4: Measurement, Valuation, and Disclosure: Liabilities
- Study Unit 5: Revenue and Impairment Recognition
- Study Unit 6: Integrated Reporting

This study unit discusses the basic concepts underlying financial accounting, which are important to understand before moving on to Study Units 2 through 5. Topics covered in this study unit include

- Users of accounting
- Accrual accounting
- Basic financial statements
- The accounting equation and transaction analysis
- Equity transactions

1.1 Concepts of Financial Accounting

The Objective of General-Purpose Financial Reporting

The objective of general-purpose financial reporting is to report financial information that is **useful in making decisions** about providing resources to the reporting entity.

The information reported relates to the entity's economic resources and claims to them (financial position) and to changes in those resources and claims. Information about economic resources and claims helps to evaluate liquidity, solvency, financing needs, and the probability of obtaining financing.

Users need to differentiate between changes in economic resources and claims arising from the entity's performance (income statement) and other events and transactions, such as issuing debt and equity (balance sheet). Information about financial performance is useful for

- Understanding the return on economic resources, its variability, and its components
- Evaluating management
- Predicting future returns

For general-purpose financial statements to be useful to external parties, they **must be prepared in conformity with accounting principles that are generally accepted in the United States (GAAP)**.



Success Tip

The CMA exam also tests some knowledge of International Financial Reporting Standards (IFRS). Significant differences between international standards and U.S. GAAP are detailed in Appendix B. If an exam question does not distinguish between GAAP and IFRS, use GAAP.

Financial accounting differs from management accounting. Management accounting assists management decision making, planning, and control. Management accounting information is therefore primarily directed to specific internal users. Management accounting topics are covered in Study Units 7 through 16.

Users of Financial Statements

External users are the primary users of financial statements. External users use financial statements to determine whether doing business with the firm will be beneficial.

- Investors need information to decide whether to increase, decrease, or obtain an investment in a firm.
- Creditors need information to determine whether to extend credit and under what terms.
- Financial advisors and analysts need financial statements to help investors evaluate particular investments.
- Stock exchanges need financial statements to evaluate whether to accept a firm's stock for listing or whether to suspend the stock's trading.
- Regulatory agencies may need financial statements to evaluate the firm's conformity with regulations and to determine price levels in regulated industries.

Internal users also use financial statements to make decisions affecting the operations of the business. These users include management, employees, and the board of directors.

Features of Financial Statements

Financial statements are the primary means of communicating financial information to external parties. Additional information is provided by financial statement notes, supplementary information (such as management's discussion and analysis), and other disclosures. Information typically disclosed in notes is essential to understanding the financial statements.

- The notes are considered part of the basic financial statements. They amplify or explain information recognized in the statements and are an integral part of statements prepared in accordance with GAAP.
 - The first footnote accompanying any set of complete financial statements is generally one describing significant accounting policies, such as the use of estimates and assumptions, and policies relating to, among others, revenue recognition and allocation of asset (tangible and intangible) costs to current and future periods.

A full set of financial statements includes the following statements:

- Statement of financial position (also called a balance sheet)
- Income statement
- Statement of comprehensive income
- Statement of changes in equity
- Statement of cash flows

To be useful, information presented in the financial statements must be relevant and faithfully represented.

- Usefulness is enhanced when the information is comparable with similar information for other entities and the same entity for another period or date. **Comparability** allows users to understand similarities and differences.

Financial statements are prepared under the **going-concern assumption**, which means that the entity is assumed to continue operating indefinitely and that it will not be liquidated in the near future.

Financial Statement Relationships

Financial statements complement each other. They describe different aspects of the same transactions, and more than one statement is necessary to provide information for a specific economic decision.

The components (elements) of one statement relate to those of other statements. Among the relationships are:

- Net income or loss from the statement of income is reported and accumulated in the retained earnings account, a component of the equity section of the statement of financial position.
- The components of cash and equivalents from the statement of financial position are reconciled with the corresponding items in the statement of cash flows.
- Items of equity from the statement of financial position are reconciled with the balances on the statement of changes in equity.
- Ending inventories are reported in current assets on the statement of financial position and are reflected in the calculation of cost of goods sold on the statement of income.
- Amortization and depreciation reported in the statement of income also are reflected in asset and liability balances in the statement of financial position.

Accrual Basis of Accounting

Financial statements are prepared under the accrual basis of accounting. Accrual accounting records the financial effects of transactions and other events and circumstances when they occur rather than when their associated cash is paid or received.

- Revenues are recognized in the period in which they were earned even if the cash will be received in a future period. This is referred to as the **revenue recognition principle**.
- Expenses are recognized in the period in which they were incurred even if the cash will be paid in a future period.
 - Under the **matching principle**, expenses are recognized in the same period as the related revenue.
 - Expense recognition principles associate cause and effect, systematic and rational allocation, and immediate recognition.



Author's Note

Under the **cash basis**, revenues are recognized when cash is received and expenses are recognized when cash is paid. Under GAAP, financial statements cannot be prepared under the cash basis of accounting.

1.2 Statement of Financial Position (Balance Sheet)

The statement of financial position, also called the balance sheet, reports the amounts of assets (items of value), liabilities (debt), and equity (net worth) and their relationships at a moment in time, such as at the end of the fiscal year. It helps users assess liquidity, financial flexibility, the efficiency with which assets are used, capital structure, and risk.

The **basic accounting equation** presents a perfect balance between the entity's resources and its capital structure.

- The entity's resources consist of the assets used in its attempts to earn a return.
- The capital structure consists of the amounts contributed by creditors (liabilities) and investors (stockholders' equity).

$$\text{Assets} = \text{Liabilities} + \text{Stockholders' Equity}$$

- The equation is based on the **fund theory**.
 - The basic equation can be derived to form the proprietary theory:

$$\text{Assets} - \text{Liabilities} = \text{Stockholders' Equity}$$

- ▶ According to this theory, equity in an enterprise is what remains after the economic obligations of the enterprise are deducted from its economic resources.

Transaction Analysis

Using the basic accounting equation, all transactions of the entity can be illustrated based on the impact of the transaction to the accounting equation. Every transaction will have a dual effect, impacting at least two elements of the equation.

- The accounting equation must remain in balance with each accounting transaction.



Author's Note

Although financial accounting typically uses debits and credits to record transactions in journal entries, the CMA exam has traditionally used increases and decreases to refer to a transaction's impact on the elements of the accounting equation. This text therefore presents transactions with increases and decreases.

Example 1-1 Transaction Analysis

Examples of transaction analysis include the following:

- Borrowing cash from a bank with a note payable

Assets	=	Liabilities	+	Stockholders' Equity
Cash ↑		Notes payable ↑		

- Receiving cash when providing services for customers

Assets	=	Liabilities	+	Stockholders' Equity
Cash ↑				Service revenue ↑

- Paying a supplier an amount owed on account

Assets	=	Liabilities	+	Stockholders' Equity
Cash ↓		Accounts payable ↓		

- Purchasing inventory on account from a supplier

Assets	=	Liabilities	+	Stockholders' Equity
Inventory ↑		Accounts payable ↑		

- Purchasing equipment with cash

Assets	=	Liabilities	+	Stockholders' Equity
Cash ↓ Equipment ↑				

Elements of the Balance Sheet

Assets are resources controlled by the entity as a result of past events. They represent probable future economic benefits to the entity.

- Examples include inventory; accounts receivable; investments; and property, plant, and equipment.

Liabilities are present obligations of the entity arising from past events. Their settlement is expected to result in an outflow of economic benefits from the entity.

- Examples include loans payable, bonds issued by the entity, and accounts payable.

Equity is the residual interest in the assets of the entity after subtracting all its liabilities.

- Examples include a company's common stock, preferred stock, and retained earnings.
- Equity is affected not only by operations but also by transactions with owners, such as dividends and contributions.

Assets and liabilities are separated in the statement of financial position into **current** and **noncurrent** categories. Assets are generally reported in order of liquidity, which means the order in which the assets are expected to be converted to cash.

NOTE: In some parts of the world, assets are listed in the order of reverse liquidity with intangibles and property, plant, and equipment listed first. This is known as the “production order.” This method is not used in the United States.

Some variation of the following classifications is used by most entities:

<u>Assets</u>	<u>Liabilities</u>
Current assets:	Current liabilities:
Cash	Accounts payable
Certain investments	Current notes payable
Accounts receivable	Current maturities of noncurrent liabilities
Inventories	Noncurrent liabilities:
Prepaid expenses	Noncurrent notes payable
Noncurrent assets:	Bonds payable
Certain investments and funds	<u>Equity</u>
Property, plant, and equipment (PPE)	Common stock
Intangible assets	Retained earnings
Other noncurrent assets	

Current and Noncurrent Assets

An asset is classified as **current** on the statement of financial position if it is expected to be realized in cash or sold or consumed within the entity's operating cycle or 1 year, **whichever period is longer**.

- The following are the major categories of current assets:

- Cash and cash equivalents
- Certain individual trading, available-for-sale, and held-to-maturity debt securities
- Receivables
- Inventories
- Prepaid expenses
- Certain individual investments in equity securities

Noncurrent assets (long term assets) are those not qualifying as current. The following are the major categories of noncurrent assets:

- **Investments and funds** include nonoperating items intended to be held beyond the longer of 1 year or the operating cycle. The following assets are typically included:
 - Investments in equity securities made to control or influence another entity and other noncurrent securities.
 - Certain available-for-sale and held-to-maturity debt securities may be noncurrent.
- **Property, plant, and equipment (PPE)** are tangible operating items recorded at cost and reported net of any accumulated depreciation. They include
 - Land and natural resources subject to depletion, e.g., oil and gas
 - Buildings, equipment, furniture, fixtures, leasehold improvements, land improvements, a lessee's right-of-use assets held under finance and operating leases, noncurrent assets under construction, and other depreciable assets
- **Intangible assets** are nonfinancial assets without physical substance. Examples are patents and goodwill.

Current and Noncurrent Liabilities

Current liabilities are expected to be settled or liquidated in the ordinary course of business during the longer of the next year or the operating cycle. Generally speaking, current liabilities are expected to be settled or liquidated within 1 year from the balance sheet date.

The following are the major categories of current liabilities:

- **Accounts (or trade) payables** for items entering into the operating cycle, e.g., for materials and supplies used in producing goods or services for sale.
- **Other payables** arising from operations, such as accrued wages, salaries, rentals, royalties, and taxes.
- **Unearned revenues** arising from collections in advance of delivering goods or performing services, e.g., ticket sales revenue.
- **Other obligations** expected to be liquidated in the ordinary course of business during the longer of the next year or the operating cycle. These include
 - Short-term notes given to acquire capital assets
 - Payments on the current portion of serial bonds or other noncurrent debt
 - Long-term obligations that are or will become callable by the creditor because of the debtor's violation of a provision of the debt agreement at the balance sheet date
 - Possible obligations for warranties (guarantees) and estimated returns

Current liabilities **do not include** short-term debt if an entity intends to refinance them on a noncurrent basis and demonstrates an ability to do so.

- The ability to refinance may be demonstrated by entering into a **refinancing agreement** before the balance sheet is issued.

Noncurrent liabilities (long term liabilities) are those not qualifying as current. The noncurrent portions of the following items are reported in this section of the balance sheet:

- Noncurrent notes and bonds
- A lessee's liabilities under finance and operating leases
- Deferred tax liabilities arising from interperiod tax allocation
- Obligations under product or service warranty agreements
- Deferred revenue
- Advances for noncurrent commitments to provide goods or services

Equity

Equity represents ownership interest in a firm. Owners of corporations are referred to as stockholders or shareholders. The following are the major items of equity:

- **Capital contributions by owners** (par value of common and preferred stock issued and additional paid-in capital).
 - Additional paid-in (contributed) capital (APIC) is the amount received in excess of par value at the time stock was sold.
- **Retained earnings** is the accumulated net income not yet distributed to owners. Dividends can be paid when retained earnings has a balance. A payment in excess of this balance is a return of capital, not a dividend.
 - Occasionally, the board of directors restricts retained earnings to prevent payment of dividends. The usual reason is that the board plans to reinvest the earnings in the business.
- **Treasury stock** is the firm's own stock that has been repurchased.
 - It is reflected in shareholders' equity as a contra account (which reduces the balance of a related account).
- **Accumulated other comprehensive income** (all comprehensive income items not included in net income).

Detailed equity transactions are covered in Subunit 1.4.

Limitations of the Balance Sheet

Limitations of using the balance sheet for decision making include the following:

- The balance sheet shows a company's financial position at a single point in time. Accounts may vary significantly a few days before or after the publication of the balance sheet.
- Many balance sheet items, such as property, plant, and equipment, are recorded at historical costs, which may not equal their fair value.
- The preparation of the balance sheet requires estimates and management judgment.
- The balance sheet omits many items that cannot be recorded objectively but have financial value to the company.

1.3 Income Statement and Statement of Comprehensive Income

Income Statement Elements

The income statement reports the results of an entity's operations over a period of time, such as a year.

The Income Equation

$$\text{Income (Loss)} = \text{Revenues} + \text{Gains} - \text{Expenses} - \text{Losses}$$

The following are the elements of an income statement:

- **Revenues** are inflows or other enhancements of assets or settlements of liabilities (or both) from delivering or producing goods, providing services, or other activities that qualify as ongoing major or central operations.
- **Gains** are increases in equity (or net assets) other than from revenues or investments by owners.
- **Expenses** are outflows or other usage of assets or incurrences of liabilities (or both) from delivering or producing goods, providing services, or other activities that qualify as ongoing major or central operations.
- **Losses** are decreases in equity (or net assets) other than from expenses or distributions to owners.
- All transactions affecting the net change in equity during the period are included in income except
 - Transactions with owners
 - Prior-period adjustments (such as error correction or a change in accounting principle, which are covered in Subunit 1.4)
 - Items reported initially in other comprehensive income
 - Transfers to and from appropriated retained earnings

Cost of Goods Sold and Cost of Goods Manufactured

Cost of goods sold is an expense account reported on the income statement.

- For a **retailer**, cost of goods sold represents the cost of the items being sold to customers and is calculated based on changes in inventory:

Beginning inventory	\$10,000
Plus: Net purchases	14,000
Plus: Freight-in	1,000
Goods available for sale	<u>\$25,000</u>
Minus: Ending inventory	(5,000)
Cost of goods sold	<u>\$20,000</u>

- For a **manufacturer**, cost of goods sold represents the cost of items that were produced (manufactured) by the firm and are being sold to customers.
 - Manufacturers must calculate the cost of goods manufactured in order to calculate the cost of goods sold. The **cost of goods manufactured** is the cost of goods completed during the current year. It represents the cost of goods transferred out of work-in-process inventory to finished goods inventory.
 - Manufacturers calculate cost of goods sold as follows:

Beginning direct materials inventory	\$3,000
Purchases during the period	3,000
Ending direct materials inventory	<u>(1,000)</u>
Direct materials used in production	\$5,000
Direct labor costs	5,000
Manufacturing overhead costs* (Fixed + Variable)	<u>4,000</u>
Total manufacturing costs	\$14,000
Beginning work-in-process inventory	5,000
Ending work-in-process inventory	<u>(4,000)</u>
Cost of goods manufactured	\$15,000
Beginning finished goods inventory	6,000
Ending finished goods inventory	<u>(11,000)</u>
Cost of goods sold	<u>\$10,000</u>

*Study Unit 7, Subunit 1, has details about what is included in manufacturing overhead.

- Cost of goods sold is recognized at the time the goods are sold, which follows the matching principle.

Gross profit is the net difference between sales revenue and cost of goods sold.

- Gross profit margin as a percentage of sales is calculated as follows:

$$\text{Gross profit margin (\%)} = \text{Gross profit} \div \text{Sales}$$

Example 1-2 Cost of Goods Sold and Cost of Goods Manufactured

The following information was taken from the accounting records of Amy's Manufacturing.

<u>Inventory</u>	<u>January 1</u>	<u>December 31</u>
Raw materials	\$ 65,000	\$ 58,000
Work-in-process (WIP)	100,000	120,000
Finished goods	30,000	26,000
<u>Other Information</u>		
Purchase of raw materials	\$240,000	
Direct labor	300,000	
Factory rent	80,000	
Factory utilities	25,000	
Advertising expense	40,000	
Administrative salaries	200,000	

1. Find the direct materials used in production.

Beginning raw materials	\$ 65,000
Add: Purchases during the period	240,000
Materials available	\$305,000
Less: Ending raw materials	(58,000)
Materials used in production	\$247,000

2. Find the total manufacturing cost.

Materials used in production	\$247,000
Direct labor	300,000
Manufacturing overhead	
Factory rent	\$80,000
Factory utilities	25,000
Total manufacturing overhead	<u>105,000</u>
Total manufacturing costs	\$652,000

3. Calculate the cost of goods manufactured.

Total manufacturing costs	\$652,000
Add: Beginning WIP inventory	100,000
Less: Ending WIP inventory	(120,000)
Cost of goods manufactured	\$632,000

4. Calculate the cost of goods sold.

Cost of goods manufactured	\$632,000
Add: Beginning finished goods inventory	30,000
Less: Ending finished goods inventory	(26,000)
Cost of goods sold	\$636,000

Other Expenses

General and administrative expenses are incurred for the benefit of the enterprise as a whole and are not related wholly to a specific function, e.g., selling or manufacturing.

- They include accounting, legal, and other fees for professional services; officers' salaries; insurance; wages of office staff; miscellaneous supplies; and office occupancy costs.

Selling expenses are those incurred in selling or marketing.

- Examples include sales representatives' salaries, commissions, and traveling expenses; sales department salaries and expenses, including rent; advertising; and credit and collection costs.
- Shipping costs are also often classified as selling expenses.

Interest expense is recognized based on the passage of time. In the case of bonds, notes, and finance leases, the effective interest method is used.

Income Statement Formats

The **single-step** income statement provides one grouping for revenue items and one for expense items. The single step is the one subtraction necessary to arrive at net income.

The **multiple-step** income statement presents operating revenues and expenses in a section separate from nonoperating items.

- The most common way to present the income statement is the condensed format of the multiple-step income statement, which includes only the section totals.

Example 1-3 Multiple-Step Income Statement

Net sales	\$ 200,000
Cost of goods sold	(150,000)
Gross profit	\$ 50,000
Selling expenses	(6,000)
Administrative expenses	(5,000)
Income from operations	\$ 39,000
Other revenues and gains	3,500
Other expenses and losses	(2,500)
Income before taxes	\$ 40,000
Income taxes	(16,000)
Net income	\$ 24,000

Discontinued Operations

When an entity reports a **discontinued operation**, it must be presented in a separate section between **income from continuing operations** and **net income**.

- Because these items are reported after the presentation of income taxes, they must be shown net of tax.
- The term “continuing operations” is used only when a discontinued operation is reported.

Discontinued operations, if reported, may have two components:

- Gain or loss from operations of the component that has been disposed of or is classified as held for sale from the first day of the reporting period until the date of disposal (or the end of the reporting period if it is classified as held for sale)
- Gain or loss on the disposal of this component

Example 1-4 Discontinued Operations

Net sales	\$ 200,000
Cost of goods sold	(150,000)
Gross profit	\$ 50,000
Selling expenses	(6,000)
Administrative expenses	(5,000)
Income from operations	\$ 39,000
Other revenues and gains	3,500
Other expenses and losses	(2,500)
Income before taxes	\$ 40,000
Income taxes	(16,000)
Income from continuing operations	\$ 24,000
Discontinued operations	
Gain from operations of component (including loss on disposal of \$5,000)	\$10,000
Income taxes	(4,000)
Gain from discontinued operations	\$ 6,000
Net income	\$ 30,000

Statement of Comprehensive Income

Comprehensive income includes all changes in equity (net assets) of a business during a period except those from investments by and distributions to owners. It consists of

- Net income or loss** (the bottom line of the income statement)
- Other comprehensive income (OCI)**

Certain income items are excluded from the calculation of net income and instead are included in other comprehensive income. The following are the major items included in other comprehensive income:

- The effective portion of a gain or loss on a hedging instrument in a cash flow hedge
- Unrealized holding gains and losses due to changes in the fair value of available-for-sale debt securities
- Translation gains and losses for financial statements of foreign operations
- Certain amounts associated with accounting for defined benefit postretirement plans

All items of comprehensive income are recognized for the period in either

- **One continuous financial statement** that has two sections, net income and OCI, or
- **Two separate but consecutive statements.**
 - The first statement (the income statement) presents the components of net income and total net income.
 - The second statement (the statement of OCI) is presented immediately after the first. It presents a total of OCI with its components and a total of comprehensive income.

Example 1-5 Separate Statement of Comprehensive Income

Net income	\$70,000
Other comprehensive income (net of tax):	
Loss on defined benefit postretirement plans	\$(15,000)
Gains on foreign currency translation	6,000
Gains on remeasuring available-for-sale securities	4,000
Effective portion of losses on cash flow hedges	<u>(3,000)</u>
Other comprehensive income (loss)	<u>(8,000)</u>
Total comprehensive income	<u>\$62,000</u>

Limitations of the Income Statement

The income statement does not always show all items of income and expense. Some of the items are reported on a statement of other comprehensive income and not included in the calculation of net income.

The financial statements report accrual-basis results for the period. The company may recognize revenue and report net income before any cash was actually received.

- For example, the data from the income statement itself is not sufficient enough for assessing liquidity. This statement must be viewed in conjunction with other financial statements, such as the balance sheet and statement of cash flows.

The preparation of the income statement requires estimates and management judgment.

1.4 Statement of Changes in Equity and Equity Transactions

Statement of Changes in Equity

A statement of changes in equity presents a reconciliation for the accounting period of the beginning balance for each component of equity to the ending balance.

Each change is disclosed separately in the statement. The following are the common changes in the equity component balances during the accounting period:

Item	Equity Component and Direction
Net income	Retained earnings ↑
Net loss	Retained earnings ↓
Distributions to owners (dividends)	Retained earnings ↓
Issuance of common stock	Common stock ↑
Issuance of common stock – portion above par	Additional paid-in capital (APIC) ↑
Total change in other comprehensive income (OCI)	Accumulated OCI ↑ or ↓
Repurchase treasury stock	Total stockholders' equity ↓

Statement of Retained Earnings

A statement of retained earnings reconciles the beginning and ending balances of the account. This statement is reported as part of the statement of changes in equity in a separate column.

The following is a common example of retained earnings reconciliation:

Retained earnings beginning balance
+ Net income (loss) for the period
- Dividends distributed during the period
+ <u>Positive (negative) prior-period adjustments</u>
Retained earnings ending balance

Prior-Period Adjustments

Prior-period adjustments include the cumulative effect on the income statement of the following two items:

1. **Changes in accounting principle** (e.g., change in inventory valuation method)
2. **Corrections of prior-period financial statement errors**

- These items require **retrospective application** (i.e., adjustment of the carrying amounts of assets, liabilities, and retained earnings at the beginning of the first period reported for the cumulative effect of the new principle or the error on the prior periods).
- Correction of prior-period errors and the cumulative effect of changes in accounting principle **must not** be included in the calculation of current-period net income.

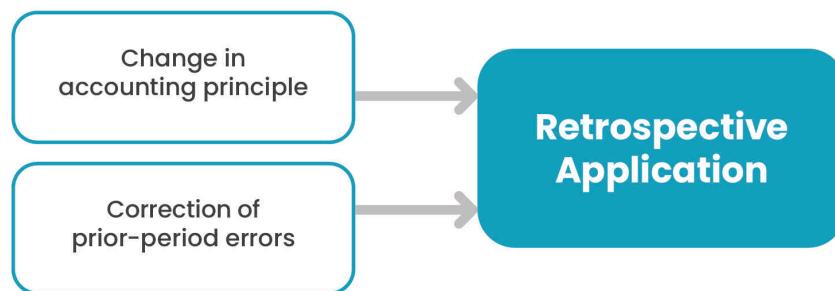


Figure 1-1

Changes in accounting estimate are not prior-period adjustments.

- Examples include a change in the percentage used for the estimation of credit losses or the change in the estimated remaining life of a depreciable asset.
- Changes in accounting estimate require **prospective application**. The effect of the change is accounted for only in the period of the change and any future periods

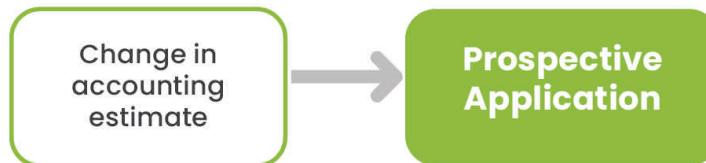


Figure 1-2

It may be **impracticable** to determine the cumulative effect of a new principle on any prior period. The new principle then must be applied as if the change had been made **prospectively** at the earliest date practicable.

Common and Preferred Stock

The most widely used classes of stock are common and preferred. If only one class of stock is issued, it is treated as common, and each shareholder must be treated equally. The following basic terminology is related to stock:

Stock Term	Definition
Authorized	Maximum amount of stock that a corporation may issue
Issued	Stock that has been sold to stockholders by the corporation
Outstanding	Stock currently held by stockholders

The **common shareholders** are the owners of the firm. They have voting rights, and they select the firm's board of directors and vote on resolutions. Common shareholders are not entitled to dividends unless declared by the board of directors. A firm may choose not to declare any.

- Common shareholders are entitled to receive **liquidating distributions** only after all other claims have been satisfied, including those of preferred shareholders.
- Common shareholders ordinarily have **preemptive rights**.
 - Preemptive rights give current common shareholders the right to purchase any additional stock issuances in proportion to their ownership percentages. This way the preemptive rights safeguard a common shareholder's proportionate interest in the firm.

Preferred stock has features of debt and equity. It is classified as an equity instrument and presented in the equity section of the firm's balance sheet.

- Preferred stock has a fixed charge, but payment of dividends is not an obligation.
- The payment of dividends is at the firm's discretion.
- Preferred shareholders tend not to have voting rights.
- Preferred shareholders have the right to receive
 - Dividends at a specified fixed rate before common shareholders may receive any
 - Distributions before common shareholders, but after creditors, in the event of firm bankruptcy (liquidation)
- The following are common features of preferred stock:
 - **Cumulative preferred stock** accumulates unpaid dividends (called dividends in arrears). Dividends in arrears must be paid before any common dividends can be paid.
 - Holders of **convertible preferred stock** have the right to convert the stock into shares of another class (usually common stock) at a predetermined ratio.

Treasury stock is the entity's own stock that was repurchased by the entity subsequent to its initial issuance to shareholders.

- Treasury stock reduces the shares outstanding, not the shares authorized.
- Dividends are never paid to these shares.

Equity Transactions

Issuance of Stock

The par value of stock is an arbitrary amount assigned by the issuer. Common and preferred stock are reported in the financial statements at par value. Additional paid-in capital (paid-in capital in excess of par) is increased for the difference between the cash received and the par value of the stock issuance.

Example 1-6 Issuance of Stock

A company issued 50,000 shares of its \$1 par value common stock. The market price of the stock was \$17 per share on the day of issue.

Assets	=	Liabilities	+	Stockholders' Equity
Cash \$850,000 ↑				Common stock \$50,000 ↑ Additional paid-in capital \$800,000 ↑

Cash: 50,000 shares × \$17 market price = \$850,000
 Common stock: 50,000 shares × \$1 par value = \$50,000
 Additional paid-in capital: \$850,000 cash – \$50,000 common stock = \$800,000

Treasury Stock

Treasury stock is reported using one of two methods:

- Under the **cost method**, treasury stock is recorded at the cost of the purchase.
 - Treasury stock is treated as a reduction to total stockholders' equity.
- Under the **par value method**, treasury stock is recorded for the par value of the stock.
 - Treasury stock reduces total stockholders' equity.
 - Additional paid-in capital is reduced.
 - Retained earnings is decreased if the acquisition price is greater than the original issue price.

Treasury stock

- Has no voting rights
- Receives no distributions in liquidation
- Receives no dividends when the entity declares a dividend



Author's Note

CMA candidates should be familiar with both methods to account for treasury stock. However, candidates should not expect questions that relate to comparing the results of the two methods.

Example 1-7 Treasury Stock -- Acquisition Price > Original Issue Price

Parvenu reacquired 5,000 shares of its \$1 par value common stock for \$20 per share. This stock had originally been issued at \$17 per share. Parvenu had no prior treasury stock transactions.

Cost method

Assets	=	Liabilities	+	Stockholders' Equity
Cash \$100,000 ↓				Treasury stock \$100,000 ↓

5,000 shares × \$20 market price = \$100,000

Par value method

Assets	=	Liabilities	+	Stockholders' Equity
Cash \$100,000 ↓				Treasury stock \$5,000 ↓ Additional paid-in capital \$80,000 ↓ Retained earnings \$15,000 ↓

Cash payment: 5,000 shares × \$20 market price = \$100,000

Treasury stock: 5,000 shares × \$1 par value = \$5,000

Additional paid-in capital: 5,000 shares × \$16 original issue excess = \$80,000

Retained earnings -- difference:

\$100,000 cash payment – \$5,000 treasury stock – \$80,000 additional paid-in capital = \$15,000

Example 1-8 Treasury Stock -- Acquisition Price < Issue Price

Parvenu reacquired 5,000 shares of its \$1 par value common stock for \$10 per share.

Cost method

Assets	=	Liabilities	+	Stockholders' Equity
Cash \$50,000 ↓				Treasury stock \$50,000 ↓

5,000 shares × \$10 market price = \$50,000

Par value method

Assets	=	Liabilities	+	Stockholders' Equity
Cash \$50,000 ↓				Treasury stock \$5,000 ↓ Additional paid-in capital \$45,000 ↓

Cash payment: 5,000 shares × \$10 market price = \$50,000

Treasury stock: 5,000 shares × \$1 par value = \$5,000

Additional paid-in capital -- difference: \$50,000 cash payment – \$5,000 treasury stock = \$45,000

Cash Dividend

The most common form of dividend is a cash dividend. An entity declares a dividend based on a dollar amount per share. Each shareholder receives cash as the form of distribution.

- On the **declaration date**, the board of directors formally approves a dividend. A declaration of a dividend decreases the retained earnings account.
- All holders of the stock on the **record date** are legally entitled to receive the dividend. There is no impact on the firm's accounting equation on the record date.
- The **payment date** is the date on which the dividend is paid.

Example 1-9 Cash Dividend

On September 12, a company's board of directors declared a \$3 per-share dividend to be paid on October 15 to all holders of common stock. On the date of declaration, 40,000 shares of common stock were outstanding.

Declaration date

Assets	=	Liabilities	+	Stockholders' Equity
--------	---	-------------	---	----------------------

Dividends payable \$120,000 ↑ Retained earnings \$120,000 ↓

40,000 shares outstanding × \$3 per share = \$120,000

Payment date

Assets	=	Liabilities	+	Stockholders' Equity
--------	---	-------------	---	----------------------

Cash \$120,000 ↓ Dividends payable \$120,000 ↓

Property Dividend

When an entity declares a dividend consisting of tangible property,

1. The property is **remeasured to fair value** as of the date of declaration, and any gain or loss on the remeasurement is recognized in the statement of income.
2. The carrying amount of retained earnings is decreased for the fair value of the property to be distributed.
3. The property is distributed as a dividend.

Example 1-10 Property Dividend

On August 1, a company's board of directors declared a property dividend (land) to be distributed on December 1 to holders of common stock. On August 1, the carrying amount of the land to be distributed is \$50,000 and its fair value is \$80,000. The journal entries to record the declaration and distribution of the property dividend are as follows:

August 1 -- Declaration date

Assets	=	Liabilities	+	Stockholders' Equity
Land \$30,000 ↑		Property dividend payable \$80,000 ↑	+	Gain on land remeasurement \$30,000 ↑ Retained earnings \$80,000 ↓

December 1 -- Payment date

Assets	=	Liabilities	+	Stockholders' Equity
Land \$80,000 ↓		Property dividend payable \$80,000 ↓		

Stock Dividends and Stock Splits

A stock dividend involves no distribution of cash or other property. Stock dividends are accounted for as a reclassification of different equity accounts, not as liabilities.

The accounting for stock dividends depends on the percentage of new shares to be issued.

- **Small stock dividend:** An issuance of shares **less than 20% to 25%** of the previously outstanding common shares should be recognized as a **stock dividend**.
- **Large stock dividend:** An issuance of **more than 20% to 25%** of the previously outstanding common shares should be recognized as a **stock split in the form of a dividend**.

In accounting for a **stock dividend**, the **fair value** of the additional shares issued is reclassified from retained earnings to common stock (at par value) and the difference to additional paid-in capital.

Example 1-11 Small Stock Dividend

On May 1, a company's board of directors declared and paid a 10% stock dividend on the 45,000 shares of common stock outstanding (\$1 par value). The stock was trading for \$15 per share at the declaration date.

May 1 -- Declaration and payment date

Assets	=	Liabilities	+	Stockholders' Equity
				Common stock \$4,500 ↑
				APIC \$63,000 ↑
				Retained earnings \$67,500 ↓

45,000 shares × 10% = 4,500 shares

Retained earnings: 4,500 shares × \$15 market price = \$67,500

Common stock: 4,500 shares × \$1 par value = \$4,500

Additional paid-in capital -- difference: \$67,500 retained earnings – \$4,500 common stock = \$63,000

For a stock dividend that is accounted for as a **stock split in the form of a dividend**, the **par value** of the additional shares issued is reclassified from retained earnings to common stock.

Example 1-12 Large Stock Dividend

Continuing from Example 1-11, assume that a 40% stock split in the form of a dividend was declared.

May 1 -- Declaration and payment date

Assets	=	Liabilities	+	Stockholders' Equity
				Common stock \$18,000 ↑
				Retained earnings \$18,000 ↓

45,000 shares × 40% = 18,000 shares

18,000 shares × \$1 par value = \$18,000

Stock splits are issuances of shares that do not affect any aggregate par value of shares issued and outstanding or total equity. Stock split reduces the par value of each stock and increases the number of shares outstanding.

- No entry is made, and no transfer from retained earnings occurs.
- The primary purpose of a stock split is to improve the stock's marketability by reducing its market price and proportionally increasing the number of shares outstanding.

The following table summarizes the impact on the par value per share:

Item	Par value per share
Small stock dividend	No change
Large stock dividend	No change
Stock split	Decrease

The following table summarizes the impact on the elements of the accounting equation:

Item	Common Stock	Additional Paid-In Capital	Retained Earnings	Total Stockholders' Equity
Small stock dividend	Increase	Increase	Decrease	No change
Large stock dividend	Increase	No change	Decrease	No change
Stock split	No change	No change	No change	No change

Limitations of the Statement of Changes in Equity

The financial statements report accrual-basis results for the period. The company may recognize revenue and/or expense and report net income before any cash was actually received and/or paid.

- The data for retained earnings is not sufficient for assessing the amount actually available to be reinvested in the company or to pay debt.

The statement of changes in equity illustrates a company's equity based on a specific time period, which means equity may vary significantly a few days before or after publication of the statement.

1.5 Statement of Cash Flows

The **primary purpose** of the statement of cash flows is to provide relevant information about the cash receipts and cash payments of an entity during the period.

- To achieve this purpose, the statement should provide information about cash inflows and outflows from the operating, investing, and financing activities of an entity. This is the accepted order of presentation.
- The statement of cash flows should help users assess the entity's ability to generate positive future net cash flows (liquidity), its ability to meet obligations (solvency), and its financial flexibility.

The statement of cash flows explains the change in cash and cash equivalents during the period. It reconciles the period's beginning balance of cash and cash equivalents with the ending balance.

Example 1-13 Summary of Cash Flow Statement

The following is an example of the summarized format of the statement of cash flows (only the headings). The amounts of cash and cash equivalents at the beginning and end of the year are taken from the balance sheet.

Entity A's Statement of Cash Flows for the Year Ended December 31, Year 1

Net cash provided by (used in) operating activities	\$20,000
Net cash provided by (used in) investing activities	(5,000)
Net cash provided by (used in) financing activities	9,000
Net increase (decrease) in cash and cash equivalents during the year	\$24,000
Cash and cash equivalents at beginning of year (January 1, Year 1)	6,000
Cash and cash equivalents at end of year (December 31, Year 1)	<u>\$30,000</u>

Operating Activities

Operating activities are all transactions and other events that are not financing or investing activities.

- Cash flows from operating activities are primarily derived from the principal revenue-producing activities of the entity.
- They generally result from transactions and other events that enter into the determination of net income.

The following are examples of **cash inflows** from operating activities:

- Cash receipts from the sale of goods and services (including collections of accounts receivable)
- Cash receipts from royalties, fees, commissions, trading debt securities, and other revenue
- Cash received in the form of **interest** or **dividends**

The following are examples of **cash outflows** from operating activities:

- Cash payments to suppliers for goods and services
- Cash payments to employees
- Cash payments to government for taxes, duties, fines, and other fees or penalties
- Payments of **interest on debt**

Investing Activities

Cash flows from investing activities represent the extent to which expenditures have been made for resources intended to generate future income and cash flows.

The following are examples of **cash outflows (and inflows)** from investing activities:

- Cash payments to acquire (cash receipts from sale of) property, plant, and equipment; intangible assets; and other long-lived assets
- Cash payments to acquire (cash receipts from sale and maturity of) equity and debt instruments (such as held-to-maturity securities and available-for-sale debt securities) of other entities for investing purposes
- Cash advances and loans made to other parties (cash receipts from repayment of advances and loans made to other parties)

Financing Activities

Cash flows from financing activities generally involve the cash effects of transactions and other events that relate to the issuance, settlement, or reacquisition of the entity's debt and equity instruments.

The following are examples of **cash inflows** from financing activities:

- Cash proceeds from issuing shares and other equity instruments (obtaining resources from owners).
- Cash proceeds from issuing loans, notes, bonds, and other short-term or long-term borrowings.

The following are examples of **cash outflows** from financing activities:

- Cash repayments of amounts borrowed
 - Payments of cash dividends
 - Cash payments to acquire or redeem the entity's own shares
 - Cash payments by a lessee for a reduction of the outstanding liability relating to a finance lease
-

Major Statement of Cash Flows Note Disclosures

Information about all **noncash investing and financing activities** (i.e., investing and financing activities that affect recognized assets or liabilities **but not cash flows**) must be disclosed in the notes.

The following are examples of noncash investing and financing activities:

- Conversion of debt to equity
- Acquisition of assets either by assuming directly related liabilities or by a lessee's recognition of a finance or operating lease
- Exchange of a noncash asset or liability for another

Indirect Method of Presenting Operating Cash Flows

Under the indirect method (also called the reconciliation method), the net cash flow from operating activities is determined by adjusting the net income of a business for the effect of the following:

- **Noncash revenue and expenses** that were **included in net income**, such as depreciation and amortization expenses, impairment losses, undistributed earnings of equity-method investments, and amortization of discount and premium on bonds
- Items **included in net income** whose cash effects relate to **investing or financing cash flows**, such as gains or losses on sales of property and equipment (related to investing activities) and gain or losses on extinguishment of debt (related to financing activities)
- All **deferrals** of past operating cash flows, such as changes during the period in inventory and deferred income
- All **accruals** of expected future operating cash flows, such as changes during the period in accounts receivable and accounts payable



Author's Note

The net income for the period as it is reported in the income statement was calculated using the accrual method of accounting. Therefore, adjustments must be made to reach the amount of cash flow from operating activities.



Success Tip

The following rules will help reconcile net income to net cash flow from operating activities under the indirect method:

Increase in current operating liabilities	Added to net income
Decrease in current operating assets	Added to net income
Increase in current operating assets	Subtracted from net income
Decrease in current operating liabilities	Subtracted from net income
Noncash losses and expenses included in net income	Added to net income
Losses and expenses whose cash effects are related to investing or financing cash flows	Added to net income
Noncash gains and revenues included in net income	Subtracted from net income
Gains and revenues whose cash effects are related to investing or financing cash flows	Subtracted from net income

Example 1-14 Statement of Cash Flows -- Indirect Method

Dize Corp's consolidated balance sheet accounts as of December 31, Year 6 and Year 5, are presented below. Information relating to Year 6 activities is to the left.

Information Relating to Year 6 Activities

- Cash dividends of \$240,000 were declared and paid by Dize in Year 6.
- The accounts receivable balances at the beginning and end of Year 6 were net of allowances for credit losses of \$50,000 and \$60,000, respectively. Dize wrote off \$40,000 of accounts receivable during Year 6.
- Current investments consist of Treasury bills maturing on 6/30/Year 7. They were acquired for cash on December 31, Year 6.
- Equipment costing \$400,000 and having a carrying amount of \$140,000 was sold on January 1, Year 6, for \$150,000 in cash. Additional plant assets were purchased in Year 6 for cash.
- Dize accounts for its interest in Thrice Corp. under the equity method. Its equity in Thrice's Year 6 earnings was \$25,000. During Year 6, Dize received a \$10,000 cash dividend from Thrice. At the end of Year 6, Dize sold part of its investment in Thrice for \$135,000 in cash. Significant influence over Thrice was not lost as a result of the sale.
- The provision for Year 6 income taxes was \$210,000.
- 10,000 shares of common stock were issued in Year 6 for \$22 a share.

	December 31	
	Year 6	Year 5
Assets		
Cash	\$ 195,000	\$ 100,000
Current investments	300,000	0
Accounts receivable (net)	480,000	510,000
Inventory	680,000	600,000
Prepaid expenses	15,000	20,000
Equity method investment	215,000	300,000
Plant assets	1,730,000	1,000,000
Accumulated depreciation	(480,000)	(450,000)
Goodwill	90,000	100,000
Total assets	\$3,225,000	\$2,180,000
Liabilities and Equity		
Accounts payable	\$ 825,000	\$ 720,000
Interest payable	15,000	10,000
Income tax payable	20,000	30,000
Current debt	325,000	0
Deferred taxes	250,000	300,000
Common stock, \$10 par	800,000	700,000
Additional paid-in capital	370,000	250,000
Retained earnings	620,000	170,000
Total liabilities & equity	\$3,225,000	\$2,180,000

The following computations are necessary to determine the net cash flows from operating, investing, and financing activities:

- Net income.** The starting point for presenting the net cash flow from operating activities is net income (loss) for the period. Net income can be calculated as follows:

Ending retained earnings	\$620,000
Dividends declared	240,000
Beginning retained earnings	(170,000)
Year 6, net income	\$690,000

- The \$240,000 of cash dividends paid in Year 6 are a cash outflow from financing activities.

-- Continued on next page --

Example 1-14 -- Continued

- **Accounts receivable.** The easiest way to determine the reconciling adjustment for accounts receivable is to calculate the change in their net amount (Accounts receivable – Allowance for credit losses). Net accounts receivable are current operating assets. A decrease in net accounts receivable of **\$30,000** ($\$510,000 - \$480,000$) is **added** to net income to determine the net cash flow from operating activities.
- **Plant assets.** The items that affect the presentation of cash flow from operating activities are depreciation expense, gain or loss on disposal, and impairment loss.

- **Depreciation expense** for Year 6 can be calculated as follows:

Ending accumulated depreciation	\$480,000
Accumulated depreciation on items sold	260,000
Beginning accumulated depreciation	<u>(450,000)</u>
Depreciation expense	<u>\$290,000</u>

Depreciation expense is a noncash expense included in net income. Thus, **\$290,000** is **added** to net income in determining the net cash flows from operating activities.

- The **gain on disposal** of the equipment is **\$10,000** ($\$150,000$ cash received – $\$140,000$ carrying amount). The cash effect is related to investing activities. Thus, it is **subtracted** from net income to determine the net cash flow from operating activities.
- The $\$150,000$ of cash proceeds from sale of equipment is a cash inflow from investing activities.
- Plant assets purchased in Year 6 (cash outflow from investing activities) can be calculated as follows:

Ending plant assets at cost	\$1,730,000
Plant assets sold at cost	400,000
Beginning plant assets at cost	<u>(1,000,000)</u>
Plant assets purchased	<u>\$1,130,000</u>

NOTE: The following equation may be useful for deriving the required information if the data given in the question are for the carrying amount (Cost – Accumulated depreciation) of the PPE item.

Beginning carrying amount	\$XXX
Purchases during the period	XXX
Depreciation expense	(XXX)
Disposals during the period	(XXX)
Ending carrying amount	<u>\$XXX</u>

- **Equity-method investment.** The carrying amount of the equity-method investment sold can be calculated as follows:

Beginning carrying amount	\$300,000
Equity in Thrice's current year earnings	25,000
Dividends received from Thrice	(10,000)
Ending carrying amount	(215,000)
Carrying amount of investment sold	<u>\$100,000</u>

-- Continued on next page --

Example 1-14 -- Continued

NOTE: Accounting for equity method investments is covered in detail in Study Unit 3, Subunit 2.

- **The gain on sale of the investment is \$35,000** (\$135,000 cash received – \$100,000 carrying amount). The cash effect is related to investing activities. Thus, it is **subtracted** from net income in determining the net cash flows from operating activities.
- **Undistributed earnings on equity-method investment.** Under the equity method, the investor's share of the investee's earnings is recorded to the investment account and reported as income. A cash dividend from the investee is a return of an investment that results in an increase to cash and a decrease to the investment. The undistributed earnings on the equity-method investments equal **\$15,000** (\$25,000 share in earnings – \$10,000 dividends received). This amount is a noncash revenue included in net income. Thus, it is **subtracted** from net income in determining the net cash flow from operating activities.
- The cash received on the sale of the investment of \$135,000 is a cash inflow from investing activities.
- **Goodwill.** Goodwill is not amortized. Thus, the **\$10,000** decrease in the amount of goodwill (\$100,000 beginning balance – \$90,000 ending balance) must be a result of impairment. A loss on impairment of goodwill is a noncash loss included in net income. Thus, it is **added** to net income in determining the net cash flow from operating activities. Goodwill is covered in detail in Subunit 1.6 and Study Unit 3, Subunit 5.
- **Current investments.** The purchase of current investments for \$300,000 is a cash outflow from investing activities.
- **Common stock.** The proceeds from issuing common stock were \$220,000 ($10,000 \times \22). This cash inflow from financing activities equals the sum of the increases in the common stock and additional paid-in capital accounts.
- **Inventory** is a current operating asset. Inventory increased by **\$80,000** (\$680,000 – \$600,000). This amount is **subtracted** from net income in determining the net cash flow from operating activities.
- **Prepaid expenses** are current operating assets. Prepaid expenses decreased by **\$5,000** (\$15,000 – \$20,000). This amount is **added** to net income in determining the net cash flow from operating activities.
- **Accounts payable** is a current operating liability. Accounts payable increased by **\$105,000** (\$825,000 – \$720,000). This amount is **added** to net income in determining the net cash flow from operating activities.
- **Interest payable** is a current operating liability. Interest payable increased by **\$5,000** (\$15,000 – \$10,000). This amount is **added** to net income in determining the net cash flow from operating activities.
- **Income tax payable** is a current operating liability. Income tax payable decreased by **\$10,000** (\$20,000 – \$30,000). This amount is **subtracted** from net income in determining the net cash flow from operating activities.
- **Current debt.** The issuance of \$325,000 of current debt (\$325,000 – \$0) is a cash inflow from financing activities.
- The **deferred tax liability** decreased by **\$50,000** (\$250,000 – \$300,000). The decrease in the deferred tax liability increases net income by decreasing income tax expense. This decrease is a noncash item included in net income. Thus, it is **subtracted** from net income in determining the net cash flow from operating activities. Deferred taxes are covered in Study Unit 4, Subunit 3.

-- Continued on next page --

Example 1-14 -- Continued

Dize Corp.
Consolidated Statement of Cash Flows -- Indirect Method
for the Year Ended December 31, Year 6

Cash flows from operating activities:

Net income for Year 6	\$ 690,000
Decrease in accounts receivable	30,000
Depreciation expense	290,000
Gain on disposal of equipment	(10,000)
Gain on sale of investment	(35,000)
Undistributed earnings of equity-method investment	(15,000)
Loss on impairment of goodwill	10,000
Increase in inventories	(80,000)
Decrease in prepaid expenses	5,000
Increase in accounts payable	105,000
Increase in interest payable	5,000
Decrease in income tax payable	(10,000)
Decrease in deferred tax liability	<u>(50,000)</u>
Net cash provided by operating activities	\$ 935,000

Cash flows from investing activities:

Proceeds from sale of equipment	\$ 150,000
Purchases of plant assets	(1,130,000)
Proceeds from sale of equity-method investment	135,000
Purchases of current investments	<u>(300,000)</u>
Net cash used in investing activities	<u>\$(1,145,000)</u>

Cash flows from financing activities:

Dividends paid	\$ (240,000)
Proceeds from issuing common stock	220,000
Proceeds from current debt	<u>325,000</u>
Net cash provided by financing activities	\$ 305,000
Net increase in cash	\$ 95,000
Cash, beginning of year	100,000
Cash, end of year	\$ 195,000

Limitations of the Statement of Cash Flows

A cash flow statement is not sufficient for forecasting the profitability of a firm as noncash items are not included in the calculation of cash flow from operating activities.

A cash flow statement may not represent the true liquid position of an entity.

- Decisions regarding large expenditures could be based on misconceived information when decisions are based only on the statement of cash flows.
- This statement must be viewed in conjunction with other financial statements, such as the balance sheet and the income statement.

Information can be manipulated in the statement of cash flows.

- For instance, management can schedule vendor payments to occur after year end to increase net cash flows reported on the statement of cash flows.

1.6 Consolidation Accounting

When one entity controls another, consolidated financial statements must be issued by a parent company regardless of the percentage of ownership.

Consolidated Financial Statements

A **business combination** is a transaction in which an acquirer obtains control of another business.

Control is a controlling financial interest. It is the direct or indirect ability to determine the direction of management and policies of the investee. Control usually is when one entity has direct or indirect ownership of **more than 50%** of the outstanding voting interests of another entity.

A **parent** is an entity with a controlling financial interest in one or more **subsidiaries**.

Consolidated statements present amounts for the parent and subsidiary(ies) as if they were a single economic entity.

The primary **consolidation models** are the voting interest entity (VOE) model and the variable interest entity (VIE) model.

- Under the **VOE** model, financial control is determined by ownership of a majority voting interest, i.e., more than 50%.
- Under the **VIE** model, financial control exists even if the reporting entity does not have more than 50% voting ownership. This occurs when one entity has the power to direct the activities of another entity.
 - The controlling entity absorbs the losses or benefits from the controlled entity.
 - ▶ The controlled entity does not have sufficient financial resources to support its ongoing operating needs.
 - The controlling interest is generally arranged through a contract, not direct ownership.

A parent and subsidiary may exist separately for an indefinite period, but consolidated financial statements must report them as a single economic entity.

Required consolidated reporting is an example of substance over form. Even if the two entities remain legally separate, the financial statements are more meaningful to users if they see the effects of control by one over the other.

Acquisition Method

A business combination must be accounted for using the **acquisition method**. It

- Determines the acquirer and the acquisition date.
- Recognizes and **measures at acquisition-date fair value** the
 - Identifiable assets acquired,
 - Liabilities assumed, and
 - Any noncontrolling interest in the acquiree.
- Recognizes goodwill or a gain from a bargain purchase.

The consideration transferred in a business combination must be measured at **acquisition-date fair value**.

Calculation of Goodwill or Gain from a Bargain Purchase

Goodwill is an intangible asset reflecting the future economic benefits resulting from other assets acquired in a business combination that are not individually identified and separately recognized.

At the acquisition date, the acquirer recognizes and measures goodwill or a gain from a bargain purchase.

- This measure is the difference between the fair value of the consideration transferred minus the fair value of identifiable net assets acquired.
- If the result is positive, goodwill is recognized. If the result is negative, a gain from a bargain purchase is recognized.

Consolidated Financial Reporting – Acquisition-Date Balance Sheet

Acquisition-Date Balance Sheet

A balance sheet should be prepared that reports the financial position of the consolidated entity on the acquisition date.

Step 1: Determine the amount of goodwill or gain from a bargain purchase recognized on the business combination.

Step 2: Prepare the assets section of the consolidated balance sheet by adding the assets of the parent and subsidiary. Assets and liabilities are reported at 100% of their fair value. In Example 1-15, land is revalued to its fair value, and goodwill is recognized.

Example 1-15 Assets Section of the Balance Sheet

Consolidated assets are calculated as follows:

Current assets of parent	\$140,000
Current assets of subsidiary	40,000
Consolidated current assets	<u>\$180,000</u>
Noncurrent assets of parent	\$180,000
Noncurrent assets of subsidiary	80,000
Excess fair value -- land	25,000
Goodwill	25,000
Consolidated noncurrent assets	<u>\$310,000</u>

Step 3: Prepare the liabilities section of the consolidated balance sheet, adding the liabilities of the parent and subsidiary together.

Step 4: Determine the **noncontrolling interest (NCI)**.

- An NCI (a minority interest) exists when less than 100% of the acquiree was acquired. An NCI is not reported for every asset and liability. The entire NCI is reported as a single component of consolidated equity.

Step 5: Because a combination is an acquisition of net assets, the subsidiary's equity accounts are eliminated.

- In the absence of a bargain purchase, the equity of the consolidated entity immediately after acquisition is the equity of the parent just prior to acquisition plus the fair value of the noncontrolling interest.

Step 6: Prepare the acquisition-date balance sheet.

**Author's Note**

Candidates are not required to prepare a consolidated balance sheet on the CMA exam.

Example 1-16 Calculation of Goodwill

Entity C acquired 80% of the outstanding common stock of Entity D for \$192,000. Entity D's acquisition-date fair values of identifiable assets and liabilities were \$350,000 and \$140,000, respectively. The acquisition-date fair value of NCI was \$48,000. The goodwill is calculated as follows:

Consideration transferred	\$192,000
Noncontrolling interest	48,000
Acquisition-date fair value of identifiable net assets (Assets – Liabilities) acquired:	
Assets	\$350,000
Liabilities	(140,000)
Goodwill	<u>\$ 30,000</u>

Example 1-17 Calculation of Goodwill

Using the information provided in Example 1-16, assume that the acquisition-date fair value of the identifiable assets acquired was \$400,000 (instead of \$350,000). The gain from the bargain purchase is calculated as follows:

Acquisition-date fair value of identifiable net assets (Assets – Liabilities) acquired:

Assets	\$400,000
Liabilities	(140,000)
Consideration transferred	
Noncontrolling interest	
Gain from bargain purchase	<u>\$ 20,000</u>

Consolidated Financial Reporting: Subsequent to the Acquisition Date

Consolidation Process

After the close of the fiscal year in which the combination occurred, the consolidated entity prepares its first full set of consolidated financial statements.

The following steps must be performed when preparing consolidated financial statements:

- All line items of assets, liabilities, revenues, expenses, gains, losses, and other comprehensive income (OCI) of a subsidiary are added item-by-item to those of the parent. These items are reported at the consolidated amounts.
- No investment in the subsidiary account is presented in the consolidated financial statements. Consolidated statements report the assets and liabilities of the subsidiary and the parent as if they are a single economic entity.
- All the equity accounts of the subsidiary are eliminated (not presented in the consolidated financial statements). Retained earnings of the consolidated entity at the acquisition date consist solely of the retained earnings of the parent.
- Goodwill from the acquisition of a subsidiary is presented separately in the noncurrent assets section of the consolidated balance sheet.
- Intraentity balances, transactions, income, and expenses must be eliminated in full.
- NCI is reported separately in one line item in the equity section.

Consolidated Net Income

The consolidated income statement must present separate amounts for the following:

- Total consolidated net income
- Net income attributable to the NCI
- Net income attributable to the shareholders of the parent

Example 1-18 Net Income Attributable to Parent and Subsidiary

Below are the separate statements of income of Platonic and Socratic, excluding Platonic's share of income from Socratic, for the year ended December 31, Year 1. Platonic is the parent, and Socratic is the subsidiary.

Assume that (1) the ownership percentages were the same as at the acquisition date (80%), (2) no items of OCI were recognized in Year 1, and (3) no intraentity transactions occurred during Year 1.

Platonic's Year 1 consolidated statement of income is below.

Separate Income Statements for
Platonic and Socratic

	Platonic	Socratic
Sales	\$250,000	\$120,000
Cost of goods sold	(120,000)	(70,000)
Selling and administrative expenses	(50,000)	(10,000)
Interest costs	(20,000)	0
Income tax expense	(21,000)	(14,000)
Net income	\$ 39,000	\$ 26,000

Year 1 Consolidated Income Statement

Sales	\$370,000
Cost of goods sold	(190,000)
Selling and administrative expenses	(60,000)
Interest costs	(20,000)
Income tax expense	(35,000)
Net income	\$ 65,000
Net income attributable to NCI	(5,200)
Net income attributable to Platonic's shareholders	\$ 59,800

Net income attributable to NCI is \$5,200 (\$26,000 net income reported by Socratic \times 20%).

Net income attributable to Platonic's shareholders is \$59,800 [\$39,000 + (\$26,000 \times 80%)].



Author's Note

Calculating the NCI is not covered on the CMA exam. Also, candidates are not required to prepare a consolidated income statement on the CMA exam. Rather, candidates should be able to demonstrate a general understanding of the consolidation process.

Consolidated Financial Reporting – Intraentity Eliminations

Year-End Consolidated Financial Statements

Consolidating entities routinely conduct business with each other. The effects of these intraentity transactions must be eliminated in full during the preparation of the consolidated financial statements.

Consolidated financial statements report the financial position, results of operations, and cash flows as if the consolidated entities were a single economic entity.

- All line items in the consolidated financial statements must be presented at the amounts that would have been reported if the intraentity transactions had **never occurred**.
- After adding all the assets, liabilities, and income statement items of a parent and a subsidiary, **eliminating journal entries** for intraentity transactions must be recorded for proper presentation of the consolidated financial statements.

Reciprocal Balances

In a consolidated balance sheet, reciprocal balances, such as receivables and payables, between a parent and a subsidiary are eliminated in their entirety, regardless of the portion of the subsidiary's stock held by the parent.

Example 1-19 Intraentity Eliminations -- Reciprocal Balances

Platonic's separate balance sheet reports a \$12,600 receivable from, and an \$8,500 payable to, Socratic. Socratic's separate balance sheet reports an \$8,500 receivable from, and a \$12,600 payable to, Platonic. These balances are not reported on the consolidated balance sheet.

Intraentity Inventory Transactions – Gross Profit

Intraentity transactions resulting in gross profit require more complex treatment.

- Profit from the sale of inventory between consolidating entities is a component of the net income of the entity that sold the inventory.
- However, the consolidated entity recognizes profit on this exchange only in proportion to the inventory that is sold to nonaffiliated parties. Accordingly, the gross profit included in the inventory remaining on the purchaser's books must be eliminated from consolidated net income.
- A year-end journal entry eliminates the gross profit recognized for the inventory remaining on the purchaser's books. It also reduces the inventory account to the balance it would have had if the intraentity transactions had never occurred.

Intraentity Noncurrent Assets Transactions

Transfers of noncurrent assets require elimination of any gain or loss on the sale recognized on the intraentity transaction.

- All the accounts related to the asset transferred must be reported in the consolidated financial statements at the amounts that would have been reported if the intraentity transactions had never occurred.
- Thus, the **depreciation expense** recognized in the consolidated financial statements must be the depreciation expense that would have been recognized in the seller's separate financial statements.

Debt

When one entity holds the debt securities of another entity with which it is consolidated, the elimination is treated as an **extinguishment of debt**, with recognition of any resulting gain or loss.

- All accounts related to the debt, such as the maturity amount, interest receivable (payable), and interest income (expense), must be eliminated.
- The premium or discount on the debtor's and creditor's books, and any related amortization, is eliminated and recognized as a gain or loss on **extinguishment** in the period of purchase.

Reciprocal Dividends

When consolidated entities hold reciprocal equity stakes, the portion of dividends paid to each other must be eliminated from the consolidated financial statements.

- The portion of the parent's dividends paid to outside parties reduces consolidated retained earnings.
- The portion of the subsidiary's dividends paid to outside parties reduces any noncontrolling interest.

Three Types of Consolidations

Full Consolidation Method

The previous coverage of consolidations is referred to as full consolidation.

Equity Method

The **equity method** is used when the investor has significant influence over a company (investee), i.e., an investment of 20% or more, but not more than 50%, in the voting stock of the investee.

Preparing consolidated financial statements is not necessary when applying the equity method.



Author's Note

The equity method is covered in more detail in Study Unit 3, Subunit 2.

Proportionate Consolidation Method

The proportionate consolidation method accounts for a joint venture of two or more entities.

Assets and liabilities of a joint venture are recorded on the balance sheet in proportion to the percentage of participation an entity maintains in the joint venture.

Study Unit Two

Measurement, Valuation, and Disclosure: Assets -- Short-Term Items

2.1	<i>Accounts Receivable</i>	2
2.2	<i>Inventory -- Fundamentals</i>	8
2.3	<i>Inventory -- Cost Flow Methods</i>	12
2.4	<i>Measurement of Inventory Subsequent to Initial Recognition</i>	21

This study unit is the **second of six on external financial reporting decisions**. The relative weight assigned to this major topic in Part 1 of the exam is **15%**. The six study units are

- Study Unit 1: External Financial Statements
- **Study Unit 2: Measurement, Valuation, and Disclosure: Assets -- Short-Term Items**
- Study Unit 3: Measurement, Valuation, and Disclosure: Assets -- Long-Term Items
- Study Unit 4: Measurement, Valuation, and Disclosure: Liabilities
- Study Unit 5: Revenue and Impairment Recognition
- Study Unit 6: Integrated Reporting

This study unit discusses two current assets: accounts receivable and inventory. Topics covered in this study unit include

- Accounting for accounts receivable, including
 - Transactions related to accounts receivable, including the timing of recognition
 - Credit losses
 - Types of factoring
- Accounting for inventory, including
 - Items to include in the counts of inventory
 - Cost flow assumption methods
 - Calculating cost of goods sold and ending inventory using different cost flow assumption methods
 - The effects of inventory errors
 - The lower of cost or market rule
 - The lower of cost or net realizable value rule

2.1 Accounts Receivable

Accounts receivable (**trade receivables**) are amounts owed to an entity by its customers resulting from credit sales in the ordinary course of business that are due in customary trade terms.

- The recording of a receivable, which often coincides with revenue recognition, is consistent with the accrual method of accounting.

Allowance for Credit Losses

The allowance for credit losses is a contra asset that reduces accounts receivable on the entity's balance sheet. This account is used to keep track of management's estimate for the amount of accounts receivable that the entity estimates it will not be able to collect.

Credit Loss Expense

Credit loss expense is the income statement account used to keep track of the expense related to estimating credit losses.

Balance Sheet Presentation

Receivables should be separated into **current and noncurrent** portions.

- Most of the entity's accounts receivable are classified as current assets because they are expected to be collected within 1 year or the entity's normal operating cycle.
- **Current** accounts receivable are reported in the balance sheet at **net realizable value (NRV)**, i.e., net of allowance for credit losses (uncollectible accounts), allowance for sales returns, and billing adjustments.
- **Noncurrent** receivables are measured at net present value of future cash flows expected to be collected.

Allowance Method (Required under GAAP)

The allowance method attempts to match **credit loss expense** with the **related revenue**. This method is **required under GAAP**.

- As specific accounts receivable are written off, they are charged to the allowance account.
 - Write-offs do not affect the carrying amount of the net accounts receivable balance because the reductions of gross accounts receivable and the allowance are the same.
 - ▶ The **write-off** of a particular account has no effect on expenses.

- In the balance sheet, the carrying amount of accounts receivable is reported at the net amount expected to be collected.

Balance Sheet:	
Accounts receivable	\$X,XXX
Allowance for credit losses	(X,XXX)
Accounts receivable, net	<u>\$X,XXX</u>

- Under the allowance method, the two approaches to calculating the amount charged to credit loss expense are the income statement approach and the balance sheet approach.

Income Statement Approach (Percentage of Sales)

Under the income statement approach, the entity estimates the periodic credit loss expense as a percentage of sales on credit.

- The ending balance of the allowance for credit losses is determined after all the activity in the allowance account is recorded during the period.

Example 2-1 Income Statement Approach

Midburg Co. has the following unadjusted account balances at year end:

Cash	\$ 85,000
Accounts receivable	100,000
Allowance for credit losses	2,000
Sales on credit	500,000

Based on its experience, Midburg expects credit losses to average 2% of credit sales. Thus, the estimated credit loss expense is \$10,000 ($\$500,000 \times 2\%$). The year-end adjusting entry is

Assets	=	Liabilities	+	Stockholders' Equity
Allowance for credit losses \$10,000 ↓				Credit loss expense \$10,000 ↓

Since allowance for credit losses is a contra asset, this \$10,000 entry reduces total assets but increases the balance in the contra asset.

The year-end adjusted balance of allowance for credit losses is \$12,000 ($\$10,000 + \$2,000$).

Balance sheet presentation:

Accounts receivable	\$100,000
Allowance for credit losses	(12,000)
Accounts receivable, net	<u>\$ 88,000</u>

Balance Sheet Approach (Percentage of Receivables)

Under this approach, the ending balance of the allowance for credit losses is a percentage of the ending balance of accounts receivable.

- Credit loss expense reflects the adjustment of the allowance to its correct ending balance.

Example 2-2 Balance Sheet Approach

Using the data from Example 2-1, assume that, based on Midburg's experience, 6% of accounts receivable are determined to be uncollectible. The ending balance of the allowance for credit losses needs to be \$6,000 ($\$100,000 \times 6\%$). Because the allowance currently has a balance of \$2,000, the following entry is required:

Assets	=	Liabilities	+	Stockholders' Equity
Allowance for credit losses \$4,000 ↓				Credit loss expense \$4,000 ↓
Balance sheet presentation:				
Accounts receivable		\$100,000		
Allowance for credit losses		(6,000)		
Accounts receivable, net		<u>\$ 94,000</u>		

An entity rarely experiences a single rate of uncollectibility on all its accounts. For this reason, entities using the balance sheet approach to estimate expected credit losses for accounts receivable generally prepare an **aging schedule**.

Example 2-3 Balance Sheet Approach with Aging Schedule

Midburg prepares the following aging schedule of its accounts receivable:

Balance Range	Less than 30 Days	31-60 Days	61-90 Days	Over 90 Days	Total Balances
\$0 - \$100	\$ 5,000	\$ 200	\$ 100	\$ 100	\$ 5,400
\$100 - \$1,000	8,000	3,800			11,800
\$1,000 - \$5,000	20,000	2,000	1,900		23,900
\$5,000 - \$10,000	38,000		8,000	900	46,900
Over \$10,000		12,000			12,000
Totals	<u>\$71,000</u>	<u>\$18,000</u>	<u>\$10,000</u>	<u>\$1,000</u>	<u>\$100,000</u>

-- Continued on next page --

Example 2-3 -- Continued

Midburg then applies an appropriate percentage to each stratum based on experience.

Aging Intervals	Balance	Estimated Uncollectible	Ending Allowance
Less than 30 days	\$ 71,000	2%	\$1,420
30-60 days	18,000	12%	2,160
61-90 days	10,000	15%	1,500
Over 90 days	1,000	20%	200
Total	<u>\$100,000</u>		<u>\$5,280</u>

Because the allowance currently has a balance of \$2,000, the following entry is required to establish the proper measurement:

Assets	=	Liabilities	+	Stockholders' Equity
Allowance for credit losses \$3,280 ↓				Credit loss expense \$3,280 ↓
Balance sheet presentation:				
Accounts receivable				\$100,000
Allowance for credit losses				(5,280)
Accounts receivable, net				<u>\$ 94,720</u>

Reconciliation Summaries

The following equation illustrates the reconciliation of the beginning and ending balances of gross accounts receivable (accounts receivable before adjustment for allowance for credit losses):

$$\begin{aligned}
 &\text{Beginning accounts receivable} \\
 &+ \text{Credit sales during the period} \\
 &- \text{Cash collected on credit sales during the period} \\
 &- \text{Accounts receivable written-off during the period} \\
 &= \text{Ending accounts receivable}
 \end{aligned}$$

The following equation illustrates the reconciliation of the beginning and ending balances of the allowance for credit losses:

$$\begin{aligned}
 &\text{Beginning allowance for credit losses} \\
 &+ \text{Credit loss expense recognized for the period} \\
 &- \text{Accounts receivable written off} \\
 &+ \text{Collection of accounts receivable previously written off} \\
 &= \text{Ending allowance for credit losses}
 \end{aligned}$$

Allowance for Customers' Right of Sales Return

When a right of return exists, an entity may recognize revenue from a sale of goods at the time of sale only if the amount of future returns can be reliably estimated. A provision must be made for the return of merchandise because of product defects, customer dissatisfaction, etc.

To be consistent with the **matching principle** (recognition of revenue and related expense in the same accounting period), the revenue from the sale of goods and the expense for the estimated sales returns must be recognized in the same period.

- An allowance for sales returns should be established.
-

Factoring of Accounts Receivable

Factoring is a transfer of receivables to a third party (a factor) who assumes the responsibility of collection.

Factoring discounts receivables on a **nonrecourse**, notification basis. Thus, payments by the debtors on the transferred assets are made to the factor. If the transferor (seller) surrenders control, **the transaction is a sale**.

- If a sale is **without recourse**, the transferee (credit agency) assumes the risks and receives the rewards of collection. This sale is final, and the seller has no further liabilities to the transferee. Accordingly, the receivables are no longer reported on the seller's financial statements.
- If a sale is **with recourse**, the transferor (seller) may be required to make payments to the transferee or to buy back receivables in specified circumstances.
 - In this circumstance, the transfer might not qualify as a sale. The parties account for the transaction as a secured borrowing with a pledge of noncash collateral.
 - The receivables are still on the seller's financial statements and it must recognize a liability for the amount of cash received.

Example 2-4 Factoring of Accounts Receivable

A factor charges a 2% fee plus an interest rate of 18% on all cash advanced to a transferor of accounts receivable. Monthly sales are \$100,000, and the factor advances 90% of the receivables submitted after deducting the 2% fee and the interest. Credit terms are net 60 days. What is the cost to the transferor of this arrangement?

Amount of receivables submitted	\$100,000
Minus: 10% reserve	(10,000)
Minus: 2% factor's fee	(2,000)
Amount accruing to the transferor	<u>\$ 88,000</u>
Minus: 18% interest for 60 days	(2,640) [$\$88,000 \times 18\% \times (60 \div 360)$]
Amount to be received immediately	<u>\$ 85,360</u>

The transferor also will receive the \$10,000 reserve at the end of the 60-day period if it has not been absorbed by sales returns and allowances. Thus, the total cost to the transferor to factor the receivables for the month is \$4,640 (\$2,000 factor fee + interest of \$2,640). Assuming that the factor has approved the customers' credit in advance (the sale is without recourse), the transferor will not absorb any bad debts.

The main reasons for factoring transactions are:

- The factor often operates more efficiently than its clients because of the specialized nature of its services.
- An entity (seller) that uses a factor tries to speed up its collections.
 - The entity can eliminate its credit department and accounts receivable staff.
 - Credit losses are eliminated from the financial statements.

These reductions in costs can offset the fee charged by the factor.

Credit card sales are a common form of factoring. The retailer benefits by prompt receipt of cash and avoidance of bad debts and other costs. In return, the credit card company charges a fee.

2.2 Inventory -- Fundamentals

Inventory is the total of tangible personal property

- Held for sale in the ordinary course of business,
- In the form of work-in-process to be completed and sold in the ordinary course of business, or
- To be used up currently in producing goods or services for sale.
 - Inventory does not include long-term assets subject to depreciation.

Financial Statement Presentation

Inventories are generally classified as current assets in the financial statements. They are expected to be realized in cash or sold or consumed during the normal operating cycle of the business.

Inventory Accounts

The inventories of a **retailer** (trading entity) consist of goods purchased to be resold without substantial modification.

The inventories of a **manufacturer** consist of

- Goods to be consumed in production (materials),
- Goods in the process of production (work-in-process), and
- Finished goods.

Cost Basis of Inventory -- Initial Measurement

The **cost of inventory** includes all costs incurred in bringing the inventories to their existing location and ready-to-use condition.

The **cost of purchased inventories** includes

- The price paid or consideration given to acquire the inventory (net of trade discounts, rebates, and other similar items)
 - Import duties and other unrecoverable taxes
 - Handling, insurance, freight-in, and other costs directly attributable to
 - Acquiring finished goods and materials
 - Bringing them to their present location and condition (salable or usable condition)
-

Inventory Accounting Systems

A **perpetual inventory system** updates inventory accounts after each purchase or sale.

- This system is generally more suitable for entities that sell relatively expensive and heterogeneous items and requires continuous monitoring of inventory and cost of goods sold accounts.
- Under this system, inventory and cost of goods sold are adjusted as sales occur.
- An **advantage** of the perpetual inventory system is that the amount of inventory on hand and the cost of goods sold can be determined at any time.
- A **disadvantage** of the perpetual inventory system is that the bookkeeping is more complex and expensive.

In the **periodic inventory system**, inventory and cost of goods sold are updated at specific intervals, such as quarterly or annually, based on the results of a **physical count**.

- Bookkeeping is simpler under this system. It is generally used by entities with relatively inexpensive and homogeneous items that have no need to continuously monitor their inventory and cost of goods sold.
- Under the periodic system, changes in inventory and cost of goods sold are recorded **only at the end of the period**, based on the physical count.

Inventory Period-End Physical Count

An annual period-end **inventory physical count** is necessary under both the perpetual and periodic inventory accounting systems. The amount of inventory reported in the annual financial statements should be based on a physical count.

- Under the **perpetual system**, a physical count helps to detect misstatements in the records and thefts of inventory.
- Under the **periodic system**, the amounts of inventory and cost of goods sold can be determined based only on the results of a physical count.

For a physical count to be accurate, the entity must count all items considered to be inventory and eliminate all items that are not. Items to be counted as inventory include the following:

- **Goods in transit** – Items in transit are inventories that on the physical count date (1) are not on the entity's premises and are on the way to the desired location and (2) whose legal title is held by the entity; i.e., the entity bears the risk of loss on inventory in transit.
 - The following are the most common shipping terms:
 - ▶ **FOB shipping point** – Legal title and risk of loss pass to the buyer when the seller delivers the goods to the carrier.
 - The **buyer** must include the goods in inventory during shipping.
 - ▶ **FOB destination** – Legal title and risk of loss pass to the buyer when the seller delivers the goods to a specified destination.
 - The **seller** must include the goods in inventory during shipping.
- **Goods out on consignment** – A consignment sale is an arrangement between the owner of goods (consignor) and the sales agent (consignee). Consigned goods are not sold but rather transferred to an agent for possible sale. The consignor records sales only when the goods are sold to third parties by the consignee.
 - Goods out on consignment are included in the **consignor's** inventory at cost.
 - ▶ Costs of transporting goods to the consignee are inventoriable costs, not selling expenses.
 - The **consignee** never records the consigned goods as an asset.

Inventory Errors

Inventory errors impact many elements of the entity's financial statements.

- Affected elements of the balance sheet include current assets, working capital (Current assets – Current liabilities), and ending stockholders' equity.
- Affected elements of the income statement include cost of goods sold and net income.

A common error is inappropriate timing of the recognition of transactions.

- If a purchase on account is not recorded and the goods are not included in ending inventory, cost of goods sold and net income are unaffected. Current assets and current liabilities are understated.
- If purchases and beginning inventory are properly recorded but items are excluded from ending inventory, cost of goods sold is overstated. Net income, inventory, retained earnings, and working capital are understated.
- Errors arising from transactions recorded in the wrong period may reverse in the subsequent period.
 - If ending inventory is overstated, the overstatement of net income will be offset by the understatement in the following year that results from the overstatement of beginning inventory.

An **overstatement error in year-end inventory** of the current year affects the financial statements of 2 different years.

The **first year's** effects may be depicted as follows:

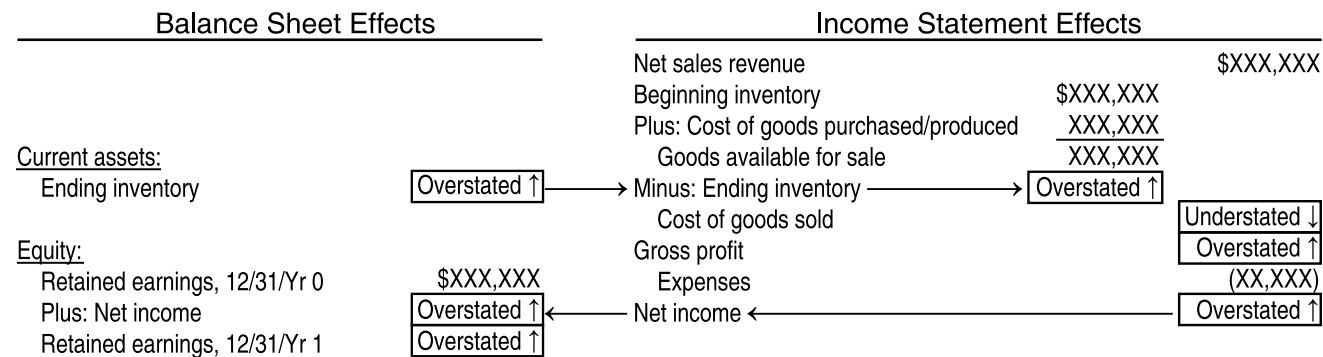


Figure 2-1

At the end of the **second year**, retained earnings is correctly stated as follows:

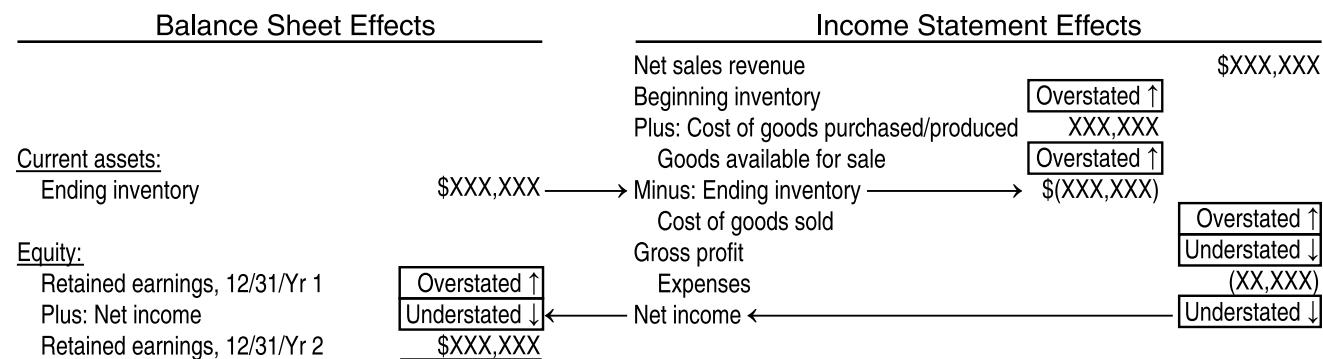


Figure 2-2

2.3 Inventory -- Cost Flow Methods

Specific Identification Method

Specific identification requires determining which specific items are sold and therefore reflects the actual physical flow of goods. This system is appropriate for

- Items that are not ordinarily interchangeable
- Items that are segregated for a specific project
- Blocks of investment securities or special inventory items, such as automobiles or heavy equipment
 - Any item that has a serial number on it is a candidate for the specific identification method.

Specific identification is the most accurate method because it identifies each item of inventory. However, it requires detailed records and may not be feasible or cost effective.

When the inventory items purchased or produced are identical and interchangeable, specific identification is not appropriate. In such circumstances, several assumptions about the flow of cost, such as **average**, **FIFO**, or **LIFO**, may be appropriate for the measurement of periodic income. The method selected should be the one that, under the circumstances, most clearly reflects periodic income.

Average Method

The average method assumes that goods are indistinguishable and are therefore measured at an average of the costs incurred. The average may be calculated on the periodic basis or as each additional purchase occurs (perpetual basis).

- The **moving-average method** is used under the **perpetual** inventory accounting system. It requires determination of a new weighted-average inventory cost after each purchase. This cost is used for every sale until the next purchase.

Example 2-5 Moving-Average Method

The following data relate to Entity A's Year 1 activities:

Date	Transaction	Number of units	Purchase price per unit (\$)	Sale price per unit (\$)
January 1	Beginning balance	100	20	
March 1	Purchase	20	32	
April 1	Sale	70		40
June 1	Purchase	30	14	
October 1	Sale	40		24

Under the **moving-average method**, the year-end inventory and Year 1 cost of goods sold are calculated as follows:

Date	Activity	Units	Price	Cost of inventory purchased/sold	Inventory total balance	On-hand units	Cost per unit
Jan. 1	Beg. bal.	100	\$20		\$2,000 (100×20)	100	\$20
Mar. 1	Purchase	20	\$32	$\$640 = 20 \times \32	\$2,640 ($2,000 + 640$)	120	\$22 ($\$2,640 \div 120$)
Apr. 1	Sale	70	\$22	$(\$1,540) = 70 \times \22	\$1,100 ($2,640 - 1,540$)	50	\$22 ($\$1,100 \div 50$)
Jun. 1	Purchase	30	\$14	$\$420 = 30 \times \14	\$1,520 ($1,100 + 420$)	80	\$19 ($\$1,520 \div 80$)
Oct. 1	Sale	40	\$19	$(\$760) = 40 \times \19	\$760 ($1,520 - 760$)	40	\$19 ($\$760 \div 40$)

The cost of **inventory** on December 31, Year 1, is **\$760**. The Year 1 **cost of goods sold** is **\$2,300**.

Beginning inventory	\$2,000
Purchases ($\$640 + \420)	1,060
Ending inventory	(760)
Cost of goods sold ($\\$1,540 + \\760)	<u>\$2,300</u>

- The **weighted-average method** is used under the **periodic** inventory accounting system. The average cost is determined only at the end of the period. The weighted-average cost per unit is used to determine the ending inventory and the cost of goods sold for the period. It is calculated as follows:

$$\frac{\text{Cost of beginning inventory (\$)} + \text{Cost of purchases during the period (\$)}}{\text{Units in beginning inventory} + \text{Number of units purchased during the period}}$$

Example 2-6 Weighted-Average Method

Under the **weighted-average method**, Entity A's ending inventory and Year 1 cost of goods sold are determined as follows:

First, the weighted-average cost per unit is calculated.

$$\frac{\text{Cost of beginning inventory} + \text{Cost of purchases during the period}}{\text{Units in beginning inventory} + \text{Number of units purchased}} = \frac{\$2,000 + \$1,060}{100 + 20 + 30} = \$20.40$$

Second, the ending inventory and Year 1 cost of goods sold are calculated using the weighted-average cost per unit (WACPU).

Beginning inventory	\$2,000
Purchases	1,060
Ending inventory	(816) $(40 \times \$20.40) = (\text{WACPU} \times \text{Units in ending inventory})$
Cost of goods sold	<u>\$2,244</u> $(110 \times \$20.40) = (\text{WACPU} \times \text{Units sold during the period})$

First-in, First-out (FIFO)

This method assumes that the first goods purchased are the first sold. Ending inventory consists of the latest purchases. Cost of goods sold includes the earliest goods purchased.

Under the FIFO method, year-end inventory and cost of goods sold for the period are **the same** regardless of whether the perpetual or the periodic inventory accounting system is used.

Example 2-7 FIFO

The number of units in Entity A's ending inventory is 40. Under the FIFO method, the cost of these units is the cost of the **latest purchases (\$740)**.

Date of purchase	Units	Price per unit	Total cost
June 1, Year 1	30	\$14	\$420
March 1, Year 1	10	32	320
Ending inventory	40		\$740

The Year 1 cost of goods sold is **\$2,320**.

Beginning inventory	\$2,000
Purchases (\$640 + \$420)	1,060
Ending inventory	(740)
Cost of goods sold	\$2,320

NOTE: The results are the same under the periodic and perpetual systems.

Last-in, First-out (LIFO)

The LIFO (last-in, first-out) method assumes the newest items of inventory are sold first. Thus, the items remaining in inventory are the oldest.

- Under the LIFO method, the perpetual and the periodic inventory accounting systems may result in different values for year-end inventory and cost of goods sold.
 - Under the **periodic** inventory accounting system, the calculation of inventory and cost of goods sold are made at the end of the period.

Example 2-8 LIFO Periodic -- Entity A

The number of units in Entity A's ending inventory is 40. Under the LIFO method, the cost of those units is the cost of the **earliest purchases** (beginning inventory) of **\$800** ($40 \text{ units} \times \20). The Year 1 cost of goods sold is **\$2,260**.

Beginning inventory	\$2,000
Purchases (\$640 + \$420)	1,060
Ending inventory	(800)
Cost of goods sold	<u>\$2,260</u>

For another example with different data, see Example 2-11.

- Under the **perpetual** inventory accounting system, cost of goods sold is calculated every time a sale occurs and consists of the most recent (latest) purchases.

Example 2-9 LIFO Perpetual -- Entity A

Date	Activity	Units	Cost per unit	Cost of inventory purchased/sold	Inventory total balance		Number of units
Jan. 1	Beg. bal.	100	\$20		$100 \times \$20 = \$2,000$		100
Mar. 1	Purchase	20	\$32	$20 \times \$32 = \640	Jan. 1, layer Mar. 1, layer	$100 \times \$20 = \$2,000$ $20 \times \$32 = \frac{\$640}{\$2,640}$	120
Apr. 1	Sale	70		$20 \times \$32 = \640 $50 \times \$20 = \frac{1,000}{\$1,640}$	Jan. 1, layer	$50 \times \$20 = \$1,000$	50
Jun. 1	Purchase	30	\$14	$30 \times \$14 = \420	Jan. 1, layer Jun. 1, layer	$50 \times \$20 = \$1,000$ $30 \times \$14 = \frac{420}{\$1,420}$	80
Oct. 1	Sale	40		$30 \times \$14 = \420 $10 \times \$20 = \frac{200}{\$620}$	Jan. 1, layer	$40 \times \$20 = \800	40

Entity A's cost of ending **inventory** is **\$800**, and the Year 1 **cost of goods sold** is **\$2,260** ($\$1,640 + \620).

NOTE: The results of the LIFO method under the perpetual and periodic systems are the same in this example but may differ in other situations.

For another example with different data, see Example 2-12.



LIFO is not permitted.

IFRS Difference

Retail Inventory Method

The retail inventory method is a very effective means of estimating inventory value. It is used for

- Interim and annual financial reporting in accordance with GAAP
- Federal income tax purposes
- Verifying year-end inventory and cost of goods sold data, e.g., as an analytical procedure by an independent auditor

Cost Flow Methods -- Comparison

The cost flow model selected should be the one that most clearly reflects periodic income.

Example 2-10 Cost Flow Methods

The following are Entity A's varying results under each of the five cost flow methods:

	Ending Inventory	Cost of Goods Sold
Moving average	\$760	\$2,300
Weighted average	816	2,244
FIFO	740	2,320
LIFO periodic	800	2,260
LIFO perpetual	800	2,260

In a time of **rising prices** (inflation), use of the LIFO method results in the lowest year-end inventory, the highest cost of goods sold, and the lowest gross profit. LIFO assumes that the oldest (and therefore the lowest-priced) goods purchased are in year-end inventory, and that cost of goods sold consists of the latest (and therefore the highest-priced) goods purchased.

Example 2-11 LIFO Periodic -- Entity B

The following data relate to Entity B's Year 1 activities:

Date	Transaction	Number of units	Purchase price per unit (\$)	Sale price per unit (\$)
January 1	Beginning balance	15	6	
March 1	Purchase	10	9	
April 1	Sale	8		18
June 1	Purchase	20	10	
October 1	Sale	14		21

The number of units in Entity B's ending inventory is 23. Under the LIFO method, the cost of those units is the cost of the **earliest purchases** of \$162 [(15 units beginning inventory $\times \$6$) + (8 units from March purchase $\times \$9$)]. The Year 1 cost of goods sold is **\$218**.

Beginning inventory	\$ 90
Purchases (\$90 + \$200)	290
Ending inventory	(162)
Cost of goods sold	<u>\$218</u>

Example 2-12 LIFO Perpetual -- Entity B

Date	Activity	Units	Cost per unit	Cost of inventory purchased/sold	Inventory total balance			Number of units
Jan. 1	Beg. bal.	15	\$6		$15 \times \$6 = \90			15
Mar. 1	Purchase	10	\$9	$10 \times \$9 = \90	Jan. 1, layer	$15 \times \$6 = \90		
					Mar. 1, layer	$10 \times \$9 = \underline{\underline{\$90}}$		25
Apr. 1	Sale	8		$8 \times \$9 = \72	Jan. 1, layer	$15 \times \$6 = \90		
					Mar. 1, layer	$2 \times \$9 = \underline{\underline{18}}$		17
Jun. 1	Purchase	20	\$10	$20 \times \$10 = \200	Jan. 1, layer	$15 \times \$6 = \90		
					Mar. 1, layer	$2 \times \$9 = 18$		37
					Jun. 1, layer	$20 \times \$10 = \underline{\underline{\$200}}$		
Oct. 1	Sale	14		$14 \times \$10 = \140	Jan. 1, layer	$15 \times \$6 = \90		
					Mar. 1, layer	$2 \times \$9 = 18$		23
					Jun. 1, layer	$6 \times \$10 = \underline{\underline{60}}$		

Entity B's cost of ending **inventory** is **\$168**, and the Year 1 **cost of goods sold** is **\$212** ($\$72 + \140).

The following table compares the results under FIFO and LIFO:

During a Period of Inflation	Ending Inventory	Cost of Goods Sold	Gross Profit (Net Income)
LIFO	Lowest	Highest	Lowest
FIFO	Highest	Lowest	Highest

Advantages of FIFO:

- Ending inventory approximates current replacement cost
- In times of rising prices, results in highest net income
- Often matches the physical flow of inventory

Disadvantage of FIFO:

- Matches current revenues with older costs

Advantage of LIFO:

- Lower gross profit in periods of rising prices leads to lower taxable income

Disadvantages of LIFO:

- Management can manipulate net income with an end-of-period purchase that immediately alters cost of goods sold
- Rarely matches physical flow of inventory

2.4 Measurement of Inventory Subsequent to Initial Recognition

The subsequent measurement of inventory depends on the cost method used.

- Inventory accounted for using LIFO or the retail inventory method is measured at the **lower of cost or market**.
- Inventory accounted for using any other cost method (e.g., **FIFO or average cost**) is measured at the **lower of cost or net realizable value**.

Loss on Write-Down of Inventory

A write-down of inventory below its cost may result from damage, deterioration, obsolescence, changes in price levels, changes in demand, etc.

- The **loss on write-down** of inventory to market or net realizable value (NRV) generally is presented as a component of cost of goods sold.
 - However, if the amount of loss is material, it should be presented as a separate line item in the current-period income statement.
- A **reversal of a write-down** of inventory recognized in the annual financial statements is **prohibited** in subsequent periods. Once inventory is written down below cost, the reduced amount is the new cost basis.
- Depending on the nature of the inventory, the rules for write-down below cost may be applied either directly to each item or to the total of the inventory (or in some cases, to the total of each major category). The method should be the one that most clearly reflects periodic income.

Measurement of Inventory at the Lower of Cost or Market (LCM)

Inventory accounted for using the **LIFO or retail inventory method** must be written down to **market** if its utility is no longer as great as its cost. The excess of cost over market is recognized as a loss on write-down in the income statement.

Market is the current cost to replace inventory, subject to certain limitations. Market should not (1) exceed a **ceiling** equal to NRV or (2) be less than a **floor** equal to NRV reduced by an allowance for an approximately **normal profit margin**.

- NRV is the estimated selling price in the ordinary course of business minus reasonably predictable costs of completion, disposal, and transportation.
- Current replacement cost (CRC)** is not to be greater than NRV or less than NRV minus a normal profit ($NRV - P$).

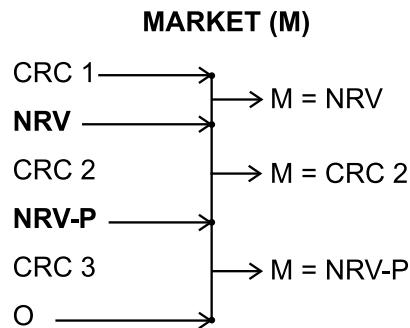


Figure 2-3

- The excess of **cost over market** is recognized as a loss on write-down in the income statement.

Example 2-13 Calculating LCM

The following information is related to a company's year-end inventories:

Cost per inventory unit	Item A	Item B	Item C
Estimated selling price	\$80	\$70	\$44
Minus: Cost of completion	(20)	--	(3)
Minus: Cost of disposal	(6)	(5)	(2)
NRV (ceiling)	\$54	\$65	\$39
Minus: Normal profit margin	(3)	(7)	(4)
NRV – NPM (floor)	\$51	\$58	\$35
Current replacement cost (CRC)	\$53	\$55	\$40
(a) Market	\$53 Ceiling > CRC > Floor	\$58 Floor > CRC	\$39 CRC > Ceiling
(b) Historical cost per unit	\$50	\$60	\$45
Lower of cost (b) or market (a)	\$50 Cost < Market	\$58 Market < Cost	\$39 Market < Cost

Example 2-14 LIFO -- LCM

Lala Co. accounts for its inventory using the **LIFO** cost method. The following is its inventory information at the end of the fiscal year:

Historical cost	\$100,000
Current replacement cost	82,000
Net realizable value (NRV)	90,000
Normal profit margin	5,000

Under the LIFO method, inventory is measured at the lower of cost or market (current replacement cost subject to certain limitations). Market cannot be higher than NRV (\$90,000) or lower than NRV reduced by a normal profit margin ($\$90,000 - \$5,000 = \$85,000$). Thus, market is \$85,000. (The current replacement cost of \$82,000 is below the floor.) Because market is lower than cost, the inventory is reported in the balance sheet at market of \$85,000. The write-down of inventory of \$15,000 ($\$100,000 - \$85,000$) is recognized as a loss in the income statement.



IFRS Difference

Inventories are measured at the lower of cost or net realizable value (NRV) regardless of the cost method used. NRV is the estimated selling price less the estimated costs of completion and disposal. NRV is assessed each period. Accordingly, a write-down **may be reversed** but not above original cost. The write-down and reversal are recognized in profit or loss.

A list of IFRS differences can be found in Appendix B.

Measurement of Inventory at the Lower of Cost or NRV (LCNRV)

Inventory measured using any method other than LIFO or retail (e.g., **FIFO or average cost**), must be measured at the **lower of cost or net realizable value**.

- **NRV** is the estimated selling price in the ordinary course of business minus reasonably predictable costs of completion, disposal, and transportation.
- The excess of **cost over NRV** is recognized as a loss on write-down in the income statement.

Example 2-15 FIFO -- LCNRV

Using the data from Example 2-14, assume that Lala Co. accounts for its inventory using the **FIFO** cost method.

Under the FIFO method (or any other method except for LIFO or retail), inventory is measured at the **lower of cost or net realizable value**. NRV of \$90,000 is lower than cost of \$100,000. Thus, a loss on write-down to NRV of \$10,000 is recognized.

Inventory Measurement at Interim Dates

A write-down of inventory below cost (to market for LIFO and retail and to NRV for all other methods) may be **deferred in the interim financial statements** if no loss is reasonably anticipated for the year.

- But inventory losses from a **nontemporary** decline below cost must be recognized at the interim date.
- If the loss is recovered in another quarter, it is recognized as a gain and treated as a change in estimate. The amount recovered is limited to the losses previously recognized.

Study Unit Three

Measurement, Valuation, and Disclosure: Assets -- Long-Term Items

3.1	<i>Investments in Equity Securities</i>	2
3.2	<i>Equity Method</i>	5
3.3	<i>Investments in Debt Securities</i>	8
3.4	<i>Property, Plant, and Equipment</i>	12
3.5	<i>Intangible Assets</i>	18

This study unit is the **third of six** on **external financial reporting decisions**. The relative weight assigned to this major topic in Part 1 of the exam is **15%**. The six study units are

- Study Unit 1: External Financial Statements
- Study Unit 2: Measurement, Valuation, and Disclosure: Assets -- Short-Term Items
- **Study Unit 3: Measurement, Valuation, and Disclosure: Assets -- Long-Term Items**
- Study Unit 4: Measurement, Valuation, and Disclosure: Liabilities
- Study Unit 5: Revenue and Impairment Recognition
- Study Unit 6: Integrated Reporting

This study unit discusses long-term assets. Topics covered in this study unit include

- Valuation, classification, and measurement of debt and equity securities
- Initial measurement of property, plant, and equipment
- Depreciation methods
- Accounting for intangible assets

3.1 Investments in Equity Securities

An **equity security** is an **ownership** interest in an entity (e.g., common stock or preferred stock) or a right to acquire or dispose of such an interest (e.g., warrants or call options). Convertible debt securities are not equity interests in the issuer.

This subunit applies to all investments in equity securities **except** for investments

- Accounted for under the equity method
- In consolidated subsidiaries
- For which the entity has elected the fair value option (FVO)

The accounting method for an investment in voting stock depends on the presumed influence that the investor has over the investee. The presumed influence usually is determined based on the ownership interest held. The table below depicts the three possibilities.

Percentage Ownership	Presumed Influence	Accounting Method
100%	Control	Consolidation
50%	Significant	Equity Method or FVO
20%	Little or none	Fair Value Measurement
0%		

Figure 3-1

The equity method is covered in Subunit 2 of this study unit. Consolidated financial statements are covered in detail in Study Unit 1, Subunit 6.

Fair Value Measurement of an Investment in Equity Securities

The following summarizes accounting for equity securities measured at fair value.

- The investment is measured at **fair value** at each balance sheet date.
- **Unrealized holding gains and losses** on the remeasurement of the investment to fair value are reported in the **income statement** (net income) at each subsequent reporting date.
- Realized gain or loss on the sale of the equity security is included in net income on the income statement.
- Dividends received from investments in equity securities are reported as dividend income in the income statement.
- Cash flows from purchases and sales of equity securities are classified in the statement of cash flows based on the nature and purpose for which the securities were acquired.

Equity Security Presumed Influence	Accounting Method	Balance Sheet	Income Statement	Statement of Cash Flows
Little or none	Fair value measurement	Measured at fair value each balance sheet date	Unrealized holding gain or loss on remeasurement Dividend income Realized gain or loss on sale	Purchases and sales classified based on nature and purpose

Example 3-1 Investment in Equity Securities

On November 1, Year 1, Abi Co. purchased 200 shares of Gail Co.'s common stock at fair value. This investment is less than 1% of the ownership interests in Gail Co. The following are the fair values per share of Gail common stock at the relevant dates:

Date	Fair Value
November 1, Year 1	\$100
December 31, Year 1	90
December 31, Year 2	115

November 1, Year 1

Assets	=	Liabilities + Stockholders' Equity
---------------	---	------------------------------------

Investment in equity securities \$20,000 ↑

Cash \$20,000 ↓

200 shares × \$100 fair value = \$20,000

This investment in equity securities of Gail Co. is reported at fair value through net income on each balance sheet date.

December 31, Year 1

Assets	=	Liabilities + Stockholders' Equity
---------------	---	------------------------------------

Investment in equity securities \$2,000 ↓

Unrealized holding loss \$2,000 ↓

200 shares × (\$90 – \$100) = \$(2,000)

In Abi's December 31, Year 1, balance sheet, the investment in equity securities of Gail Co. is reported at its fair value of \$18,000 (200 × \$90). In the Year 1 income statement, an unrealized loss of \$2,000 is recognized.

December 31, Year 2

Assets	=	Liabilities + Stockholders' Equity
---------------	---	------------------------------------

Investment in equity securities \$5,000 ↑

Unrealized holding gain \$5,000 ↑

200 shares × (\$115 – \$90) = \$5,000

In Abi's December 31, Year 2, balance sheet, the investment in equity securities of Gail Co. is reported at its fair value of \$23,000 (200 × \$115). In the Year 2 income statement, an unrealized gain of \$5,000 is recognized.

Impairment Test

A qualitative assessment of whether an investment is impaired must be performed at each reporting date. An investment is impaired if the fair value of the investment is lower than its carrying amount.

- A **qualitative** assessment may consider many impairment indicators, such as significant deterioration in earnings performance, credit rating, or asset quality.

If the qualitative assessment indicates potential impairment, the entity must estimate the fair value of the investment and perform a **quantitative** impairment test.

- The carrying amount of the investment is compared with its fair value. An impairment loss is recognized in the income statement (net income) for the excess of the carrying amount over the fair value.

$$\text{Impairment loss} = \text{Carrying amount} - \text{Fair value}$$

3.2 Equity Method

Significant Influence

An investment in voting stock that enables the investor to exercise significant influence over the investee should be accounted for by the **equity method** [assuming no fair value option (FVO) election].

Significant influence is presumed to exist when the investor holds between 20% and 50% of the investee's voting interests (shares of common stock).

- The amount of preferred stock held by the investor is irrelevant. Preferred stock usually is non-voting.

Application of the Equity Method

An equity method investment is initially recognized at cost.

Under the equity method, the investor recognizes in income its **share of the investee's earnings or losses** in the periods for which they are reported by the investee.

- An investor recognizes increases in earnings and the **investment account** for its share of the investee's net income for the period.
- An investor recognizes a **loss** and a **decrease in the investment account** for its share of the investee's net loss for the period.
- The investor's share of the investee's earnings or losses is recognized only for the portion of the year that the investment was held under the equity method.

Dividends from the investee are treated as a return of an investment. They have no effect on the investor's income.

- The investor's share of dividends distributed by the investee increases cash and **decreases the investment**.

Example 3-2 Equity Method Transactions

On May 1, Year 3, Company P purchased shares of Company XYZ common stock for \$200,000. This investment represents a 30% ownership in XYZ.

May 1, Year 3

Assets	=	Liabilities	+	Stockholders' Equity
--------	---	-------------	---	----------------------

Investment in XYZ \$200,000 ↑
Cash \$200,000 ↓

XYZ reports \$60,000 of net income for Year 3.

Because Company P only owned the shares in XYZ for a portion of the year, Company P recognizes the earnings only for the portion of the year the investment was held under the equity method.

Company P Year 3 earnings from XYZ = $\$60,000 \times (8/12) = \$40,000 \times 30\% \text{ ownership} = \$12,000$

Assets	=	Liabilities	+	Stockholders' Equity
--------	---	-------------	---	----------------------

Investment in XYZ \$12,000 ↑ Revenue – Share of XYZ earnings \$12,000 ↑

XYZ reports \$100,000 of net income for Year 4 and declares and pays a \$20,000 dividend.

Company P Year 4 earnings from XYZ = $\$100,000 \times 30\% = \$30,000$

Assets	=	Liabilities	+	Stockholders' Equity
--------	---	-------------	---	----------------------

Investment in XYZ \$30,000 ↑ Revenue – Share of XYZ earnings \$30,000 ↑

Company P Year 4 dividends from XYZ = $\$20,000 \times 30\% = \$6,000$

Assets	=	Liabilities	+	Stockholders' Equity
--------	---	-------------	---	----------------------

Cash \$6,000 ↑
Investment in XYZ \$6,000 ↓

Equity Security Presumed Influence	Accounting Method	Balance Sheet	Income Statement	Statement of Cash Flows
Significant	Equity method	Investment increased by portion of investee earnings Investment decreased by portion of investee losses Investment decreased by dividends received	Share of investee earnings (loss) Realized gain or loss on sale	Purchases and sales are investing activities

If an investor can **no longer be presumed** to exercise significant influence (for example, due to a decrease in the level of ownership), it ceases to account for the investment using the equity method.


Author's Note

The fair value option is not covered because it is beyond the scope of the CMA exam.

3.3 Investments in Debt Securities

A **debt security** represents a **creditor** relationship with the issuer.

- In addition to the common forms of debt, this category includes
 - Mandatorily redeemable preferred stock (stock that must be redeemed by the issuer)
 - Preferred stock redeemable at the investor's option
 - Collateralized mortgage obligations
- Leases, options, financial futures contracts, and forward contracts are not debt securities.

This subunit applies to all investments in debt securities.

Debt securities are classified at acquisition into one of **three categories**. The classification is reassessed at each reporting date.

Category	Criteria
Held-to-maturity	Debt securities that the reporting entity has the positive intent and ability to hold to maturity
Trading	Debt securities intended to be sold in the near term
Available-for-sale	Debt securities not classified as held-to-maturity or trading

Held-to-Maturity Securities -- Amortized Cost

An investment in a debt security is classified as held-to-maturity when the holder has both the **positive intent** and the **ability** to hold the security until its maturity date.

- The investor may intend to hold the security for an indefinite period.
 - The possibility may exist that it will be sold before maturity to supply needed cash, avoid interest rate risk, etc. In these cases, the security cannot be classified as held-to-maturity.
- If a sale before maturity takes place, the security still can be deemed to have been held-to-maturity if
 - Sale is near enough to the maturity or call date (e.g., within 3 months) so that interest rate risk (change in the market rate) does not have a significant effect on fair value, or
 - Sale is after collection of 85% or more of the principal.

Held-to-maturity securities are reported at **amortized cost**. This is initial cost net of any unamortized premium or discount.

Debt Security	Balance Sheet	Income Statement	Statement of Cash Flows
Held-to-maturity	Amortized cost, net of any unamortized premium or discount May be current or noncurrent assets	Interest income (includes any amortization of premium or discount) Realized gains and losses	Purchases and sales are investing activities

Trading Securities -- Fair Value through Net Income

Trading securities are bought and held primarily for sale in the near term. They are purchased and sold frequently.

- Each trading security is initially recorded at **cost** (including brokerage commissions and taxes).
- At each balance sheet date, trading securities are **remeasured at fair value**.

Unrealized holding gains and losses on trading securities are reported in the **income statement** (net income). A holding gain or loss is the net change in fair value during the period, not including recognized dividends or interest not received.

Debt Security	Balance Sheet	Income Statement	Statement of Cash Flows
Trading	Current asset Reported at fair value	Interest income (includes any amortization of premium or discount) Unrealized holding gains and losses Realized gains and losses	Typically considered operating activities

Example 3-3 Trading Securities

On October 1, Year 1, Maverick Co. purchased 1,000 shares of Larson Co. mandatorily redeemable preferred stock (i.e., debt securities) at fair value. Maverick classified this investment as trading securities. On March 1, Year 2, Maverick sold all of its investment at fair value. The following are the fair values per share of Larson mandatorily redeemable preferred stock at the relevant dates:

Date	Fair Value
October 1, Year 1	\$15
December 31, Year 1	14
March 1, Year 2	21

October 1, Year 1

Assets	=	Liabilities	+	Stockholders' Equity
---------------	---	--------------------	---	-----------------------------

Trading securities \$15,000 ↑
Cash \$15,000 ↓

$$1,000 \text{ shares} \times \$15 = \$15,000$$

December 31, Year 1

At each balance sheet date, trading securities are remeasured at fair value. Unrealized holding gains and losses are reported in earnings.

Assets	=	Liabilities	+	Stockholders' Equity
---------------	---	--------------------	---	-----------------------------

Securities fair value adjust. – Trading \$1,000 ↓ Unrealized holding loss \$1,000 ↓

$$1,000 \text{ shares} \times (\$14 - \$15) = \$(1,000)$$

In Maverick's December 31, Year 1, balance sheet, the investment in Larson is reported in the current assets section as trading securities. It is measured at year-end fair value of \$14,000 ($1,000 \times \14).

March 1, Year 2

Assets	=	Liabilities	+	Stockholders' Equity
---------------	---	--------------------	---	-----------------------------

Cash \$21,000 ↑
Trading securities \$14,000 ↓ Gain on sale of trading securities \$7,000 ↑

$$\begin{aligned} \text{Cash proceeds: } & 1,000 \text{ shares} \times \$21 = \$21,000 \\ \text{Gain: } & \$21,000 \text{ cash proceeds} - \$14,000 \text{ fair value} = \$7,000 \end{aligned}$$

Available-for-Sale Securities -- Fair Value through OCI

Securities that are not classified as held-to-maturity or trading are considered available-for-sale.

- The initial acquisition is recorded at **cost**.
- At each balance sheet date, available-for-sale securities are **remeasured at fair value**.
- **Unrealized holding gains and losses** resulting from the remeasurement to fair value are reported in **other comprehensive income (OCI)**.
 - Tax effects are recorded directly to OCI.
 - Amortization of any discount (premium) is reported in available-for-sale securities or an allowance and to interest income.
 - Receipt of cash dividends is recorded as dividend income.
 - All or part of unrealized gains and losses for an available-for-sale security designated and qualifying as the hedged item in a fair value hedge are recognized in earnings.

Debt Security	Balance Sheet	Income Statement	Statement of Comprehensive Income	Statement of Cash Flows
Available-for-sale	Current or noncurrent asset Reported at fair value Equity section – unrealized holding gains and losses reported in accumulated other comprehensive income	Realized gains and losses Interest income (including amortization of premium or discount)	Unrealized holding gains and losses	Purchases and sales are investing activities

Impairment

Unrealized changes in fair value are recognized in earnings (income statement) if they represent **permanent declines**.

- The **amortized cost basis** is used to calculate any impairment.
 - The amortized cost basis differs from fair value, which equals the cost basis plus or minus the net unrealized holding gain or loss.
- If a decline in fair value of an individual **held-to-maturity** or **available-for-sale** security below its amortized cost basis is permanent, the amortized cost basis is **written down to fair value** as a new cost basis.
- The impairment is a **realized loss** included in **earnings** (income statement).
 - The new cost basis is not affected by recoveries in fair value.
 - Subsequent changes in fair value of available-for-sale securities, except for other-than-temporary declines, are included in OCI.

3.4 Property, Plant, and Equipment

Property, plant, and equipment (PPE), also called fixed assets, are tangible property expected to benefit the entity for **more than 1 year**. They are held for the production or supply of goods or services, rental to others, or administrative purposes.

Initial Measurement

PPE are initially measured at historical cost, which consists of all the costs necessarily incurred to bring the asset to the condition and location necessary for its intended use. The historical (initial) cost includes

- The net purchase price (minus trade discounts and rebates, plus purchase taxes and import duties).
- The directly attributable costs of bringing the asset to the location and condition needed for its intended operation, such as architects' and engineers' fees, site preparation, delivery and handling, installation, assembly, and testing.
- The interest (borrowing costs) attributable to the acquisition, construction, or production of PPE.

In the case of a constructed building, historical cost does not include site preparation costs (e.g., the costs of clearing, draining, filling, and leveling the land). Instead, such costs are costs of the attached land, not of the building to be constructed on the land.



IFRS Difference

The IFRS difference related to borrowing costs is detailed in Appendix B.

Measurement Subsequent to Initial Recognition

The carrying amount of an item of PPE is the amount at which it is presented in the balance sheet. This amount is equal to the historical cost minus accumulated depreciation and impairment losses.

$$\begin{aligned} & \text{Historical or initial cost} \\ & - \text{Accumulated depreciation} \\ & - \text{Impairment losses} \\ & = \underline{\text{Asset's carrying amount}} \end{aligned}$$

The accounting issue related to expenditures for PPE subsequent to initial recognition is to determine whether they should be

1. Capitalized at cost and depreciated in future periods (a capital expenditure) or
2. Recognized as an expense as incurred (a revenue expenditure).

Capital expenditures provide additional benefits by improving the quality of services rendered by the asset, extending its useful life, or increasing its output. These expenditures are capitalized at cost.

- An improvement expenditure must be capitalized if it
 - Results in a betterment to the unit of property,
 - Adapts the unit of property to a new or different use, or
 - Results in a restoration of the unit of property.

Revenue expenditures (expenses) maintain an asset's normal service capacity.

- These costs are recurring, not expected to benefit future periods, and expensed as incurred.
- Routine, minor expenditures made to maintain the operating efficiency of PPE are ordinarily expensed as incurred.

Depreciation

Depreciation is the process of systematically and rationally allocating the depreciable base of a tangible capital asset over its expected useful life. The periodic depreciation expense is recognized in the income statement. Accumulated depreciation is a contra-asset account.

The entry to record depreciation is:

Assets	=	Liabilities	+	Stockholders' Equity
Accumulated depreciation ↓				Depreciation expense ↓

The following items are needed to calculate depreciation:

- The asset's **depreciable base** (the amount to be allocated) is calculated as follows:

$$\text{Depreciable base} = \text{Historical cost} - \text{Salvage value} - \text{Recognized impairment loss}$$

- **Estimated useful life** is an estimated period over which services or economic benefits are expected to be obtained from the use of the asset.
- **Salvage value** (residual value) is the amount that the entity expects to obtain from disposal of the asset at the end of the asset's useful life.

Land has an indefinite useful life and therefore must not be depreciated. The depreciable base of property that consists of land or a building is the depreciable base of the building only.

Example 3-4 Depreciable Base

Jayhawk Co. recently acquired a robot to be used in its fully automated factory for a purchase price of \$850,000. Jayhawk spent another \$150,000 installing and testing the robot. The company estimates that the robot will have a 5-year useful life and can be sold at the end of that time for \$100,000.

The depreciable base for this asset is calculated as follows:

Purchase price	\$ 850,000
Installation and testing	150,000
Historical cost	<u>\$1,000,000</u>
Estimated salvage value	(100,000)
Depreciable base	<u>\$ 900,000</u>

The **depreciation method** chosen should reflect the pattern in which economic benefits (or services) from the assets are expected to be received. The chosen method allocates the cost of the asset as equitably as possible to the periods during which services (or economic benefits) are obtained from the use of the asset.



CMA candidates are expected to be able to determine the effect on the financial statements of using different depreciation methods and recommend a depreciation method for a given set of data.

Depreciation Methods

Straight-line Depreciation Method

Straight-line (S-L) depreciation is the simplest method because an equal amount of depreciation is charged to each period of the asset's useful life. The easiest way to calculate straight-line depreciation is to divide the depreciable base by the estimated useful life.

$$\text{Periodic depreciation expense} = \text{Depreciable base} \div \text{Estimated useful life}$$

Example 3-5 Depreciation Expense -- Straight-Line

If Jayhawk applies the straight-line method, depreciation expense over the life of the asset will be calculated as follows:

	Depreciable Base	Divided: Estimated Useful Life	Equals: Depreciation Expense	Accumulated Depreciation	Carrying Amount, End of Year
Year 1:	\$900,000	5	\$180,000	\$180,000	\$820,000
Year 2:	900,000	5	180,000	360,000	640,000
Year 3:	900,000	5	180,000	540,000	460,000
Year 4:	900,000	5	180,000	720,000	280,000
Year 5:	900,000	5	180,000	900,000	100,000
Total			\$900,000		

The straight-line percentage for Jayhawk's new robot is 20% ($100\% \div 5$ -year estimated useful life).

Because an asset is most likely to be acquired or disposed of in the middle of a period, the calculation often involves a fraction of a period. Time-based methods most often compute depreciation to the nearest month of a partial year. However, other conventions also are permitted.

Example 3-6 Depreciation for a Fractional Period

Assume that Jayhawk purchased the robot on October 1, Year 1. Depreciation expense recognized in Year 1 is \$45,000 [$\$180,000$ depreciation expense for a full year $\times (3 \div 12)$]. Annual depreciation expense recognized in Years 2 through 5 is \$180,000. Depreciation expense recognized in Year 6 is \$135,000 [$\$180,000 \times (9 \div 12)$].

Units-of-Output Method

Usage-centered activity methods calculate depreciation as a function of an asset's use rather than the time it has been held. The **units-of-output method** allocates cost based on production. As production varies, so will the depreciation expense.

$$\text{Periodic depreciation expense} = \text{Depreciable base} \times \frac{\text{Units produced during current period}}{\text{Estimated total lifetime units}}$$

Example 3-7 Units-of-Output Method

On the date of purchase, Jayhawk anticipated that the robot would produce 8,000 units of product over its 5-year life. In actuality, the robot produced the following:

Year 1	Year 2	Year 3	Year 4	Year 5	Total
2,300 units	2,000 units	1,800 units	1,200 units	700 units	8,000 units

Depreciation expense over the life of the asset will be calculated as follows:

	Depreciable Base	Times: Units-of-Production Fraction	Equals: Depreciation Expense	Accumulated Depreciation	Carrying Amount, Year End
Year 1:	\$900,000	(2,300 ÷ 8,000)	\$258,750	\$258,750	\$741,250
Year 2:	900,000	(2,000 ÷ 8,000)	225,000	483,750	516,250
Year 3:	900,000	(1,800 ÷ 8,000)	202,500	686,250	313,750
Year 4:	900,000	(1,200 ÷ 8,000)	135,000	821,250	178,750
Year 5:	900,000	(700 ÷ 8,000)	78,750	900,000	100,000
Total			\$900,000		

Accelerated Depreciation Methods

Accelerated depreciation methods are time-based. They result in decreasing depreciation charges over the life of the asset. The two major time-based methods are declining balance and sum-of-the-years'-digits.

Declining balance determines depreciation expense by multiplying the carrying amount (not the depreciable base equal to cost minus salvage value) at the beginning of each period by some percentage (e.g., 200% or 150%) of the straight-line rate of depreciation.

$$\text{Periodic depreciation expense} = \text{Carrying amount} \times \text{Declining-balance percentage}$$

- The carrying amount decreases by the depreciation recognized. The result is the use of a constant rate against a declining balance.
- Salvage value is ignored in determining the carrying amount, but the asset is not depreciated below salvage value.

Example 3-8 Declining Balance Method

If Jayhawk applies double-declining-balance (DDB) depreciation to the robot, the declining-balance percentage will be 40% (20% straight-line rate \times 2). Depreciation expense over the life of the asset will be calculated as follows:

	Carrying Amount, First of Year	Times: DDB Rate	Equals: Depreciation Expense	Accumulated Depreciation	Carrying Amount, End of Year
Year 1:	\$1,000,000	40%	\$400,000	\$400,000	\$600,000
Year 2:	600,000	40%	240,000	640,000	360,000
Year 3:	360,000	40%	144,000	784,000	216,000
Year 4:	216,000	40%	86,400	870,400	129,600
Year 5:	129,600	40%	29,600*	900,000	100,000
			\$900,000		

*Year 5 depreciation expense is \$29,600 because the carrying amount cannot be less than salvage value.

The **sum-of-the-years'-digits (SYD)** depreciation method multiplies not the carrying amount but the constant depreciable base (cost minus salvage value) by a declining fraction. It is a declining rate, declining-charge method.

$$\text{Periodic depreciation expense} = \text{Depreciable base} \times \frac{\text{Remaining years in useful life}}{\text{Sum of all years in useful life}}$$

Example 3-9 SYD Method

If Jayhawk applies sum-of-the-years'-digits depreciation, the denominator of the SYD fraction is 15 ($1 + 2 + 3 + 4 + 5$). Depreciation expense over the life of the asset will be calculated as follows:

	Depreciable Base	SYD Fraction	Depreciation Expense	Accumulated Depreciation	Carrying Amount, Year End
Year 1:	\$900,000	(5 \div 15)	\$300,000	\$300,000	\$700,000
Year 2:	900,000	(4 \div 15)	240,000	540,000	460,000
Year 3:	900,000	(3 \div 15)	180,000	720,000	280,000
Year 4:	900,000	(2 \div 15)	120,000	840,000	160,000
Year 5:	900,000	(1 \div 15)	60,000	900,000	100,000
			\$900,000		

Group and Composite Depreciation Methods

Group and composite depreciation methods apply **straight-line** accounting to a collection of assets depreciated as if they were a single asset.

- The composite method applies to groups of **dissimilar assets** with varying useful lives.
- The group method applies to **similar assets**.
- These methods
 - Provide an efficient way to account for a large number of depreciable assets
 - Result in offsetting of under and overstated depreciation estimates



IFRS Difference

IFRS differences related to depreciation and measurement of PPE are detailed in Appendix B.

3.5 Intangible Assets

Initial Recognition

An intangible asset is an identifiable, nonmonetary asset that lacks physical substance. Examples of intangible assets include licenses, patents, copyrights, franchises, goodwill, and trademarks.

- **Externally acquired intangible assets** (other than goodwill) are initially recorded at acquisition cost plus any additional costs, such as legal fees.
- **Internally developed** intangible assets (other than goodwill) are recorded initially at the amount of the additional costs other than those for research and development (e.g., legal fees).

Research and development (R&D) costs must be **expensed as incurred** (not capitalized) except under certain limited scenarios.

Example 3-10 Internally Developed Patent

A company invested \$200,000 and \$300,000 in the research phase and the development phase, respectively, of an internally developed patent. In addition, the company paid \$10,000 and \$15,000 for patent registration fees and legal fees, respectively.

The patent will be recorded at the amount of the incidental costs of \$25,000 (\$10,000 patent registration fees + \$15,000 legal fees). The amounts paid for research and development must be expensed as incurred and are never capitalized to the cost of the asset.



IFRS Difference

IFRS differences related to accounting for intangibles as well as research and development are detailed in Appendix B.

Intangible Assets with Finite Useful Lives

An intangible asset with a **finite useful life** (an amortized intangible asset) to the reporting entity is **amortized** over that useful life.

The entry to record amortization is:

Assets	=	Liabilities	+	Stockholders' Equity
Intangible asset ↓				Amortization expense ↓

The **amortizable amount** equals the amount of cost initially assigned minus the residual value.

$$\text{Amortizable amount} = \text{Historical (initial) cost} - \text{Residual value}$$

The amortization methods are similar to the depreciation methods described on page 15 in Subunit 3.4.

The carrying amount of an intangible asset with a finite useful life equals its historical cost minus accumulated amortization and any impairment losses.

- The **impairment test** for an intangible asset with a finite useful life (an amortized intangible asset) is the **two-step impairment test** for long-lived assets described in Study Unit 5, Subunit 3.

Intangible Assets with Indefinite Useful Lives

An intangible asset with an **indefinite useful life** is **not amortized**. The carrying amount of an intangible asset with an indefinite useful life equals its historical cost minus any impairment losses.

- Goodwill is an intangible asset with an indefinite useful life. However, the accounting treatment of goodwill (described below) differs from that for other intangible assets.

Goodwill

Goodwill is recognized only in a business combination, and the initial calculation to recognize goodwill is covered in Study Unit 1, Subunit 6. Goodwill is an intangible asset reflecting the future economic benefits arising from those assets acquired in the combination that are not individually identified and separately recognized.

- Goodwill has an indefinite useful life. Thus, it must not be amortized subsequent to its initial recognition and is instead periodically tested for impairment.
- The parent presents any goodwill recognized in its consolidated balance sheet as one amount under noncurrent assets.
- Internally generated goodwill must not be recognized in the financial statements.

Patents

The **amortization period** for a patent is the **shorter** of

- Its **useful life** or
- The **legal life** remaining after acquisition or the moment the application was filed.
 - The useful life may be substantially shorter than the legal life because of changes in consumer tastes, delays in marketing the product or service, and development of substitutes or improvements.

The accounting treatment of the costs of the **legal defense of a patent** depends upon the outcome of the litigation.

- The costs of **successful litigation** are **capitalized** to the cost of the patent because they will benefit future periods. They are amortized over the shorter of
 - The remaining legal life or
 - The estimated useful life of the patent.
- The costs of **unsuccessful litigation** (damages, attorneys' fees, etc.) are **expensed** as incurred.
 - An unsuccessful suit also may indicate that the unamortized cost of the patent has no value, or lower value, and an impairment loss might be recognized.

Study Unit Four

Measurement, Valuation, and Disclosure: Liabilities

4.1	<i>Contingencies and Warranties</i>	2
4.2	<i>Leases</i>	6
4.3	<i>Income Taxes</i>	14
4.4	<i>Accounting for Bonds Payable</i>	19

This study unit is the **fourth of six** on **external financial reporting decisions**. The relative weight assigned to this major topic in Part 1 of the exam is **15%**. The six study units are

- Study Unit 1: External Financial Statements
- Study Unit 2: Measurement, Valuation, and Disclosure: Assets -- Short-Term Items
- Study Unit 3: Measurement, Valuation, and Disclosure: Assets -- Long-Term Items
- **Study Unit 4: Measurement, Valuation, and Disclosure: Liabilities**
- Study Unit 5: Revenue and Impairment Recognition
- Study Unit 6: Integrated Reporting

This study unit discusses liabilities. Topics covered in this study unit include

- Accounting for contingencies
- Warranties, including the assurance warranty approach and the service warranty approach
- Income taxes, including accounting for assets and liabilities related to deferred income tax
- Leases, including the differences between operating and financing leases and the financial statement presentation of operating and financing leases
- Bonds
 - The financial statement presentation of bonds payable and the bond's related premium or discount
 - The effective interest rate method for calculating the interest expense and amortization of a bond's premium or discount

4.1 Contingencies and Warranties

Contingencies

U.S. GAAP defines a contingency as “an existing condition, situation, or set of circumstances involving uncertainty as to possible gain (a gain contingency) or loss (a loss contingency) to an enterprise that will ultimately be resolved when one or more future events occur or fail to occur.”

A contingency may be

- Probable
 - Future events are likely to occur.
- Reasonably possible
 - The chance of occurrence is more than remote but less than probable.
- Remote
 - The chance of occurrence is slight.

A **loss contingency** must be accrued (recognition of a liability and related loss contingency) when the following two conditions are met:

1. It is **probable** that, at a balance sheet date, an asset has been impaired or a liability has been incurred.
2. The amount of the loss can be **reasonably estimated**.
 - The amount with the better estimate within a **range of loss** must be accrued.
 - If no amount within that range appears to be a better estimate than any other, the **minimum** should be accrued.
 - Disclosure of the nature of the accrual and, in some cases, the amount or the range of loss may be required to prevent the financial statements from being misleading.

If at least one condition is not met but the probability of loss is at least **reasonably possible**, the nature of the contingency must be **disclosed** in the notes to the financial statements but is not recorded in the accounts.

Loss contingencies with a **remote** probability ordinarily are **not disclosed**.

Gain contingencies are **recognized only when realized**. A gain contingency must be adequately disclosed in the notes. For example, an award of damages in a lawsuit is not realized if it is being appealed.

Warranties

A warranty is a **written guarantee** of the integrity of a product or service. The seller also agrees to repair or replace a product, refund all or part of the price, or provide additional service.

- A warranty is customarily offered for a limited time, such as 2 years.
- It may or may not be separable.

A warranty that provides a customer assurance that a product will function as expected in accordance with agreed-upon specifications is an **assurance-type warranty**.

- A standard 1-year computer warranty against manufacturing defects is an example.
- If a customer does **not** have the option to purchase a warranty separately (or if the warranty is required by law), it is an assurance-type warranty.

A warranty that provides a service in addition to assurance is a **service-type warranty**.

- An example is a warranty against customer-inflicted damage (such as to a smartphone).
 - A warranty that can be **purchased separately** by the customer is a service-type warranty.
 - Service-type warranties are more likely to have longer coverage periods than assurance-type warranties.
-

Assurance-Type Warranties

An assurance-type warranty is **not** a separate performance obligation in a contract. No transaction price is allocated to the warranty. An assurance-type warranty creates a **loss contingency**.

Accrual accounting should be used if

- Warranty expense is probable,
- The amount can be reasonably estimated, and
- The amount is material.

A warranty liability is recorded when revenue is recognized **at the time of sale**.

- Even if the warranty extends beyond the period of sale, the **entire liability** (expense) for expected costs is recognized at the time of sale. It is not prorated over the annual periods covered by the warranty.

$$\begin{aligned}
 & \text{Beginning warranty liability} \\
 & + \text{Warranty expense recognized in the current period} \\
 & - \text{Warranty payments in the current period} \\
 & = \underline{\underline{\text{Ending warranty liability}}}
 \end{aligned}$$

- Actual payments for warranty costs reduce the warranty liability and do not affect warranty expense.
 - If warranty payments for the period exceed the warranty liability, the excess is recognized as warranty expense.

Example 4-1 Assurance-Type Warranty

In Year 1, a company began selling a product under a 2-year warranty. The estimated warranty costs are 3% of sales in the year of sale and 5% in the following year. Sales and actual warranty payments for Year 1 and Year 2 are as follows:

	Sales	Warranty Payments
Year 1	\$300,000	\$ 5,000
Year 2	500,000	37,000

In Year 1, warranty expense of \$24,000 [$\$300,000 \times (3\% + 5\%)$] is recognized. The warranty liability of \$19,000 ($\$24,000 - \$5,000$) is reported on the December 31, Year 1, balance sheet.

In Year 2, warranty expense of \$40,000 [$\$500,000 \times (3\% + 5\%)$] is recognized. The warranty liability of \$22,000 is reported on the December 31, Year 2, balance sheet.

Beginning warranty liability (1/1/Year 2)	\$19,000
Warranty expense recognized in Year 2	40,000
Warranty payments in Year 2	(37,000)
Ending warranty liability (12/31/Year 2)	<u>\$22,000</u>

Service-Type Warranties

A service-type warranty is a **separate performance obligation in a contract**. A portion of the total transaction price is allocated to the service-type warranty.

- The total transaction price is allocated to the service-type warranty and the related product sold based on their estimated standalone selling prices.
- At contract inception, the consideration received for the service-type warranty is accounted for as an advance payment, and a contract liability is recognized.
- Revenue from a service-type warranty is recognized **over time** (i.e., over the coverage period). The pattern of revenue recognized from a service-type warranty depends on the way the warranty performance obligation is satisfied.
 - If warranty service is provided continuously over the warranty period, revenue is recognized on the **straight-line basis** over the coverage period.
 - If warranty service costs are **not** incurred on a straight-line basis, revenue recognition over the contract's term is proportionate to the estimated service costs.
- Warranty expense is recorded when the entity pays a claim under the warranty.

If an assurance-type warranty and a service-type warranty **cannot** be separated, they are accounted for as a single performance obligation (as a service-type warranty).

4.2 Leases

A lease is a long-term contract in which the owner of property (the lessor) allows another party (the lessee) to use the property for a stated period in exchange for a stated payment.

The primary issue is whether the lease agreement transfers substantially all the benefits and risks of ownership of the asset to the lessee.

Lease Classification Test

A lease is classified as a **finance lease by the lessee** at lease commencement if **at least one** of the following **five criteria** is met:

1. The lease **transfers ownership** of the leased asset to the lessee by the end of the lease term.
2. The lease includes an **option to purchase** (commonly referred to as a bargain purchase option) the leased asset that the lessee is reasonably certain to exercise.
3. The lease term is for the major part of the remaining **economic life** of the leased asset.
 - A lease term of **75%** or more of the remaining economic life of the leased asset generally is considered to be a major part of its remaining economic life.
 - This criterion is inapplicable if the beginning of the lease term is at or near the end of the economic life of the leased asset. This period generally is considered to be the last 25% of the leased asset's total economic life.
4. The present value of the sum of (a) the **lease payments** and (b) any **residual value guaranteed by the lessee** equals or exceeds substantially all of the **fair value** of the leased asset.
 - A present value of **90%** or more of the fair value of the leased asset generally is considered to be substantially all of its fair value.
5. The leased asset is so specialized that it is expected to have **no alternative use** to the lessor at the end of the lease term.

When none of the five classification criteria described above are met, the lease is classified as an **operating lease by the lessee**.



IFRS Difference

IFRS differences related to lease classification are detailed in Appendix B.

Lessee Accounting -- Initial Measurement

For **finance and operating leases**, a **lessee** must recognize a **lease liability** and a **right-of-use asset** at the lease commencement date.

- Finance and operating leases result in the **same accounting** for
 - Initial recognition and measurement of the lease liability
 - Initial recognition and measurement of the right-of-use asset
 - Subsequent measurement of the lease liability
 - ▶ The transaction analysis for finance and operating leases differs, but the ending balance is the same for the lease liability under both types of leases.
 - The accounting for subsequent measurement of a right-of-use asset differs under finance and operating leases.
-

Lease Liability

At the lease commencement date, a **lease liability** is measured at the **present value of the lease payments** to be made over the lease term.

- The lease payments used to calculate the lease liability depend on the specific terms of each lease contract.
 - If the lease includes a purchase option that the lessee is reasonably certain to exercise, the lease payments consist of the following:
 - ▶ Rental payments
 - ▶ Exercise price of the purchase option
 - If no purchase option exists, the lease payments may have the following three components:
 - ▶ Rental payments
 - ▶ Any penalties for terminating the lease (nonrenewal penalties)
 - ▶ Amounts probable of being owed by the lessee under residual value guarantees

Right-of-Use (ROU) Asset

At the lease commencement date, a right-of-use asset is measured at the amount at which the lease liability was recognized plus initial direct costs incurred by the lessee.

- When no initial direct costs were incurred by the lessee, a **right-of-use asset equals the lease liability** recognized.
- Subsequent to initial recognition, the right-of-use asset is reported in the balance sheet at cost minus accumulated amortization and any impairment losses.

Example 4-2 Finance Lease -- Initial Measurement

On January 1, Year 1, Cottle, Inc., entered into a 3-year lease of a machine from Crimson, LLC. Cottle must pay Crimson three annual payments of \$100,000 starting on December 31, Year 1. The machine's useful life from the lease commencement date is 5 years. The lease allows Cottle the option to purchase the machine at the end of the lease term for \$15,000. Cottle is reasonably certain to exercise this purchase option. Cottle's incremental borrowing rate is 15%, but the rate implicit in the lease is 10%, which is known to Cottle.

- The present value factor for an ordinary annuity at 10% for 3 periods is 2.48685, and the present value of \$1 at 10% for 3 periods is 0.7513.
- The present value factor for an ordinary annuity at 15% for 3 periods is 2.28323, and the present value of \$1 at 15% for 3 periods is 0.65752.

The lease is a **finance lease** because it meets the lease classification criterion of including a purchase option that the lessee is reasonably certain to exercise. The rate implicit in the lease of 10% is used to calculate the present value of the lease payments because Cottle knows this rate.

PV of rental payments (\$100,000 × 2.48685)	\$248,685
PV of purchase option (\$15,000 × 0.7513)	11,270
PV of lease payments	\$259,955

Assets	=	Liabilities	+	Stockholders' Equity
ROU asset \$259,955 ↑		Lease liability \$259,955 ↑		

Example 4-3 Operating Lease -- Initial Measurement

Using the scenario in Example 4-2, assume that (1) Cottle concludes that the contract is an **operating lease**, (2) the lease does not include a purchase option, (3) the rental payments are \$100,000 at the end of Years 1 and 2 and \$160,000 at the end of Year 3, and (4) the rate implicit in the lease is not known to Cottle.

Because Cottle does not know the rate implicit in the lease, it uses its **incremental borrowing rate** of 15% to calculate the present value of lease payments.

The PV of the rental payments is \$267,774 [(\$100,000 × 2.28323) + (\$60,000 × 0.65752)].

Assets	=	Liabilities	+	Stockholders' Equity
ROU asset \$267,774 ↑		Lease liability \$267,774 ↑		

**Author's Note**

Candidates are not required to calculate the present value of lease payments in Part 1 of the CMA exam.

Lessee Accounting for Finance Leases -- Subsequent Measurement

Lease Payment

Each periodic lease payment made by the lessee has two components: **interest expense** and the **reduction of the lease liability**.

- If the first periodic lease payment is made at the **commencement date** of the lease, its only component is the reduction of the lease liability. No interest expense is recognized for the first payment because no time has elapsed between the lease commencement date and the payment.
- **Interest expense** is calculated using the effective interest method (also known as the effective-rate method or the interest method). It is calculated as the carrying amount of the lease liability at the beginning of the period times the discount rate of the lease.

$$\text{Interest expense} = \text{Lease liability at the beginning of the period} \times \text{Discount rate}$$

- The **reduction of the lease liability** is the excess of the periodic lease payment over the interest expense recognized during the period.

$$\text{Reduction of lease liability} = \text{Periodic lease payment} - \text{Interest expense}$$

Example 4-4 Finance Lease -- Lease Payment

Assume the required lease payment is \$50,000. If the calculated interest expense is \$10,000, then the remaining portion of the lease payment is a reduction to the lease liability.

Assets	=	Liabilities	+	Stockholders' Equity
Cash \$50,000 ↓		Lease liability \$40,000 ↓		Interest expense \$10,000 ↓

**Author's Note**

Candidates are not required to calculate interest expense using the effective interest rate method for lease accounting.

Amortization of a Right-of-Use Asset

A lessee amortizes the right-of-use asset on a **straight-line basis**.

- The right-of-use asset is amortized over the shorter of (1) its **useful life** or (2) the **lease term**.
 - However, if, at the end of the lease term, (1) the ownership of the leased asset is transferred to the lessee, or (2) the lessee is reasonably certain to exercise the purchase option, the amortization period is the **useful life of the leased asset**.

Lease Classification Criterion Satisfied	Amortization Period of the ROU Asset
Criterion 1 - Transfer of ownership	Useful life of the leased asset
Criterion 2 - Exercise of purchase option	Useful life of the leased asset
Criterion 3 - Major part of the remaining economic life	Shorter of ROU asset's useful life or lease term
Criterion 4 - Substantially all of the fair value	Shorter of ROU asset's useful life or lease term
Criterion 5 - No alternative use to the lessor	Shorter of ROU asset's useful life or lease term

The following is the entry to record the amortization of the right-of-use asset:

Assets	=	Liabilities	+	Stockholders' Equity
ROU asset ↓				Amortization expense ↓

Lessee Accounting for Operating Leases -- Subsequent Measurement

As noted previously, accounting for finance leases and operating leases is **the same** for

- Initial recognition and measurement of the lease liability and the right-of-use asset
- Subsequent measurement of the lease liability
 - The transaction for the lease payment and reduction in the lease liability is different than the finance lease transaction. However, the ending liability is the same.

The following are the **differences** in accounting for finance and operating leases:

- Subsequent accounting for (amortization of) the right-of-use asset
- Income statement presentation of interest expense and amortization of the right-of-use asset
- Statement of cash flow classification of cash lease payments

Lease Payments

A **single (equal) lease expense** is recognized in each period. It is calculated so that the total undiscounted lease payments are allocated over the lease term on a **straight-line basis**.

Single periodic lease expense = Total undiscounted lease payments (\$) \div **Lease term (years)**

- Initial direct costs incurred by the lessee are included in the total undiscounted lease payments. They are recognized in the single periodic lease expense on a straight-line basis over the lease term.
- The single periodic lease expense has two components:
 - Interest expense on the lease liability
 - Amortization of the right-of-use asset



Figure 4-1

- In the **income statement**, a single amount for the total lease expense for the period is reported in income from continuing operations.
 - Interest expense for the lease liability and amortization expense for the right-of-use asset are **not reported separately**.

Example 4-5 Operating Lease -- Subsequent Measurement

Using the same data as Example 4-4, the required lease payment is \$50,000 and the related interest expense is \$10,000. For an operating lease, the difference between the lease payment and the interest expense is the reduction in the lease liability and the amortization of the ROU asset. The recorded lease expense includes both the interest (\$10,000) and the amortization expense (\$40,000).

Assets	=	Liabilities	+	Stockholders' Equity
Cash \$50,000 ↓ ROU asset \$40,000 ↓	=	Lease liability \$40,000 ↓	+	Lease expense \$50,000 ↓

Financial Statement Presentation Summary

Balance Sheet Presentation

Finance leases and operating leases report the lease liability.

- The lease liability is allocated between current and noncurrent portions. The current portion at a balance sheet date is the reduction of the lease liability in the upcoming year.

Finance lease liabilities and operating lease liabilities must not be presented together in the same line item.

- They are presented in the balance sheet or disclosed in the notes, separately from each other and separately from other liabilities.

Finance lease right-of-use assets and operating lease right-of-use assets must not be presented together in the same line item.

- They are presented in the balance sheet or disclosed in the notes, separately from each other and separately from other assets.

Type of Lease	Income Statement	Statement of Cash Flows
Finance	Interest expense Amortization expense	Principal portion of lease payment is financial cash outflow Interest portion of lease payment is operating cash flow
Operating	Lease expense	Lease payment is operating cash outflow

Short-Term Lease

A short-term lease is a lease that, at the commencement date, has a lease term of **12 months or less** and does not include a purchase option that the lessee is reasonably certain to exercise.

- As an accounting policy for **short-term leases**, a **lessee** may elect **not** to recognize the **right-of-use asset** and **lease liability**.
- Under this short-term lease exception, the lessee recognizes lease payments as rent expense on the straight-line basis over the full lease term.
- A short-term lease is a form of off-balance-sheet financing. The lessee has the right to use the leased asset, but neither the asset nor a liability for future lease payments is recorded in its financial statements.
 - Lessees may prefer to account for a lease as a short-term lease instead of as a finance lease to avoid recognition in the financial statements of
 - ▶ A liability for future lease payments,
 - ▶ Interest expense, and
 - ▶ Depreciation of the leased asset.

Payments for **short-term leases** are cash outflows from **operating activities**.

4.3 Income Taxes

The objectives of accounting for income taxes are to recognize

- The amount of taxes currently payable or refundable
- Deferred tax liabilities and assets for the future tax consequences of events that have been recognized in the financial statements or tax returns

To achieve these objectives, an entity uses the asset-and-liability approach to account for income taxes currently payable or deductible and deferred taxes.

Basic Definitions

Income tax expense or benefit is the sum of (1) current tax expense or benefit and (2) deferred tax expense or benefit.

Current tax expense or benefit is the amount of taxes paid or payable (or refundable) for the year as determined by applying the enacted tax law to the taxable income or excess of deductions over revenues for that year.

- This amount is the **income tax payable** for the period.
- The approach is sometimes called income-tax-basis accounting, which is an other comprehensive basis of accounting (not GAAP). Nontaxable revenues and nondeductible expenses are included in the income statement.

Taxable income is the income calculated under the tax code. Taxable income equals pretax accounting income adjusted for permanent and temporary tax differences.

Deferred tax expense or benefit is the net change during the year in an entity's deferred tax amounts.

A **deferred tax liability (or asset)** records the deferred tax consequences of taxable (or deductible) temporary differences.

- A deferred tax liability or asset is recognized for the estimated future tax effects of temporary differences and carryforwards.
- A deferred tax amount is measured using the enacted tax rate(s) expected to apply when the liability or asset is expected to be settled or realized.

Intraperiod Tax Allocation

Intraperiod tax allocation **is required**. Income tax expense (benefit) is allocated to

- Continuing operations
- Discontinued operations
- Other comprehensive income
- Items debited or credited directly to equity

Intraperiod tax allocation is needed because items included in determining taxable income may be presented in different sections of the income statement. A tax or tax benefit should be shown in the same section as the related income or expense.

Interperiod Tax Allocation

Amounts in the entity's income tax return for a year include the tax consequences of most items recognized in the financial statements for the same year. Significant exceptions may exist because of differences between the GAAP-basis of accounting and the income-tax-basis of calculating taxable income.

Temporary differences result when the GAAP basis and the tax basis of an asset or liability differ. Differences in the two bases arise when items of income and expense are recognized in different periods under GAAP and under the tax code. The effect is that a taxable or deductible amount will occur in future years when the asset is recovered or the liability is settled.

- Tax consequences of some items may be recognized in **tax returns** for a year different from that in which their **financial-statement effects** are recognized. The following are examples:
 - Different depreciation methods may be used for tax purposes and in the financial statements.
 - ▶ Accelerated depreciation is allowed for tax purposes for certain assets, but they may be depreciated using the straight-line method in the financial statements.
 - Expenses for warranty liability are recognized in the financial statements on the date of the sale under the accrual method of accounting.
 - ▶ For tax purposes, warranty expenses are recognized under the cash basis when actual payments of warranty costs are made.
 - Credit loss expense is recognized in the financial statements under the allowance method in accordance with the income-statement or balance-sheet approach.
 - ▶ For tax purposes, credit loss expense is recognized when the debts are determined to be uncollectible using the direct write-off method or a special allowance method subject to reasonableness limitations.

A **permanent difference** is an event that is recognized either in pretax financial income or in taxable income **but never in both**.

- It does not result in a deferred tax amount.
- The following are examples:
 - Payments of fines or penalties are recognized as an expense in the financial statements but are never deducted in the tax return.
 - Interest on state or municipal bonds is recognized as income in the financial statements but not in taxable income for tax purposes.

When tax consequences and financial-statement effects differ, income taxes currently payable or refundable also may differ from income tax expense or benefit. The accounting for these differences is **interperiod tax allocation**.

Deferred Taxes

Deferred tax liabilities and assets result from temporary differences, not permanent differences.

Deferred Tax Liabilities

Taxable temporary differences result in future taxable amounts and deferred tax liabilities (DTL).



Figure 4-2

- DTLs arise when **revenues or gains** are recognized under GAAP before they are included in taxable income.
 - An example is income recognized under the equity method for financial statement purposes and at the time of distribution in taxable income.
- DTLs also result when **expenses or losses** are deductible for tax purposes before they are recognized under GAAP.
 - An example is accelerated tax depreciation of property.

$$\text{DTL} = \text{Future taxable amount} \times \text{Tax rate}$$

Deferred Tax Assets

Deductible temporary differences result in future deductible amounts and deferred tax assets (DTA).



Figure 4-3

- DTAs result when **revenues or gains** are included in taxable income before they are recognized under GAAP.
 - Examples are unearned revenues such as rent and subscriptions received in advance. Rent or subscriptions received in advance are taxable when received but are only reported for accounting purposes when the revenue has been earned.
- DTAs also result when **expenses or losses** are recognized under GAAP before they are deductible for tax purposes.
 - Examples are credit loss expense recognized under the allowance method and warranty costs.

$$\text{DTA} = \text{Future deductible amount} \times \text{Tax rate}$$

Calculating Tax Expense or Benefit

Income tax expense or benefit reported on the income statement is the sum of the current component and the deferred component.

- **Current tax expense or benefit** is the amount of taxes paid or payable (or refundable) for the year based on the enacted tax law.

$$\text{Current tax expense or benefit} = \frac{\text{Taxable income}}{\text{(or excess of deductions over revenue)}} \times \text{Tax rate}$$

- **Deferred tax expense or benefit** is the net change during the year in an entity's deferred tax amounts.

$$\text{Changes in DTL balances} \pm \text{Changes in DTA balances}$$

Example 4-6 Calculating Tax Expense or Benefit

Lucas Company had the following deferred tax balances for the year just ended. The deferred tax asset is fully realizable. The company's taxable income was \$1,000,000 for the year. The enacted tax rate is 40%.

	Beginning Balance	Ending Balance
Deferred tax asset	\$ 9,000	\$17,000
Deferred tax liability	13,000	23,000

Lucas calculates income tax expense for the year as follows:

- Current tax expense is \$400,000 ($\$1,000,000 \times 40\%$).
- Deferred tax expense is the net change in the deferred tax liability and asset balances for the year. The DTL balance increased by \$10,000 ($\$23,000 - \$13,000$), and the DTA balance increased by \$8,000 ($\$17,000 - \$9,000$). Thus, the net DTL increase is \$2,000 ($\$10,000 - \$8,000$).

Lucas records the following entry:

Assets	=	Liabilities	+	Stockholders' Equity
Deferred tax asset \$8,000 ↑		Income tax payable \$400,000 ↑ Deferred tax liability \$10,000 ↑		Income tax exp. -- current \$400,000 ↓ Income tax exp. -- deferred \$2,000 ↓

4.4 Accounting for Bonds Payable

Nature of Bonds

A bond is a formal contract to pay an amount of money (face amount) at the maturity date plus interest at the stated rate at specific intervals.

Example 4-7 Nature of Bonds

At the beginning of the year, a company issues 200 8%, 5-year, \$5,000 bonds. Annual cash interest payments will be made at the end of each year. The total face amount of bonds issued is \$1,000,000 (200 bonds \times \$5,000 face amount), and the annual interest payment is \$80,000 (\$1,000,000 face amount \times 8% stated rate).

The proceeds received from the investors on the day the bonds are sold equal the present value of the sum of the future cash flows expected to be received from the bonds, calculated as follows:

Present value of the face amount + Present value of the annuity of interest payments



Author's Note

Calculating a bond's issue price is tested on Part 2 of the CMA exam. In Part 1, candidates need to know how to record bonds and their impact on the financial statements.

The bonds are recognized in the financial statements as the amount of proceeds paid for them, i.e., the face amount of the bonds plus any premium or minus any discount. They are recorded as a debt in the issuer's financial statements and as an investment in the investors' financial statements.

Bond Issuance

The cash proceeds from the sale of bonds can be equal to, less than, or greater than the face amount of the bonds depending on the relationship of the bonds' stated rate of interest to the market rate of interest on the date the bonds are sold.

Rate Relationship	Comparison of Cash Proceeds to Face Amount	Bonds Are Issued at . . .
Stated rate = Market rate	Cash proceeds = Face amount	Par
Stated rate > Market rate	Cash proceeds > Face amount	Premium
Stated rate < Market rate	Cash proceeds < Face amount	Discount

Amortization of Premium or Discount

Bond premium or discount must be amortized over the life of the bonds using the **effective-interest method** (the market interest rate on the date the bond was sold). Under this method, interest expense changes every period and equals the following:

$$\text{Annual interest expense} = \frac{\text{Carrying amount of the bond at the beginning of the period}}{\times \text{Effective interest rate}}$$

The carrying amount of bonds presented in the financial statements equals the face amount plus the premium (or minus the discount).

Example 4-8 Amortization of Premium and Discount

Using the data from Example 4-7:

- Assume the market interest rate was 6% and the bonds were issued at \$1,083,960. The premium is \$83,960 (\$1,083,960 – \$1,000,000). The related interest expense and amortization for the first 2 years is as follows:

Year	A			B			A – B	
	Beginning Carrying Amount of Bonds	Rate	Interest Expense	Cash Interest Paid	Premium Amortized	Remaining Premium	Ending Carrying Amount of Bonds	
1	\$1,083,960	× 6%	= \$65,038	– \$80,000	= \$14,962	\$68,998	\$1,068,998	
2	1,068,998	× 6%	= 64,140	– 80,000	= 15,860	53,138	1,053,138	

- Assume the market interest rate was 10% and the bonds were issued at \$924,280. The discount is \$75,720 (\$1,000,000 – \$924,280). The related interest expense and amortization for the first 2 years is as follows:

Year	A			B			A + B	
	Beginning Carrying Amount of Bonds	Rate	Interest Expense	Cash Interest Paid	Discount Amortized	Remaining Discount	Ending Carrying Amount of Bonds	
1	\$924,280	× 10%	= \$92,428	– \$80,000	= \$12,428	\$63,292	\$936,708	
2	936,708	× 10%	= 93,671	– 80,000	= 13,671	49,621	950,379	

- At the maturity date, the discount or premium is fully amortized, and the carrying amount of the bonds equals the face amount.

Study Unit Five

Revenue and Impairment Recognition

5.1	<i>Revenue from Contracts with Customers</i>	2
5.2	<i>Recognition of Revenue over Time</i>	6
5.3	<i>Impairment and Disposal of Long-Lived Assets</i>	11

This study unit is the **fifth of six** on **external financial reporting decisions**. The relative weight assigned to this major topic in Part 1 of the exam is **15%**. The six study units are

- Study Unit 1: External Financial Statements
- Study Unit 2: Measurement, Valuation, and Disclosure: Assets -- Short-Term Items
- Study Unit 3: Measurement, Valuation, and Disclosure: Assets -- Long-Term Items
- Study Unit 4: Measurement, Valuation, and Disclosure: Liabilities
- **Study Unit 5: Revenue and Impairment Recognition**
- Study Unit 6: Integrated Reporting

This study unit discusses revenue and impairment recognition. Topics covered in this study unit include

- The five-step model for revenue recognition for contracts with customers
- Revenue recognition principles for various types of transactions
- Accounting for impairment for long-term assets and intangible assets, including goodwill
- Gains and losses on the sale of fixed assets, including
 - Calculating the dollar amount of a gain or loss
 - Understanding the financial statement presentation

5.1 Revenue from Contracts with Customers

The Five-Step Model

The **core principle** is that an entity recognizes revenue for the transfer of promised goods or services to customers in an amount that reflects the consideration to which the entity expects to be entitled in the exchange.

Below is the **five-step model** for recognizing revenue from contracts with customers.

Step 1:	Identify the contract(s) with a customer.
Step 2:	Identify the performance obligations in the contract.
Step 3:	Determine the transaction price.
Step 4:	Allocate the transaction price to the performance obligations in the contract.
Step 5:	Recognize revenue when (or as) a performance obligation is satisfied.

Step 1: Identify the Contract with a Customer

A contract is an agreement between two or more parties that creates enforceable rights and obligations.

Revenue is recognized for a contract with a customer if **all** of the following criteria are met:

- The contract was approved by the parties.
- The contract has commercial substance.
- Each party's rights regarding (1) goods or services to be transferred and (2) the payment terms can be identified.
- It is probable that the entity will collect substantially all of the consideration to which it is entitled according to the contract.
 - **Probable** means that the future event is likely to occur.

If the criteria described on the previous page are not met (e.g., if collectibility cannot be reliably estimated), the consideration received is recognized as a liability, and **no revenue is recognized** until the criteria are met.

- However, even when the criteria are not met, revenue in the amount of **nonrefundable consideration** received from the customer is recognized if at least one of the following has occurred:
 - The contract has been terminated.
 - Control over the goods or services was transferred to the customer and the entity has stopped transferring (and has no obligation to transfer) additional goods or services to the customer.
 - The entity (1) has no obligation to transfer goods or services and (2) has received substantially all consideration from the customer.

A **contract modification** exists when the parties approve a change in the scope or price of a contract.

- It is accounted for as a **separate contract** if the following conditions are met:
 - The scope of the contract increases because of the addition of promised goods or services that are distinct, and
 - The price of the contract increases by a consideration amount that reflects the entity's standalone selling prices of the additional promised goods or services.

Step 2: Identify the Performance Obligations in the Contract

A **performance obligation** is a promise in a contract with a customer to transfer to the customer

- A good or service that is distinct or
- A series of distinct goods or services that are substantially the same and have the same pattern of transfer to the customer.

Promised goods or services are **distinct** if

- The customer can benefit from them either on their own or together with other resources that are readily available (**capable of being distinct**), and
- The entity's promise to transfer them to the customer is separately identifiable from other promises in the contract (**distinct within the context of the contract**).
 - A **separately identifiable good or service**
 - ▶ Does not significantly modify or customize another good or service promised in the contract
 - ▶ Is not highly dependent on, or highly interrelated with, other goods or services promised in the contract

Step 3: Determine the Transaction Price

The **transaction price** is the amount of consideration to which an entity expects to be entitled in exchange for transferring promised goods or services to a customer.

- It excludes amounts collected on behalf of third parties (e.g., sales taxes).
- Any consideration payable to the customer, such as coupons, credits, or vouchers, reduces the transaction price.
- To determine the transaction price, an entity should consider the effects of the **time value of money** and **variable consideration**.

The revenue recognized must reflect the price that a customer would have paid for the promised goods or services if the cash payment had been made when they were transferred to the customer (i.e., the cash selling price).

- The transaction price is adjusted for the effect of the time value of money when the contract includes a **significant financing component**.
 - Interest income or expense is recognized using the **effective interest method**. It must be presented in the income statement **separately** from revenue from contracts with customers.

Step 4: Allocate the Transaction Price to the Performance Obligations in the Contract

After separate performance obligations are identified and the total transaction price is determined, the transaction price is allocated to performance obligations on the basis of relative standalone selling prices.

A **standalone selling price** is the price at which an entity would sell a promised good or service separately to a customer.

- The best evidence of a standalone selling price is the **observable price** of a good or service when it is sold
 - Separately,
 - In similar circumstances, and
 - To similar customers (e.g., the list price of a good or service).

Step 5: Recognize Revenue when (or as) a Performance Obligation Is Satisfied

An entity recognizes revenue when (or as) it satisfies a performance obligation by transferring a promised good or service (an asset) to a **customer**. An **asset** is transferred when (or as) the customer obtains control of that asset.

Control of an asset is transferred when the customer

- Has the ability to direct the use of the asset and
- Obtains substantially all of the remaining benefits (potential cash flows) from the asset.

A performance obligation can be satisfied either over time or at a point in time.

- Recognizing revenue **over time** requires transfer of the control of goods or services to a customer over time and therefore satisfaction of a performance obligation over time. **One** of the following criteria must be met:
 - The customer **simultaneously** receives and consumes the benefits provided by the entity's performance as the entity performs.
 - ▶ For example, cleaning services are provided to a customer's offices every day throughout the accounting period.
 - The entity's performance **creates or enhances an asset** that the customer controls as the asset is created or enhanced.
 - ▶ For example, a construction company erects a building on the customer's land.
 - The asset created has **no alternative use** to the entity, and the entity has an enforceable **right** to payment for the performance completed to date.
 - ▶ For example, an aerospace company contracts to build a satellite designed for the unique needs of a specific customer.
- The accounting for contracts in which revenue is recognized over time is described in Subunit 5.2.
- If a performance obligation is **not satisfied over time**, an entity satisfies the performance obligation **at a point in time**.
 - Revenue is recognized at a point in time when the customer obtains **control** over the promised asset. The following indicators of the transfer of control should be considered:
 - ▶ The entity has a present right to payment for the asset.
 - ▶ The customer has legal title to the asset.
 - ▶ The entity has transferred physical possession of the asset.
 - ▶ The customer has the significant risks and rewards of ownership of the asset.
 - ▶ The customer has accepted the asset.

Balance Sheet Presentation

A **contract liability** is recognized for an entity's obligation to transfer goods or services to a customer for which the entity has received consideration from the customer. Deposits and other advance payments by the customer, such as sales of gift certificates, are recognized as contract liabilities.

A **contract asset** is recognized for an entity's right to consideration in exchange for goods or services that the entity has transferred to a customer.

- However, the entity must have an **unconditional** right to the consideration to recognize a **receivable**.
- A right to consideration is unconditional if only the passage of time is required before payment of that consideration is due.

Contract assets and contract liabilities resulting from different contracts must not be presented net in the statement of financial position.

5.2 Recognition of Revenue over Time

For each performance obligation satisfied over time, an entity must recognize revenue over time. For this purpose, the entity measures the **progress toward complete satisfaction** using the **output method** or the **input method**.

- To determine the appropriate method, an entity must consider the nature of the good or service that it promised to transfer to the customer.
- The chosen method should describe the entity's performance in transferring control of the promised asset to the customer.
- At the end of each reporting period, the progress toward complete satisfaction of the performance obligation must be **remeasured** and updated for any changes in the outcome of the performance obligation.
 - Such changes must be accounted for prospectively as a **change in accounting estimate**.

Input Method

The input method recognizes revenue on the basis of (1) the entity's inputs to the satisfaction of the performance obligation relative to (2) the total expected inputs to the satisfaction of that performance obligation.

Examples of input include

- Costs incurred
- Labor hours expended
- Resources consumed
- Time elapsed
- Machine hours used

Cost-to-Cost Method

In long-term construction contracts, **costs incurred relative to total estimated costs** often are used to measure the progress toward completion. This method is the **cost-to-cost** method (formerly known as the percentage-of-completion method).

- Only costs that contribute to progress in satisfying the performance obligation are used in the cost-to-cost method. The following costs must not be included in measuring the progress:
 - Costs incurred that relate to significant inefficiencies in the entity's performance (e.g., abnormal amounts of wasted materials or labor) that were not chargeable to the customer under the contract
 - General and administrative costs not directly related to the contract
 - Selling and marketing costs

When an entity's inputs are incurred evenly over time, recognition of revenue on a straight-line basis may be appropriate.

Example 5-1 Cost-to-Cost Method

On January 1, Year 1, a contractor agrees to build on the customer's land a bridge that is expected to be completed at the end of Year 3. The promised bridge is a single performance obligation to be satisfied over time. The contractor determines that the progress toward completion of the bridge is reasonably measurable using the input method based on costs incurred. The contract price is \$2,000,000, and expected total costs of the project are \$1,200,000.

	Year 1	Year 2	Year 3
Costs incurred during each year	\$300,000	\$600,000	\$550,000
Costs expected in the future	900,000	600,000	

-- Continued on next page --

Example 5-1 -- Continued**Year 1**

By the end of Year 1, 25% [$\$300,000 \div (\$300,000 + \$900,000)$] of the total expected costs have been incurred. Using the input method based on costs incurred, the contractor recognizes 25% of the total expected revenue ($\$2,000,000$ contract price \times 25% = $\$500,000$) and cost of goods sold ($\$1,200,000 \times 25\% = \$300,000$). The difference between these amounts is the gross profit for Year 1.

Revenue	\$500,000
Cost of goods sold	(300,000)
Gross profit -- Year 1	<u>\$200,000*</u>

* The gross profit in Year 1 of \$200,000 also may be calculated as total expected gross profit from the project of \$800,000 ($\$2,000,000 - \$1,200,000$) times the progress toward completion of the contract of 25%.

Year 2

By the end of Year 2, total costs incurred are \$900,000 ($\$300,000 + \$600,000$). Given that \$600,000 is expected to be incurred in the future, the total expected cost is \$1,500,000 ($\$900,000 + \$600,000$). The change in the total cost of the contract must be accounted for prospectively. By the end of Year 2, 60% ($\$900,000 \div \$1,500,000$) of expected costs have been incurred. Thus, \$1,200,000 ($\$2,000,000 \times 60\%$) of cumulative revenue and \$900,000 ($\$1,500,000 \times 60\%$) of cumulative cost of goods sold should be recognized for Years 1 and 2. Because \$500,000 of revenue and \$300,000 of cost of goods sold were recognized in Year 1, revenue of \$700,000 ($\$1,200,000$ cumulative revenue – \$500,000) and cost of goods sold of \$600,000 ($\$900,000$ cumulative cost of goods sold – \$300,000) are recognized in Year 2.

Revenue	\$700,000
Cost of goods sold	(600,000)
Gross profit -- Year 2	<u>\$100,000*</u>

* The gross profit in Year 2 of \$100,000 also may be calculated as the cumulative gross profit for Years 1 and 2 of \$300,000 [$(\$2,000,000 - \$1,500,000) \times 60\%$] minus the gross profit recognized in Year 1 of \$200,000.

Year 3

At the end of Year 3, the project is completed, and the total costs incurred for the contract are \$1,450,000 ($\$300,000 + \$600,000 + \$550,000$). Given \$1,200,000 of cumulative revenue and \$900,000 of cumulative cost of goods sold for Years 1 and 2, \$800,000 ($\$2,000,000$ contract price – \$1,200,000) of revenue and \$550,000 ($\$1,450,000$ total costs – \$900,000) of cost of goods sold are recognized in Year 3.

Revenue	\$800,000
Cost of goods sold	(550,000)
Gross profit -- Year 3	<u>\$250,000</u>

NOTE: (1) The total gross profit from the project of \$550,000 ($\$200,000 + \$100,000 + \$250,000$) equals the contract price of \$2,000,000 minus the total costs incurred of \$1,450,000. (2) When progress toward completion is measured using the cost-to-cost method, as in the example above, the cost of goods sold recognized for the period equals the costs incurred during that period.

Output Method

The output method recognizes revenue based on direct measurement of (1) the value of goods or services transferred to the customer to date relative to (2) the remaining goods or services promised under the contract.

- Revenue might not be recognized until all performance obligations are satisfied by transfer of control of the goods or services to the buyer. The effect then is that revenue is recognized at a point in time, not over time. The result is the same as under what was formerly known as the completed-contract method.
- Examples of output methods include
 - Appraisals of results achieved
 - Milestones reached
 - Units produced
 - Units delivered
- An entity may have a right to consideration from a customer in an amount corresponding directly with the value to the customer of performance to date. Using a practical expedient, revenue may be recognized at the amounts to which the entity has a **right to invoice the customer**.

Example 5-2 Output Method -- Practical Expedient

A law firm enters into a contract to provide consulting services to a customer for a 1-year period for a fixed amount per hour of service provided. Because the customer simultaneously receives and consumes the benefits provided by the law firm's performance as it performs, revenue is recognized over time. Under the practical expedient, the law firm may recognize revenue that it has a right to bill to the customer.

An entity recognizes revenue for a performance obligation satisfied over time only if progress toward complete satisfaction of the performance obligation can be reasonably measured.

- Revenue can be recognized to the **extent of the cost incurred** (zero profit margin) when
 - An entity is not able to reasonably measure the outcome of a performance obligation or its progress toward satisfaction of that obligation, but
 - An entity expects to recover the costs incurred in satisfying the performance obligation.

Example 5-3 Revenue Recognition -- Extent of Costs

On January 1, Year 1, Sadik Co. agrees to build on the customer's land a bridge that is expected to be completed at the end of Year 3. The contract price is \$2 million. The promised bridge is a single performance obligation to be satisfied over time. Because Sadik has no experience with this type of contract, it cannot reasonably determine the total expected costs of the project. Accordingly, by the end of Year 1, progress toward completion of the bridge is not reasonably determinable. In Year 1, \$300,000 of costs were incurred and paid by Sadik. However, the contract specified that Sadik has an enforceable right to payment of the costs incurred. Sadik therefore expects to recover these costs.

In Year 1, revenue and cost of goods sold are recognized at the amount of costs incurred of \$300,000, and no gross profit is recognized. The following entries are recorded by Sadik in Year 1:

Assets	=	Liabilities	+	Stockholders' Equity
Accounts receivable \$300,000 ↑				Revenue \$300,000 ↑
Cash \$300,000 ↓				Cost of goods sold \$300,000 ↓

As soon as an **estimated loss** on any project becomes apparent, it must be recognized in full, regardless of the methods used.

5.3 Impairment and Disposal of Long-Lived Assets

Impairment Test for Fixed Assets and Intangible Assets with Finite Useful Lives

This two-step impairment test is applied to fixed assets and to intangible assets with finite useful lives.

Testing for impairment occurs when events or changes in circumstances indicate that the carrying amount of the asset may not be recoverable, for example, when

- The market price has decreased significantly or
- The use or physical condition of the asset has changed significantly and adversely.

The test for impairment is a **two-step test**:

1. **Recoverability test.** The carrying amount of a long-lived asset to be held and used is not recoverable if it exceeds the sum of the **undiscounted** future cash flows expected from the use and disposition of the asset.
2. If the carrying amount is not recoverable, an impairment loss is recognized. It equals the excess of the carrying amount of the asset over its fair value.
 - An impairment loss is recognized immediately in income from continuing operations.
 - The entry to recognize the impairment loss for a depreciable fixed asset is

Assets	=	Liabilities	+	Stockholders' Equity
Accumulated depreciation ↓				Impairment loss ↓

Determination of an Impairment Loss
1. Events or changes in circumstances indicate a possible loss
2. Carrying amount of an asset > Sum of undiscounted cash flows
3. Impairment loss = Carrying amount – Fair value

The carrying amount of a long-lived asset adjusted for an impairment loss is its new cost basis. A previously recognized impairment loss **must not be reversed**.

Example 5-4 Two-Step Impairment Test

On December 31, Year 2, a machine's carrying amount after the recognition of annual depreciation expense is \$160,000 (\$200,000 historical cost – \$40,000 accumulated depreciation). On that date, as a result of low demand for the company's products, management concludes that the carrying amount of the machine may not be recoverable. Management estimates that the undiscounted future cash flows over the remaining useful life of the machine will be \$150,000. On that date, the machine's estimated fair value is \$136,000.

The carrying amount of the machine exceeds the undiscounted future cash flows expected from the machine ($\$160,000 > \$150,000$). Thus, the carrying amount is deemed to not be recoverable, and the amount of impairment loss recognized is the excess of the machine's carrying amount over its fair value ($\$160,000 - \$136,000 = \$24,000$).

In the Year 2 income statement, **\$24,000** is recognized as an impairment loss.

The carrying amount of the machine as it is reported in the balance sheet on December 31, Year 2, is calculated as follows:

Historical (initial) cost	\$200,000
Accumulated depreciation	(40,000)
Impairment losses	(24,000)
Asset's carrying amount	<u>\$136,000</u>

Impairment Test for Intangible Assets with Indefinite Useful Lives

An intangible asset with an indefinite useful life (a **nonamortized** intangible asset, such as goodwill) must be reviewed for impairment at least annually. It is tested more often if events or changes in circumstances suggest that the asset may be impaired.

- An entity may elect to perform a **qualitative assessment** to determine whether a **quantitative impairment test** is needed. The entity also may directly perform the quantitative test.
- **Qualitative assessment.** After the assessment of qualitative factors, the entity may determine that it is more likely than not (probability > 50%) that an indefinite-lived intangible asset is not impaired.
 - ▶ In this case, the quantitative impairment test is not required.
 - ▶ If potential impairment is found, the quantitative impairment test must be performed.

- **Quantitative impairment test.** The carrying amount of an asset is compared with its fair value. If the carrying amount exceeds the fair value, the asset is impaired, and the excess is the recognized impairment loss.

Determination of an Impairment Loss
1. Review for impairment
2. Impairment loss = Carrying amount – Fair value

- This impairment loss is **nonreversible**, so the adjusted carrying amount is the new accounting basis.

Impairment -- Goodwill

Goodwill is tested for impairment at the reporting-unit level. All goodwill is assigned to the reporting units that will benefit from the business combination. It is tested for impairment each year at the same time.

- As in the case of an intangible asset with an indefinite useful life, an entity may elect to perform a **qualitative assessment** to determine whether the quantitative impairment test is needed.
- If the qualitative assessment indicates that **potential impairment exists**, the quantitative impairment test below is performed to determine whether goodwill is impaired.
 - **The fair value of the reporting unit is compared with its carrying amount, including goodwill.**
 - A goodwill impairment loss is recognized for the amount that the carrying amount of a reporting unit, including goodwill, exceeds its fair value. The loss is limited to the total amount of goodwill allocated to that reporting unit.
 - The goodwill impairment loss is recognized in the income statement and cannot be reversed in subsequent periods.



IFRS Difference

IFRS differences related to impairment tests and impairment losses are detailed in Appendix B.

Disposal of Long-Lived Assets

When an item of property, plant, and equipment (PPE) is sold, the gain or loss on disposal is the difference between the net proceeds and the carrying amount of the asset.

- Depreciation (if any) is recognized to the date of sale, the carrying amount is removed from the books, the proceeds are recorded, and any gain or loss is recognized.

Example 5-5 Disposal of a Long-Lived Asset

A company sold a machine with a carrying amount of \$100,000 (\$180,000 historical cost – \$80,000 accumulated depreciation) for \$135,000 in cash. The gain on disposal recognized is \$35,000 (\$135,000 – \$100,000). The transaction would be recorded as

Assets	=	Liabilities	+	Stockholders' Equity
Cash \$135,000 ↑				Gain on disposal \$35,000 ↑
Machine \$180,000 ↓				
Accumulated depreciation \$80,000 ↑				

If the machine were sold for \$90,000 in cash, the loss on disposal recognized would be \$10,000 (\$90,000 – \$100,000). The transaction would be recorded as

Assets	=	Liabilities	+	Stockholders' Equity
Cash \$90,000 ↑				Loss on disposal \$10,000 ↓
Machine \$180,000 ↓				
Accumulated depreciation \$80,000 ↑				

Study Unit Six

Integrated Reporting

6.1	<i>Integrated Reporting, Integrated Thinking, and the Integrated Report</i>	2
6.2	<i>Fundamental Concepts of Integrated Reporting</i>	4
6.3	<i>Guiding Principles and Content Elements of the Integrated Report</i>	9
6.4	<i>Adoption of Integrated Reporting</i>	13

This study unit is the **sixth of six** on **external financial reporting decisions**. The relative weight assigned to this major topic in Part 1 of the exam is **15%**. The six study units are

- Study Unit 1: External Financial Statements
- Study Unit 2: Measurement, Valuation, and Disclosure: Assets -- Short-Term Items
- Study Unit 3: Measurement, Valuation, and Disclosure: Assets -- Long-Term Items
- Study Unit 4: Measurement, Valuation, and Disclosure: Liabilities
- Study Unit 5: Revenue and Impairment Recognition
- **Study Unit 6: Integrated Reporting**

This study unit discusses the Integrated Reporting concepts tested on the CMA exam. Topics covered include

- Integrated thinking
- The integrated report
- Value creation
- The six capitals
- Adopting integrated reporting

6.1 Integrated Reporting, Integrated Thinking, and the Integrated Report

Background 6-1 Integrated Reporting

Traditionally, the main goal of corporate reporting was disclosure of the organization's financial information to increase transparency and accountability. However, organizations have come to own more intangible assets, from only 17% in 1975 to more than 80% currently. To represent this value accurately, organizations began to provide more nonfinancial information, often in the form of separate CSR reports. However, such information was usually scattered and incomplete and often lacked consistency and comparability.

Integrated reporting is a relatively new concept. It gained momentum with the creation of the International Integrated Reporting Council (IIRC) in 2010. This global entity, composed of regulators, organizations, accounting firms, and standards setters, issued the International <IR> (Integrated Reporting) Framework in 2013. This principles-based framework gives guidance to organizations preparing integrated reports. The objective is to bring together capital allocation and corporate activity to create financial well-being and sustainable expansion through the use of integrated thinking and integrated reporting.

Although the <IR> Framework primarily focuses on providers of financial capital in the private sector, its mission is for IR to become the worldwide corporate reporting standard for both private and public companies.

In 2021, the IIRC merged with the Sustainability Accounting Standards Board (SASB) to form the Value Reporting Foundation (VRF). The VRF also presented a renewed version of the <IR> Framework, although no major changes to the original concept took place. In 2022, the VRF was consolidated into the IFRS Foundation (The International Financial Reporting Standards Foundation), an important step toward aligning IR and nonfinancial reporting requirements with traditional financial reporting standards known under IFRS.

Integrated Reporting

As defined in the glossary of the <IR> Framework, integrated reporting is “a process founded on integrated thinking that results in a periodic integrated report by an organization about value creation over time and related communications regarding aspects of value creation.”

- This definition of IR requires an understanding of three major concepts:

Integrated thinking

Integrated report

Value creation

Through IR, an organization is able to explain how strategy, corporate governance, employee and management performance, and prospects lead to value creation over time.

- In the context of the entity's external environment, value is created using a combination of financial and nonfinancial information for decision making.
- IR enables an organization to share its story of value creation with a broader group of stakeholders beyond the traditional stakeholders (providers of financial capital).

The process to publish an integrated report is based on integrated thinking within the organization. It is important to note that integrated reporting is not a static concept but a process that continuously evolves and aims to improve reporting, internal decision making, and integrated thinking.

Integrated Thinking

Integrated thinking is a process of decision making, management, and reporting. It is based on the connectivity and interdependencies among the organization-specific factors that affect the organization's ability to create value over time.

Integrated thinking is a prerequisite to IR. Understanding the influences financial and nonfinancial factors have on each other is necessary to

- Report in an integrated manner about the performance of the organization and
- Make well-informed decisions for long-term value creation.

Through integrated thinking, an organization learns how the interdependencies among its financial and nonfinancial aspects interact and affect value creation. Thus, integrated thinking is the basis for the externally communicated integrated report.

Integrated thinking cannot be done in a stand-alone department. Different departments must work together to measure and report the organization's value creation for both itself and its environment.

Integrated Report

The product of IR and integrated thinking is the integrated report. In the context of the organization's external environment, an integrated report concisely communicates how strategy, governance, performance, and prospects lead to value creation over the short, medium, and long term.

The <IR> Framework provides guidance for organizations to prepare their integrated reports. This framework is principles-based.

An integrated report provides a holistic view of the organization for **all** relevant stakeholders.

An integrated report is **not** a mere combination of the annual report with a separate sustainability or corporate social responsibility report. It should be a designated, identifiable communication.

Purpose of the Integrated Report

The main goal of an organization's integrated report is to give providers of financial capital more information about how the entity creates, preserves, or erodes value over a period of time.

An integrated report also benefits other stakeholders who are interested in the entity's effectiveness in creating value, such as employees, customers, suppliers, communities in which the entity is located, and assorted regulators.

6.2 Fundamental Concepts of Integrated Reporting

The main purpose of IR is to show how an organization creates value over time. An entity's value-creation process is influenced by

- The external environment in which the organization operates
- Relationships with stakeholders
- Various resources (e.g., the six capitals defined on the next page)

These topics are addressed in the integrated report based on the three required fundamental concepts:



By focusing on the fundamental concepts defined by the <IR> Framework, an organization provides not only financial information but also context about its operations and goals over the short, medium, and long term.

Value Creation

When an organization sells a product, it creates value for itself (in the form of revenues) and indirectly for the customer (the form of which depends on the nature of the good or service sold). This process affects not only the financial aspect of the organization but also its reputation and its relationship with its stakeholders.

In selling products to customers, an organization is operating within a social environment, and the outcomes of these interactions (connectivity) affect the organization's **social license to operate**.

When the value created by the organization for itself or for others is **material**, it should be incorporated in the integrated report.

Externalities also need to be included in the integrated report. **Externalities** are the positive and/or negative effects on the capitals not owned by the organization itself.

The Six Capitals

Value creation depends on different sources, defined as the six capitals:



Figure 6-1

The six capitals are affected by the regular course of business; i.e., they are increased, decreased, or transformed by the activities and outputs of the organization. For example,

- By selling a product and making a profit, financial capital increases.
- By having a toxic substance leak in a plant, natural (environmental) capital decreases.
- By filing a patent on a new product, intellectual capital increases.

Not all capitals are equally important for a given organization. Also, sometimes one capital may need to decrease in order to make another capital increase.

- Value can be created over different capitals and is not necessarily measured in financial capital.
- Value creation in the sense of IR is not only seen as an increase of the overall stock of capitals, but also as preservation of this overall value.

Description and Interpretation of the Capitals

Financial capital is the available pool of funds.

- It is the liquid capital available through financing for production of goods or provision of services (e.g., equity, debt, investments, or operational activities).

Natural capital consists of the renewable and nonrenewable environmental resources and processes that provide goods or services that support the organization's prosperity.

- These include land, water, air, minerals, biodiversity, and ecosystems.

Manufactured capital consists of manufactured tangible objects.

- It is the physical capital (not natural capital) available for the production of goods or provision of services.
 - Examples include property, plant, and equipment and infrastructures, such as roads and ports.
- Manufactured capital is not about ownership but about availability of the tangible objects.
 - For example, the closure of a port a company relies on due to political irregularities decreases its manufactured capital, even though the port is not owned by the company itself.

Intellectual capital is the intangible knowledge of the organization. It includes intellectual property, e.g., software, patents, copyrights, and licenses, and organizational capital, e.g., systems, procedures, and protocols.

- Employees' competencies are not intellectual capital. They can be transferred to another organization.

Human capital refers to employees' competencies, abilities, and experience, including

- Training and development
- Ability and willingness to understand and implement the organization's strategy
- Loyalty to the organization and motivation for the job
- Support for governance, risk management, and ethics

Social and relationship capital is the relationship of the organization with the environment in which it operates. This includes

- Networks between and among the organization, stakeholders, institutions, communities, and shareholders
- Brand recognition and the external reputation of the organization
- Key stakeholders' willingness to share information, maintain the values and goals of the organization, and keep in touch with the organization
- The organization's social license to operate

Capitals in the Integrated Report

The capitals ensure that organizations at least think about all the different forms of capital affected by their operations. All six capitals need not be present in every integrated report. Some capitals may not be relevant for a particular organization. Capitals need not be identified by the same name in every integrated report.

- Organizations are allowed to show the change in value of the capitals by combining them or by using different names.
- An integrated report need not be structured using the six capitals.
- The capitals merely show how and through which vehicles value is created for the organization.

Examples of Organizations' Reporting Metrics for Types of Capital

Capital	Organization	Example of Metric in IR
Financial capital	Prudential Financial (Financial services, North America)	Return on equity
	General Electric (Technology, North America)	Cash from operating activities
Natural capital	Coca-Cola Hellenic Bottling Company (Food and beverages, Europe)	Water resources used
	PostNL (Postal company, Europe)	CO ₂ emissions per package delivered
Manufactured capital	Royal Bafokeng Platinum, Ltd. (Mining, Africa)	Mining infrastructure above and below ground
	Transnet (Consumer services, Africa)	Multi-cargo ports, rolling stock
Intellectual capital	Philips (Technology, Europe)	Investments in R&D
Human capital	Sasol (Oil and gas, Africa)	Skilled and experienced employees
	CIMA (Professional services, Europe)	Number of new students attracted
	Smithfield (Consumer goods, North America)	Employee injury rates
Social and relationship capital	Schiphol Group (Airport, Europe)	Network of destinations
	Clorox (Consumer goods, North America)	Number of employee volunteer hours

The Value-Creation Process

The value-creation process consists of the following elements:

- **Inputs** are resources and relationships (capitals) used in business activities.
 - The organization obtains inputs from the external environment.
- The **business model** transforms inputs through business activities into outputs and outcomes.
 - A business model is sensitive to changes in quality, cost, and availability of inputs. It may or may not be able to adapt quickly to changes.
- **Business activities** are the core of the business model that transforms the inputs (capitals) into outputs.
- **Outputs** are the results of the organization's business activities.
 - Outputs may be products, services, by-products, or waste.
- **Outcomes** are the internal and external effects of business activities and outputs on the capitals.
 - Outcomes relate directly to the external environment and are not necessarily controlled by the organization.
 - Outcomes determine the status for new inputs. In this sense, the value-creation process is circular.



Author's Note

The way the organization shows the three fundamental concepts in the integrated report is not fixed. Organizations can either show all of the capitals and depict the whole value-creation process or they can stress certain details.

6.3 Guiding Principles and Content Elements of the Integrated Report

Preparing an integrated report involves certain challenges. The Guiding Principles are designed and included in the <IR> Framework to help preparers of integrated reports present information. The Guiding Principles are guidelines and cannot always be applied strictly. Judgment is needed in applying these guidelines because they sometimes conflict (e.g., conciseness and completeness).

Guiding Principles

Strategic Focus and Future Orientation

The report should indicate how the strategy affects the ability to create value in the short, medium, and long term; how the strategy affects the capitals; and how the availability, quality, and affordability of capitals contribute to creating value.

Connectivity of Information

The integrated report should show a holistic picture of the interrelatedness of different aspects of the organization. The report should explain how these factors affect the ability of the organization to create value over time.

Stakeholder Relationships

The key stakeholders and the quality of their relationship with the organization should be reported.

Materiality

The organization should disclose information that has a substantial effect on its ability to create value over time.

Conciseness

An integrated report should be clear and concise. A judgment must be made as to what information should be included in the report.

Reliability and Completeness

An integrated report should be free of material errors. An integrated report must include all material information, whether it is positive or negative.

Consistency and Comparability

The material information in an integrated report should be consistent over time. Changes and improvements made should be explained. Comparability among organizations is difficult due to the application of the <IR> Framework to the specific situation of each organization.

Overview of Content Elements

Each integrated report should contain the nine Content Elements.

- Each of the Content Elements is explained in the <IR> Framework and includes one question that should be answered in the integrated report.
- Answering questions rather than checking off a list of requirements makes the content of the integrated report adaptable for different organizations in different situations.

The Content Elements are interrelated. The information gathered from answering the questions should be presented in a logical way.

The Content Elements and the questions posed include the following:

Organizational Overview and External Environment

What does the organization do, and what are the circumstances under which it operates?

- An integrated report identifies the market in which the organization operates, its mission and vision, competitive landscape, key quantitative information, stakeholder needs, external environment changes, and reactions to external environment changes.

Governance

How does the organization's governance structure support its ability to create value in the short, medium, and long term?

- An integrated report provides insight about an organization's leadership structure, diversity, strategic decision-making processes, values and ethics, and linkage between remuneration and value creation.

Business Model

What is the organization's business model?

- An organization's business model is part of its value-creation process and is usually supported by a narrative, identification of critical stakeholder and other (e.g., materials) dependencies, and a diagram or flowchart.

Risks and Opportunities

What are the specific risks and opportunities that affect the organization's ability to create value over the short, medium, and long term, and how is the organization dealing with them?

- Risks and opportunities may be internal, external, or a combination. An assessment of materiality should be made in the event the identified risk actually occurs.

Strategy and Resource Allocation

Where does the organization want to go, and how does it intend to get there?

- Strategic objectives, resource allocation plans, and measurement of goal achievement are often included.
- This Content Element is closely linked to the business model and external environment.

Performance

To what extent has the organization achieved its strategic objectives for the period, and what are its outcomes in terms of effects on the capitals?

- Qualitative and quantitative measures should be used.
- Linkages between historical performance and future plans are important.
- Connections between financial performance and performance of other capitals can be made.

Outlook

What challenges and uncertainties is the organization likely to encounter in pursuing its strategy, and what are the potential implications for its business model and future performance?

- An analysis is usually made of expectations about the future, possible changes and responses, and the organization's ability to react to those changes.

Basis of Preparation and Presentation

How does the organization determine what matters to include in the integrated report, and how are such matters quantified or evaluated?

- An overview of the materiality determination process (often shown as a materiality matrix) is provided.
- The organization identifies the reporting standards and other frameworks used in its preparation.

General Reporting Guidance

This item in the Content Elements is not based on a question. It provides information about essential issues that should be considered during the preparation process, such as materiality, capital disclosures, and an explanation of the business model.

The Value-Creation Process Described by the <IR> Framework

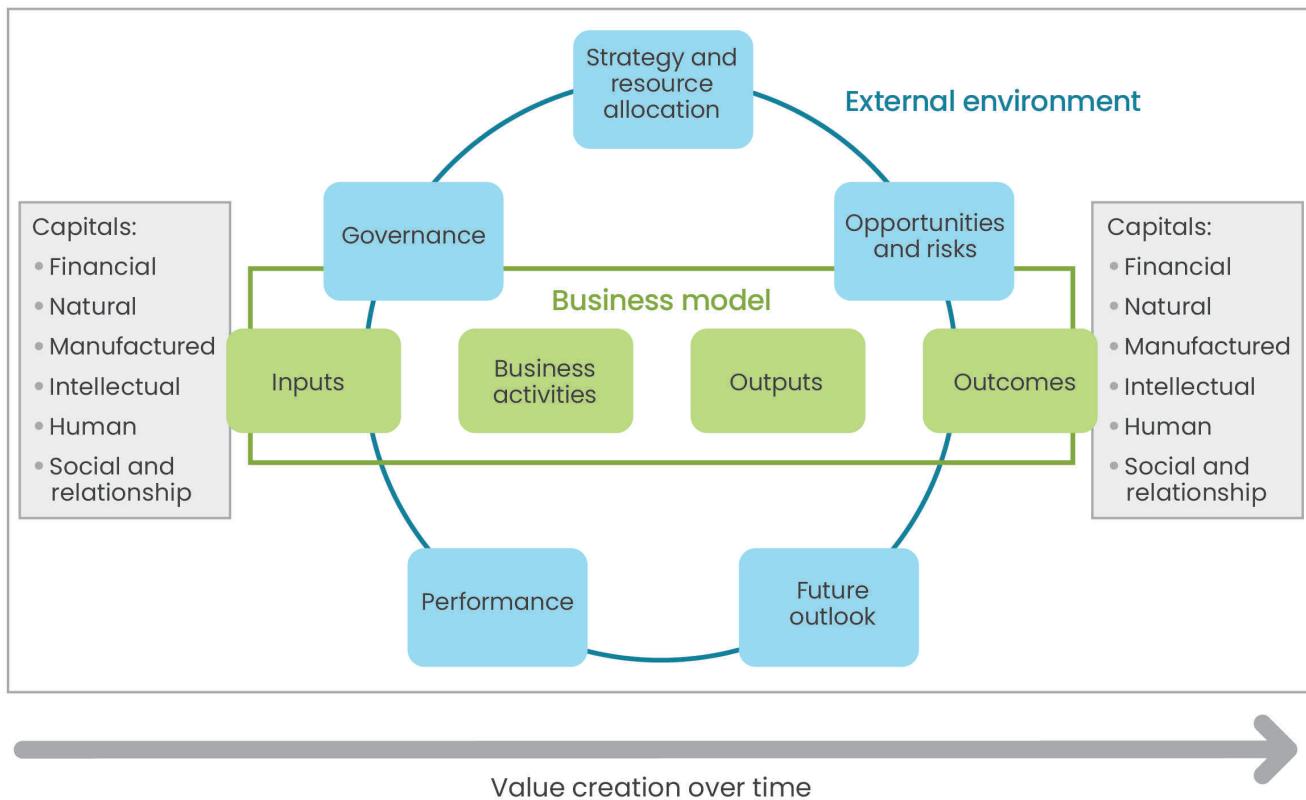


Figure 6-2

6.4 Adoption of Integrated Reporting

Challenges

An organization must be aware of the following concepts and challenges:

- **Materiality.** Because IR follows a multi-capital approach, a provider needs a materiality filter. For example, what financial capital information does a user of the report want to know? A successful start to integrated reporting requires a proper materiality definition process.
- **Data quality.** Because material matters are communicated in the report, the quality of nonfinancial data relied on is crucial. Internal controls for nonfinancial data must ensure quality the same way they do for financial information.
- **Assurance.** Although validating integrated reports and, more specifically, nonfinancial data may be difficult, it enhances the quality and comparability of integrated reports and is becoming more common in recent years.
- **Lack of universal standards.** Although the number of standards is growing rapidly, no universally accepted standards exist for measuring and reporting value creation and nonfinancial information, which makes it difficult to communicate this kind of information. Adoption of the <IR> Framework alongside other relevant frameworks is possible and can help overcome this problem.
- **Tone at the top.** An important aspect in the success of IR implementation is the tone at the top. To adopt IR, support from the CEO and the board of directors is absolutely necessary.

Building the Business Case for Integrated Reporting

The adoption of IR has many challenges and benefits. Stressing these benefits can help build the business case for integrated reporting worldwide.

The benefits of IR include

- Linking financial and nonfinancial information, which provides more clarity about the value-creation process
- Better decision making and resource allocation
- Better relationships with stakeholders
- More employee engagement
- Lower reputational risk
- More committed customers
- Better measurement and internal control systems for nonfinancial information
- Breaking down silos within the organization by requiring different departments to work together to produce an integrated report
- Lower costs of, for example, debt and equity over the long term

IR incurs costs. When building the business case for IR, management needs to address the costs associated with

- Collecting and analyzing new types of data
- Setting up new data sets
- Hiring people with the proper analytical skills
- Setting up new internal control systems
- Assurance on the integrated report
- Disclosing true (but sometimes negative or competitive) information

The field in which integrated reporting takes place is changing rapidly, with more guidelines for (nonfinancial) external reporting being published every year. Integrated reporting is a framework that remains highly relevant alongside other (external) reporting rules and regulations. This is especially true because integrated thinking plays such an important role in IR, focusing on the inner workings of the organization instead of just the required metrics that need to be reported. Therefore, IR is something that can exist easily alongside other nonfinancial reporting frameworks.

Study Unit Seven

Cost Management Concepts

7.1	<i>Cost Management Terminology</i>	2
7.2	<i>Cost Behavior and Relevant Range</i>	5
7.3	<i>Costing Techniques</i>	8
7.4	<i>Absorption and Variable Costing</i>	11

This study unit is the **first of five** on **cost management**. The relative weight assigned to this major topic in Part 1 of the exam is **15%**. The five study units are

- **Study Unit 7: Cost Management Concepts**
- Study Unit 8: Cost Accumulation Systems
- Study Unit 9: Cost Allocation Techniques
- Study Unit 10: Supply Chain Management
- Study Unit 11: Business Process Improvement

This study unit discusses foundational material used in many areas of cost management, budgeting, and performance management. Topics covered in this study unit include

- Variable, fixed, and mixed cost behaviors
- Cost measurement, including
 - Direct costs versus indirect costs
 - Manufacturing versus nonmanufacturing costs
 - Product costs versus period costs
 - Actual costing versus normal costing
 - Absorption costing versus variable costing



Success Tip

Cost management is at the heart of management accounting. Thus, the CMA exam greatly emphasizes this area of study. The candidate will face many questions involving numerical calculations and others requiring a knowledge of cost terminology and the implications of cost management decisions. There is a strategic value in knowing cost information. For example, costs need to be known for pricing and overhead allocation purposes.

7.1 Cost Management Terminology

Subdisciplines of Accounting

Financial accounting is concerned principally with reporting to external users, usually through a set of financial statements produced in accordance with GAAP. Financial accounting has a historical focus.

Management accounting is concerned principally with reporting to internal users. The management accountant's goal is to produce reports that improve organizational decision making. Management accounting is future-oriented.

Cost accounting supports both financial and management accounting. Information about the cost of resources acquired and consumed by an organization underlies effective reporting for both external and internal users.

- In financial accounting, costing information is used to account for cost of goods sold and inventory in external financial reports.
- In managerial accounting, costing information is used to make decisions about costs, production, budgeting, and pricing.

Basic Cost Definitions

A cost is defined by the IMA in two senses:

- “In financial accounting, the sacrifice measured by the price paid or required to be paid to acquire goods or services. The term ‘cost’ is often used when referring to the valuation of a good or service acquired. When ‘cost’ is used in this sense, a cost is an asset. When the benefits of the acquisition (the goods or services) expire, the cost becomes an expense or loss.”
- “In management accounting, a measurement in monetary terms of the amount of resources used for some purpose. The term by itself is not operational. It becomes operational when modified by a term that defines the purpose, such as acquisition cost, incremental cost, or fixed cost.”

A **cost object** is any object to which costs can be attached. Examples are products, processes, employees, departments, and facilities.

A **cost driver** is the basis used to assign costs to a cost object.

- Cost driver is defined by the IMA as “a measure of activity, such as direct labor hours, machine hours, beds occupied, computer time used, flight hours, miles driven, or contracts, that is a causal factor in the incurrence of cost to an entity.”
- The key aspect of a cost driver is the existence of a direct cause-and-effect relationship between the quantity of the driver consumed and the amount of total cost. In other words, a cost driver is some event that causes costs to occur.

Direct vs. Indirect

Costs can be classified by how they are assigned to cost objects.

Direct costs are costs that can be associated with a particular cost object in an economically feasible way, i.e., they can be traced to that object.

- Examples are the direct materials and direct labor inputs to a manufacturing process discussed under Manufacturing vs. Nonmanufacturing below.

Indirect costs are costs that cannot be associated with a particular cost object in an economically feasible way and thus must be allocated to that object.

- Examples are the indirect materials and indirect labor inputs to a manufacturing process discussed on the next page.
- A **cost pool** is an account into which a variety of similar cost elements with a common cause are accumulated. To simplify the allocation process, indirect costs are often collected in cost pools.
 - It is preferable for all the costs in a cost pool to have the same cost driver.
 - Manufacturing overhead, as defined on the next page, is a commonly used cost pool into which various untraceable costs of the manufacturing process are accumulated prior to being allocated.

Common costs are another notable type of indirect cost. A common cost is a cost incurred for the benefit of more than one cost object.

- The key to common costs is that, since they cannot be directly traced to a single cost object, they must be allocated using some systematic and rational basis.
 - An example is depreciation or rent on the headquarters building. This is a direct cost when treating the building as a whole, but is a common cost of the departments located in the building, and thus must be allocated when treating the individual departments.
-

Manufacturing vs. Nonmanufacturing

The costs of manufacturing a product can be classified as one of three types:

1. **Direct materials** are those tangible inputs to the manufacturing process that can practicably be traced to the product, e.g., sheet metal welded together for a piece of heavy equipment.
 - In addition to the purchase price, all costs of bringing raw materials to the production line, e.g., transportation-in, are included in the cost of direct materials.
2. **Direct labor** is the cost of human labor that can practicably be traced to the product, e.g., the wages of the welder.

3. **Manufacturing overhead** consists of all costs of manufacturing that are not direct materials or direct labor.

- **Indirect materials** are tangible inputs to the manufacturing process that cannot practicably be traced to the product, e.g., the welding compound used to put together a piece of heavy equipment.
- **Indirect labor** is the cost of human labor connected with the manufacturing process that cannot practicably be traced to the product, e.g., the wages of assembly line supervisors and janitorial staff.
- **Factory operating costs**, also known as general overhead, include utilities, real estate taxes, insurance, depreciation on factory equipment, etc.

Manufacturing costs are often grouped into the following classifications:

- **Prime cost** equals direct materials plus direct labor, i.e., those costs directly attributable to a product.
- **Conversion cost** equals direct labor plus manufacturing overhead, i.e., the costs of converting raw materials into the finished product.

Costs that are not manufacturing costs are nonmanufacturing costs. The following are the two most common classifications:

1. **Selling (marketing) expenses** are those costs incurred in getting the product from the factory to the consumer, e.g., sales personnel salaries, advertising, and product transportation.
2. **Administrative expenses** are those costs incurred by a company not directly related to producing or marketing the product, e.g., executive salaries, depreciation on the headquarters building, and rent on a warehouse containing inventory.

Product vs. Period

One of the most important classifications a management accountant can make is whether to capitalize a cost as part of finished goods inventory or to expense it as incurred.

- **Product costs** (also called inventoriable costs) are capitalized as part of finished goods inventory. They eventually become a component of cost of goods sold. Such costs include direct materials and direct labor. Product costs also include manufacturing overhead costs under various costing approaches, as discussed in Subunit 7.4.
- **Period costs** are expensed as incurred, meaning they are not capitalized in finished goods inventory and are therefore excluded from cost of goods sold.

7.2 Cost Behavior and Relevant Range

Relevant Range

The relevant range defines the limits within which per-unit variable costs remain constant and fixed costs are not changeable. The relevant range is established by the efficiency of a company's current manufacturing plant, its agreements with labor unions and suppliers, etc.

Variable Costs

Variable costs are a direct function of production volume. They increase when production grows and decrease when production shrinks.

- Raw materials and labor directly involved with production are common variable costs.

Variable cost per unit remains constant in the short run regardless of the level of production.

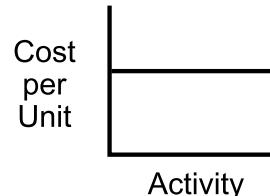


Figure 7-1

Variable costs in total, on the other hand, vary directly and proportionally with changes in volume.

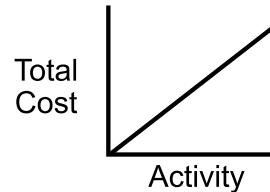


Figure 7-2

Example 7-1 Variable Costs in Total

A company requires one unit of direct material to be used in each finished good it produces.

Number of Outputs Produced	Input Cost per Unit	Total Cost of Inputs
0	\$10	\$ 0
100	10	1,000
1,000	10	10,000
5,000	10	50,000
10,000	10	100,000

Fixed Costs

Fixed costs remain constant regardless of production.

- Examples of fixed costs include rent, interest, insurance, and lease payments.

Fixed costs in total remain unchanged in the short run regardless of production level, e.g., the amount paid for an assembly line is the same even if production is halted entirely.

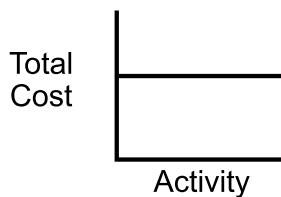


Figure 7-3

Fixed cost per unit, on the other hand, varies indirectly with the activity level.

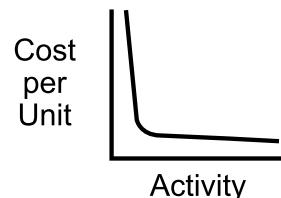


Figure 7-4

Example 7-2 Fixed Cost per Unit

The historical cost of the assembly line is settled, but its cost per unit decreases as production increases.

Number of Outputs Produced	Cost of Assembly Line	Per Unit Cost of Assembly Line
1	\$1,000,000	\$1,000,000
100	1,000,000	10,000
1,000	1,000,000	1,000
5,000	1,000,000	200
10,000	1,000,000	100

Mixed (Semivariable) Costs

Mixed (semivariable) costs **combine fixed and variable elements**, e.g., rental expense on a car that carries a flat fee per month plus an additional fee for each mile driven.

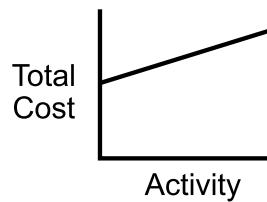


Figure 7-5

Example 7-3 Mixed (Semivariable) Costs

The company rents a piece of machinery to make its production line more efficient. The rental is \$150,000 per year plus \$1 for every unit produced.

Number of Outputs Produced	Fixed Cost of Extra Machine	Variable Cost of Extra Machine	Total Cost of Extra Machine
0	\$150,000	\$ 0	\$150,000
100	150,000	100	150,100
1,000	150,000	1,000	151,000
5,000	150,000	5,000	155,000
10,000	150,000	10,000	160,000

Two methods of estimating mixed costs are in general use:

1. The **regression (or scattergraph) method** is by far the more complex (and accurate) of the two methods. Regression analysis is covered in detail in Study Unit 12, Subunit 1.
2. The **high-low method** is the less accurate but quicker of the two methods.



Author's Note

Estimating mixed costs using the high-low method is not covered on the CMA exam.

7.3 Costing Techniques

Actual vs. Normal Costing

Actual costing is the recording of product costs based on actual

- Cost of materials,
- Cost of labor, and
- Overhead incurred.

Actual costing is the most accurate method of accumulating costs in a cost accounting system due to it not including any budget-based amounts. However, it is also the least timely and most volatile method. Because per-unit costs depend on the level of production in a period, large fluctuations arise from period to period. This volatility can lead to the reporting of misleading financial information.

Normal costing is an alternative to actual costing. Under normal costing

- Actual direct materials and actual direct labor are charged to a specific product or production department.
 - This is the same as actual costing.
- Overhead is applied on the basis of a budgeted rate.
 - This differs from actual costing and compensates for the fluctuations in unit cost inherent in actual costing.
 - There is usually a difference between budgeted overhead and actual overhead.
 - ▶ If the difference is immaterial, it should be allocated to cost of goods sold.
 - ▶ If the difference is material, it should be prorated between cost of goods sold, work-in-process inventories, and finished goods inventories.
 - ▶ This calculation of under- or overapplied overhead is covered in detail in Study Unit 9, Subunit 2.

Extended normal costing extends the use of normalized rates to direct material and direct labor, so that all three major input categories use normalized rates.

Cost Accumulation Systems

Job-order costing is appropriate when producing products with individual characteristics or when identifiable groupings are possible. Study Unit 8, Subunit 1, has a detailed explanation.

- Costs are attached to specific “jobs.” Each job will result in a single, identifiable end product.
- Examples are any industry that generates custom-built products, such as shipbuilding or a sign shop.

Process costing is used when similar products are mass produced on a continuous basis. It is discussed in Study Unit 8, Subunit 2.

- Costs are attached to specific departments or phases of production. Examples are breakfast cereal and laundry detergent.
- Because costs are attached to streams of products rather than individual items, process costing involves calculating an average cost for all units.

Activity-based costing (ABC) first assigns resource costs to activities. These activity costs are then assigned to physical goods. Study Unit 8, Subunit 3, has a detailed explanation.

- ABC is a response to the distortions of product cost information brought about by peanut-butter costing, which is the inaccurate averaging or spreading of costs like peanut butter over products or service units that use different amounts of resources.

Life-cycle costing emphasizes the need to price products to cover all the costs incurred over the lifespan of a product, not just the immediate costs of production. Study Unit 8, Subunit 4, has a detailed explanation.

- Costs incurred before production, such as R&D and product design, are referred to as **upstream costs**.
- Costs incurred after production, such as marketing and customer service, are called **downstream costs**.

Standard Costing, Flexible Budgeting, and Variance Analysis

Standard costing is a system designed to alert management when the actual costs of production differ significantly from budgeted (“standard”) costs. Standard costs are predetermined, attainable unit costs. A standard cost is not just an average of past costs, but an objectively determined estimate of what a cost should be. The cost estimate excludes past inefficiencies and takes into account expected future changes.

- Utilizing standard costs tends to simplify recordkeeping.
- The costs of using standard costing are low relative to using actual costing.
- Standard costs can be used with both job-order and process-costing systems.

Flexible budgeting is the calculation of the quantity and cost of inputs that should have been consumed given the achieved level of production. Flexible budgeting supplements the **static budget**, which is the company’s best projection of the resource consumption and levels of output that will be achieved for an upcoming period.

The static and flexible budgets are compared to the actual results, and the differences are calculated.

- These differences are referred to as variances. Preparation of a flexible budget and variances are both covered in detail in Study Unit 15.
- Variance analysis enables **management by exception**, the practice of giving attention primarily to significant deviations from expectations (whether favorable or unfavorable).

Costing Method	Benefits	Limitations
Actual costing	Most accurate method.	Least timely method. Can lead to volatile results.
Normal costing	Compensates for volatility of actual costing.	Under- or overapplied overhead needs evaluated at end of period.
Standard costing	Objectively estimates what costs should be. Takes into account future changes. Simplifies bookkeeping. Lower costs than using actual costing.	Standards must be continuously updated.

7.4 Absorption and Variable Costing

Period vs. Product Costs

Product costs are capitalized costs because they become a component of cost of goods sold.

Period costs are expensed as incurred, i.e., they are not capitalized in finished goods inventory and are thus excluded from cost of goods sold.

Absorption Costing

For **external reporting purposes**, the cost of a product must include **all** the costs of manufacturing it: direct labor, direct materials, and all factory overhead (both fixed and variable). This method is commonly known as **absorption, full costing, or full absorption costing**.

Under absorption costing, the fixed portion of manufacturing overhead is “absorbed” into the cost of each unit of product. Thus, product cost includes **all manufacturing costs**, both fixed and variable. The inventoried cost of the product includes **all production costs**, both fixed and variable. This technique is required for external financial reporting and for income tax purposes.

Variable Costing

For **internal purposes**, decision making is improved by treating fixed overhead as a period cost so that only costs that are variable in the short run are included in the cost of the product.

- Fixed overhead costs are considered period costs and deducted in the period in which they are incurred.
- This practice is termed **variable, or direct, costing**. Variable costing is the preferred term because it concisely describes what is happening (that product costs are based only on variable costs).

Variable costs are a direct function of production volume. They increase when production grows and decrease when production shrinks. Raw materials and labor directly involved with production are common variable costs. Variable costing is used internally to support the decision making of internal users of accounting information.

- Product cost includes only the variable portion of manufacturing costs.
- Fixed manufacturing costs are considered period costs and are expensed as incurred.
- This technique is not allowed for external financial reporting but is very useful for internal decision making. It also stops management from manipulating income by overproducing during the period.
- Variable-basis cost of goods sold and the variable portion of S&A expenses are subtracted from sales to arrive at **contribution margin**.
 - This amount ($\text{Sales} - \text{Total variable costs}$) is an important element of the variable costing income statement because it is the amount available for covering fixed costs (both manufacturing and S&A).
 - Contribution margin is an important metric internally but is generally considered irrelevant to external financial statement users.
 - Manufacturing contribution margin considers only the actual costs of manufacturing (i.e., direct materials, direct labor, and variable manufacturing overhead) to be product costs, i.e., inventoriable.

Example 7-4 Contribution Margin Income Statement

Company X sells 20,000 units in the current year at a sales price of \$60 per unit. X has the following costs:

Variable costs per unit		Total fixed costs	
Direct materials	\$8	Overhead	\$200,000
Direct labor	5	Selling and administrative	150,000
Overhead	2		
Selling	1		

Company X's contribution margin formatted income statement is prepared as follows:

Sales (\$60 × 20,000)		\$1,200,000	
Less: Variable costs			
Direct materials (\$8 × 20,000)	\$160,000		
Direct labor (\$5 × 20,000)	100,000		
Overhead (\$2 × 20,000)	40,000		
Selling (\$1 × 20,000)	20,000		
Contribution margin			\$ (320,000)
Less: Fixed costs			
Overhead	\$200,000		
Selling and administrative	150,000		
Operating income			\$ 530,000

Summary of Absorption Costing vs. Variable Costing

The following table summarizes product and period costs under both methods:

	Absorption Costing (Required under GAAP)	Variable Costing (For Internal Reporting Only)
Product Costs (Included in Cost of Goods Sold)	Variable production costs	Variable production costs
	Fixed production costs	
Period Costs (Excluded from Cost of Goods Sold)		Fixed production costs
	Variable S&A expenses	Variable S&A expenses
	Fixed S&A expenses	Fixed S&A expenses

Variable vs. Absorption Costing -- Income Statements

The accounting for variable production costs and fixed S&A expenses is identical under the two methods. The difference lies in the varying treatment of fixed production costs and presentation of variable S&A expenses.

Absorption and variable costing income statements can be illustrated as follows:

Absorption Costing	Variable Costing
Sales	Sales
- Cost of goods sold:	- Variable expenses:
Direct materials	Direct materials
Direct labor	Direct labor
Variable overhead	Variable overhead
Fixed overhead	Variable S&A expenses
= <u>Gross margin</u>	= <u>Contribution margin</u>
- <u>Total S&A expenses</u>	- Fixed expenses:
= <u>Operating income</u>	Fixed overhead
	Fixed S&A expenses
	= <u>Operating income</u>

Ending finished goods inventory will differ between the two methods due to the different treatment of fixed production costs. This leads to a difference in cost of goods sold and operating income.

Example 7-5 Absorption vs. Variable Costing

		Absorption Costing (Required for ext. rptg.)	Variable Costing (For internal reporting only)
	Sales	\$100,000	\$100,000
	Beg. finished goods inventory	\$10,000	\$10,000
Product Costs	Add: Variable production costs	20,000 (a)	20,000 (a)
	Add: Fixed production costs	30,000 (b)	-
	Goods available for sale	\$60,000	\$30,000
	Minus: End. finished goods inventory	<u>(35,000)</u>	<u>(25,000)</u>
	Cost of goods sold	<u>(\$25,000)</u>	<u>(\$5,000)</u>
Period Costs	Minus: Variable S&A expenses	-	(10,000) (c)
	Gross margin (abs.) / Contribution margin (var.)	<u>\$75,000</u>	<u>\$85,000</u>
	Minus: Fixed production costs	-	(30,000) (b)
	Minus: Variable S&A expenses	(10,000) (c)	-
	Minus: Fixed S&A expenses	(20,000) (d)	(20,000) (d)
	Operating income	<u>\$45,000</u>	<u>\$35,000</u>
	Legend	Cost Component	
	(a)	Variable production costs	
	(b)	Fixed production costs	
	(c)	Variable selling and administrative expenses	
	(d)	Fixed selling and administrative expenses	

The \$10,000 difference in operating income (\$45,000 – \$35,000) is the difference between the ending inventory values (\$35,000 – \$25,000). In essence, the absorption method carries 33.33% of the fixed overhead costs ($\$30,000 \times 33.33\% = \$10,000$) on the balance sheet as an asset because 33.33% of the month's production is still in inventory.

Example 7-6 Absorption Costing vs. Variable Costing

Fordice Company produces and sells one product. In the first year of operations, Fordice's costs were as follows:

Direct materials per unit	\$7.00
Direct labor per unit	3.00
Variable overhead cost per unit	1.50
Variable selling cost per unit	1.00

Fixed manufacturing overhead cost for the year totaled \$400,000. Fixed selling and administrative cost for the year totaled \$175,000.

During this year of operations, Fordice produced 200,000 units and sold 180,000 units at \$40 each.

ABSORPTION COSTING RESULTS:

Unit product cost = \$7 DM + \$3 DL + \$1.50 VOH + \$2 FOH* = \$13.50 per unit

*FOH per unit = \$400,000 ÷ 200,000 units produced = \$2

External Financial Statements (in accordance with GAAP)

Ending inventory on balance sheet = 20,000 units × \$13.50 = \$270,000

Income Statement	
Sales (180,000 units × \$40)	\$7,200,000
Less: Cost of goods sold (180,000 × \$13.50)	<u>2,430,000</u>
Gross profit	\$4,770,000
Selling and administrative expenses [(180,000 × \$1) + 175,000]	355,000
Operating income	<u>\$4,415,000</u>

VARIABLE COSTING RESULTS:

Unit product cost = \$7 DM + \$3 DL + \$1.50 VOH = \$11.50 per unit

Income Statement	
Sales (180,000 units × \$40)	\$7,200,000
Less: Variable expenses:	
Variable cost of goods sold (180,000 × \$11.50)	2,070,000
Variable selling (180,000 × \$1.00)	<u>180,000</u>
Contribution margin	\$4,950,000
Less: Fixed expenses:	
Fixed overhead	400,000
Fixed selling and administrative	175,000
Operating income	<u>\$4,375,000</u>

Example 7-7 Absorption Costing vs. Variable Costing Reconciliation

Reconciliation of the results from Example 7-6:

Year 1 Reconciliation (Production > Sales)	
Variable costing operating income	\$4,375,000
Add: FOH absorbed in ending inventory	
20,000 units × \$2.00 FOH per unit	40,000
Absorption costing operating income	<u>\$4,415,000</u>

Effects on Operating Income

As production and sales levels change, the two methods have varying effects on operating income.

- When everything produced during a period is sold that period, the two methods report the same operating income.
 - Total fixed costs budgeted for the period are charged to sales revenue in the period under both methods.
- When production and sales are not equal for a period, the two methods report different operating income.

Scenario	Absorption Costing	Variable Costing	Result
Production > Sales and Ending inventory increases	Some fixed costs are absorbed in ending inventory	All fixed costs are expensed	Absorption costing operating income > Variable costing operating income
Production < Sales and Ending inventory decreases	Some fixed costs embedded in beginning inventory are expensed (released) in the current period	Only current period fixed costs are expensed	Absorption costing operating income < Variable costing operating income

Many companies prefer variable costing for internal reporting because of the incentive inherent in absorption costing. The main advantage of variable costing is that income cannot be manipulated by management action.

Under absorption costing, whenever production exceeds sales, fewer fixed costs are expensed under the absorption basis, and operating income always increases. A production manager can thus **increase absorption-basis operating income merely by increasing production**, whether there is any customer demand for the additional product or not.

- The company must also deal with the increased carrying costs resulting from swelling inventory levels.
- This practice, called producing for inventory, can be effectively discouraged by using variable costing for performance reporting and consequent bonus calculation.

Example 7-8 Absorption Costing vs. Variable Costing Reconciliation -- Subsequent Years

Using the data from Example 7-6, assume in Year 2 that production is again 200,000 units and that sales are only 150,000 units.

ABSORPTION COSTING RESULTS -- YEAR 2:

Year 2's ending inventory = 20,000 Year 1 ending + 50,000 from Year 2 = 70,000 units
 $70,000 \text{ units} \times \$13.50 \text{ per unit} = \$945,000$

Income Statement	
Sales (150,000 units \times \$40)	\$6,000,000
Less: Cost of goods sold (150,000 \times \$13.50)	<u>2,025,000</u>
Gross profit	\$3,975,000
Selling and administrative expenses [(150,000 \times \$1) + 175,000]	325,000
Operating income	<u>\$3,650,000</u>

VARIABLE COSTING RESULTS -- YEAR 2:

Unit product cost = \$7 DM + \$3 DL + \$1.50 VOH = \$11.50 per unit

Income Statement	
Sales (150,000 units \times \$40)	\$6,000,000
Less: Variable expenses: Variable cost of goods sold (150,000 \times \$11.50)	1,725,000
Variable selling (150,000 \times \$1.00)	<u>150,000</u>
Contribution margin	\$4,125,000
Less: Fixed expenses: Fixed overhead	400,000
Fixed selling and administrative	175,000
Operating income	<u>\$3,550,000</u>

Year 2 Reconciliation (Production > Sales)

Variable costing operating income	\$3,550,000
Add: FOH absorbed in ending inventory 50,000 units \times \$2.00 FOH per unit	100,000
Absorption costing operating income	<u>\$3,650,000</u>

Assume that in Year 3, the company produces 200,000 units and sells 240,000 units.

-- Continued on next page --

Example 7-8 -- Continued**ABSORPTION COSTING RESULTS -- YEAR 3:**

Year 3's ending inventory = 70,000 Year 2 ending – 40,000 from Year 3 = 30,000 units

30,000 units × \$13.50 per unit = \$405,000

Income Statement	
Sales (240,000 units × \$40)	\$9,600,000
Less: Cost of goods sold (240,000 × \$13.50)	3,240,000
Gross profit	<u>\$6,360,000</u>
Selling and administrative expenses [(240,000 × \$1) + 175,000]	415,000
Operating income	<u>\$5,945,000</u>

VARIABLE COSTING RESULTS -- YEAR 3

Unit product cost = \$7 DM + \$3 DL + \$1.50 VOH = \$11.50 per unit

Income Statement	
Sales (240,000 units × \$40)	\$9,600,000
Less: Variable expenses:	
Variable cost of goods sold (240,000 × \$11.50)	2,760,000
Variable selling (240,000 × \$1.00)	240,000
Contribution margin	<u>\$6,600,000</u>
Less: Fixed expenses:	
Fixed overhead	400,000
Fixed selling and administrative	175,000
Operating income	<u>\$6,025,000</u>

Year 3 Reconciliation (Production < Sales)

Variable costing operating income	\$6,025,000
Less: FOH released from ending inventory 40,000 units × \$2.00 FOH per unit	(80,000)
Absorption costing operating income	<u>\$5,945,000</u>

Example 7-9 Extended Example of Absorption and Variable Operating Income

A company has the following sales and cost data:

	Year 1	Year 2	Year 3
Production in units	40,000	50,000	0
Sales in units	30,000	30,000	30,000
Ending inventory in units (Wgt. Avg.)	10,000	30,000	0
Unit sales price	\$ 1.00		
Unit variable cost	0.50		
Fixed manufacturing costs	4,000 per year		
Variable S&A expenses	0.03 per unit		
Fixed S&A expenses	1,000 per year		

Compare the 3-year income statements prepared under the two methods:

Absorption Costing (Required for external reporting)			Variable Costing (For internal reporting only)		
	Year 1	Year 2		Year 1	Year 2
Sales	\$30,000	\$30,000	\$30,000	Sales	\$30,000
Beginning inventory	\$ 0	\$ 6,000	\$17,500	Beginning inventory	\$ 0
Variable mfg. costs	20,000	25,000	0	Variable mfg. costs	20,000
Fixed mfg. costs	4,000	4,000	4,000	Goods available for sale	\$20,000
Goods available for sale	\$24,000	\$35,000	\$21,500	Less: Ending inventory	(\$5,000)
Less: Ending inventory*	(6,000)	(17,500)	0	Variable COGS	\$15,000
Absorption COGS	\$18,000	\$17,500	\$21,500	Variable S&A exps.	(900)
Gross margin	\$12,000	\$12,500	\$ 8,500	Contribution margin	\$14,100
Variable S&A expenses	(900)	(900)	(900)	Fixed mfg. costs	(4,000)
Fixed S&A expenses	(1,000)	(1,000)	(1,000)	Fixed S&A expenses	(1,000)
Operating income	\$10,100	\$10,600	\$ 6,600	Operating income	\$ 9,100

* Ending inventory is calculated on the weighted-average basis. The use of FIFO would result in slightly different numbers in Year 2 under the absorption method, but the impact would be the same.

Note that, assuming zero inventory at the beginning of Year 1 and at the end of Year 3, the total operating income for the 3-year period is the same under either costing method.

	Absorption Costing	Variable Costing
Year 1	\$10,100	\$ 9,100
Year 2	10,600	9,100
Year 3	6,600	9,100
3-Year Total	\$27,300	\$27,300

-- Continued on next page --

Example 7-9 -- Continued

Absorption costing shows a higher operating income than variable costing in Years 1 and 2 because fixed overhead has been capitalized and does not get expensed until Year 3. Variable costing, on the other hand, treats fixed overhead as an expense of the period in which the cost is incurred. In Year 2, despite the same cash flow, there is a \$1,500 difference between the final operating income figures. There is an even greater difference in Year 3.

If fixed costs increase relative to variable costs, the differences become more dramatic (here, 50% of the selling price is variable manufacturing cost, and fixed overhead is no more than 20% of the variable manufacturing cost).

From an internal point of view, a manager can manipulate absorption income by changing production levels. But, with variable costing, a manager cannot manipulate it simply by changing production levels.

Note that, under the absorption method, management was able to show higher incomes in Years 1 and 2 by overproducing. If the manager was being given a bonus for a higher level of income, (s)he could obtain the bonus by producing more units than could be sold. As a result, some fixed costs would be added to the balance sheet as inventories. Thus, the income statement and balance sheet both look good, despite the fact that the production manager has done a bad thing: (S)he has produced excessive inventories that require the company to incur storage and financing costs. Spoilage may also be a result.

Summary of Effects on Income and Ending Inventory

The value of ending inventory is **never** higher under variable costing than it is under absorption costing because fixed manufacturing costs are not included in inventory under variable costing.

Income and inventory levels will differ whenever sales and production differ.

- Income will be higher or lower under variable costing depending upon whether inventories are increased during the period or liquidated.
- If inventories increase during a period, the variable costing method will show a lower income because all fixed costs are being subtracted on the income statement, while under the absorption method, some fixed costs are being capitalized as inventories.
- Variable costing will show a higher income in periods when inventories decline because the absorption method forces the subtraction of current period fixed costs included in inventory sold, plus some fixed costs incurred (and capitalized) in prior periods.

Under variable costing, profits always move in the same direction as sales volume. Profits reported under absorption costing behave erratically and sometimes move in the opposite direction from sales trends.

In the long run, the two methods will report the same total profits if sales equal production. The inequalities between production and sales are usually minor over an extended period.

Benefits of Variable Costing

Although the use of variable costing for external financial statements is prohibited, most agree about its superiority for internal reporting. It is far better suited than absorption costing to the needs of management.

- Management requires a knowledge of cost behavior under various operating conditions. For planning and control, management is more concerned with treating fixed and variable costs separately than with calculating full costs.
- Under variable costing, the cost data for profit planning and decision making are readily available from accounting records and statements. For example, cost-volume-profit relationships and the effects of changes in sales volume on net income can easily be computed from the income statement prepared under the variable costing concept, but not from the conventional absorption cost income statement based on the same data.
- Profits and losses reported under variable costing have a relationship to sales revenue and are not affected by inventory or production variations.
 - Absorption cost income statements may show decreases in profits when sales are rising and increases in profits when sales are decreasing, which may be confusing to management.
 - Under variable costing, cost of goods sold will vary directly with sales volume, and the influence of production on gross profit is avoided. Under the variable costing method, a production manager cannot manipulate sales by overproducing.
- The full impact of fixed costs on net income, partially hidden in inventory values under absorption costing, is emphasized by the presentation of costs on an income statement prepared under variable costing.
- Proponents of variable costing maintain that fixed factory overhead is more closely correlated to capacity to produce than to the production of individual units.
- Variable costing is also preferred over absorption costing for studies of relative profitability of products, territories, and other segments of a business. It concentrates on the contribution that each segment makes to the recovery of fixed costs that will not be altered by decisions to make and sell. Under variable costing procedures,
 - The marginal income concept leads to better pricing decisions, which are a principal advantage of variable costing.
 - The impact of fixed costs on net income is emphasized by showing the total amount of such costs separately in financial reports.

Study Unit Eight

Cost Accumulation Systems

8.1	<i>Job-Order Costing</i>	2
8.2	<i>Process Costing</i>	6
8.3	<i>Activity-Based Costing</i>	9
8.4	<i>Life-Cycle Costing</i>	19

This study unit is the **second of five** on **cost management**. The relative weight assigned to this major topic in Part 1 of the exam is **15%**. The five study units are

- Study Unit 7: Cost Management Concepts
- **Study Unit 8: Cost Accumulation Systems**
- Study Unit 9: Cost Allocation Techniques
- Study Unit 10: Supply Chain Management
- Study Unit 11: Business Process Improvement

This study unit discusses cost accumulation systems. Topics covered in this study unit include

- Cost flows
- Calculating cost of goods sold and inventory values
- Normal and abnormal spoilage

8.1 Job-Order Costing

Job-order costing is concerned with accumulating costs by specific job. This method is appropriate when producing products with individual characteristics (e.g., yachts), or when identifiable groupings are possible (e.g., jewelry). Products are usually custom made for a specific customer.

Costs are recorded by classification, such as direct materials, direct labor, and manufacturing overhead, on a job-cost sheet (may be manual or electronic) that is specifically prepared for each job.

- The direct materials and direct labor costs are accumulated on job-cost sheets. Overhead application is also recorded on the job-cost sheet.
- The total of all job-cost sheets for jobs in progress will equal the balance in the work-in-process inventory account.

Steps in Job-Order Costing

A flowchart with T-accounts can be used to illustrate the flow of costs in a job-order costing system. Inventory accounts are increased by transactions on the left side of the T-account and decreased by transactions on the right side of the T-account. The transaction types illustrated in Figure 8-1 are numbered to correspond with the steps outlined on the following pages.

Job-Order Cost Flow Diagram

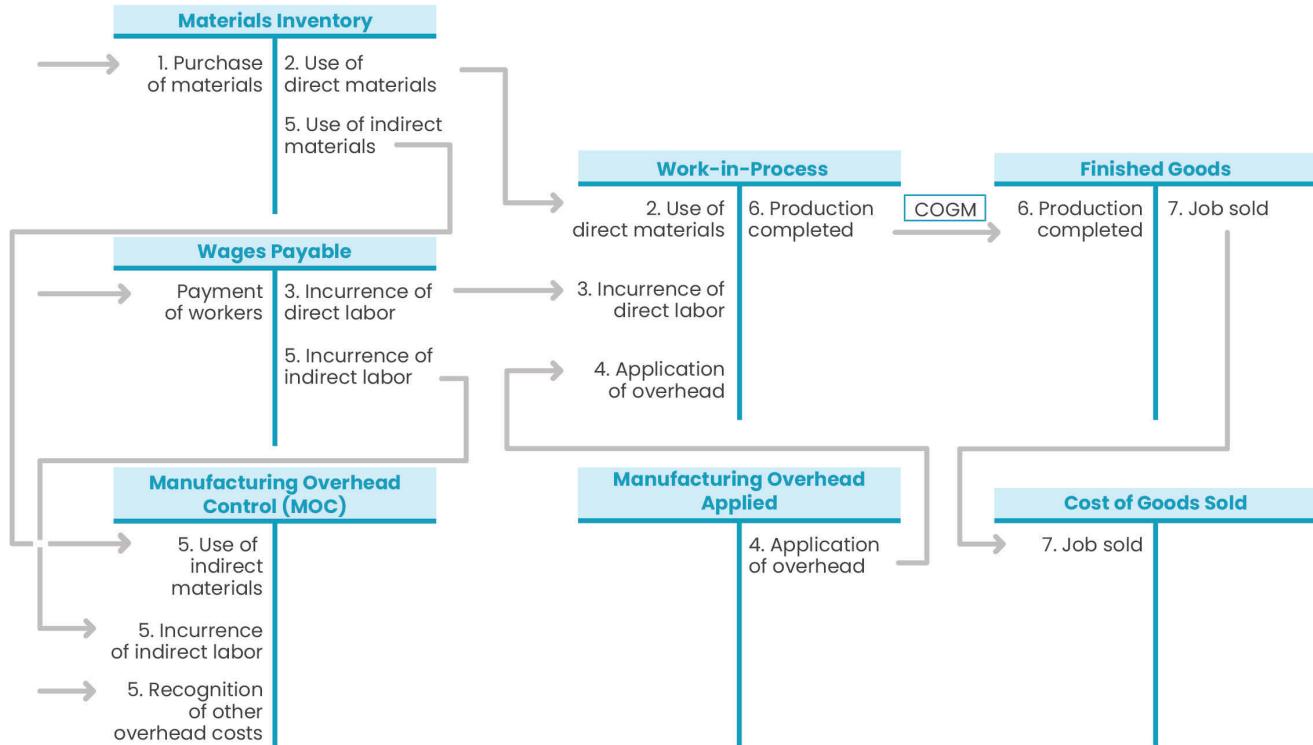


Figure 8-1

The first step in the process is the receipt of a sales order from a customer requesting a product or special group of products. The sales order is approved, and a production order is issued.

Accumulating Costs

Step 1: The physical inputs required for the production process are obtained from suppliers.

Under job-order costing, direct materials and direct labor are charged based on the amounts actually applied to each job.

Step 2: Materials requisition forms request direct materials to be pulled from the warehouse and sent to the production line.

Step 3: Time tickets track the direct labor that workers expend on various jobs.

Step 4: Under job-order costing, the third component of product cost, manufacturing overhead, is charged using an estimated rate.

- The application of an estimated overhead rate is necessary under job-order costing because the outputs are customized and the processes vary from period to period.

Step 5: As indirect costs are paid throughout the year, the transactions are recorded in the manufacturing overhead control account, not work-in-process. Work-in-process is not affected when actual overhead costs are incurred.

- Examples of indirect costs include indirect materials, indirect labor, and other overhead costs (such as rent, depreciation, insurance, and property taxes for the manufacturing facilities).

Application of Overhead

Overhead costs are applied to (“absorbed” by) each job based on a predetermined overhead application rate for the year (such as \$5 per direct labor hour, or machine hour, etc., or based on an activity-based costing system). If activity-based costing is used, the procedure for overhead applications is the same, except that multiple rates based on multiple cost drivers will be used (such as \$5 per direct labor hour, plus \$2 per machine hour, plus \$1 per material requisition used).

- At the beginning of the year, an estimate is made of the total amount that will be spent for manufacturing overhead during that year.
- An estimate is also made of the total quantity of allocation base, such as direct labor hours or machine hours, that will be required for manufacturing overhead during that year.

$$\text{Application rate} = \frac{\text{Estimated total manufacturing overhead}}{\text{Estimated total quantity of allocation base}}$$

- During the period as jobs are worked on, the amount applied equals the number of units of the allocation base used during the period times the application rate.

$$\text{Amount overhead applied} = \text{Total quantity of allocation base} \times \text{Application rate}$$

- Step 4 in Figure 8-1 represents this application of overhead. The transaction increases work-in-process inventory and manufacturing overhead applied.

- At the end of the period, the overhead control and applied accounts are netted to examine any differences, which are called variances. Overhead allocation is covered in detail in Study Unit 9, Subunit 2.
 - If applied overhead is less than actual overhead, overhead was underapplied for the period.
 - If applied overhead is more than actual overhead, overhead was overapplied for the period.
 - If the difference is immaterial, the dollar amount of the difference is closed to cost of goods sold.
 - If the difference is material, the dollar amount of the difference is closed through allocation to work-in-process inventory, finished goods inventory, and cost of goods sold.

Completing and Selling Job

Step 6: When a job order is completed, all the costs are transferred to finished goods.

Step 7: When the job is sold, the cost is transferred to cost of goods sold.

Spoilage, Rework, and Scrap

Output that does not meet the quality standards for salability is considered spoilage.

Normal spoilage is the amount expected in the ordinary course of production.

- Because management understands that good units cannot be produced without some risk of spoilage, the cost of the normal spoilage is included in the cost of the good units produced (i.e., treated as a product cost).
- This is accomplished by allowing the net cost of the spoilage to remain in the work-in-process account of the job that generated it.
 - If the normal spoilage is worthless, it should be discarded. No transaction will be recorded.
 - If the normal spoilage can be sold, its value should **not** be included in the cost of the good units produced. The transaction will record spoiled inventory and reduce work-in-process inventory.

Abnormal spoilage is spoilage over and above the amount expected in the ordinary course of production.

- Abnormal spoilage is **not** treated as a manufacturing cost and is **not** included in the cost of the good units produced.
- Instead, abnormal spoilage costs are expensed in the period they occurred and treated as a period cost. A loss from abnormal spoilage is recorded.

Spoilage	Defined	Accounting Treatment
Normal	Expected in ordinary course of production	<ul style="list-style-type: none"> • Product cost • Included in the cost of good units produced
Abnormal	Spoilage over and above the amount expected in the ordinary course of production	<ul style="list-style-type: none"> • Period cost • Loss from abnormal spoilage

Rework consists of unacceptable units that can be repaired and sold as acceptable units. Normal rework may be attributable to a job or to all jobs. It is recorded to a job (job costing) or manufacturing overhead and allocated (job and process costing).

- Abnormal rework is recorded as a loss (job and process costing).
 - Process costing is covered in Subunit 8.2.

Scrap is leftover material with no attached cost and low sales value. It may be recognized as revenue at the time of sale.

Waste is raw material leftover from the production cycle for which there is no further use. Waste is not salable at any price and must be discarded.

8.2 Process Costing

Process cost accounting is used to assign costs to inventoriable goods or services. It is applicable to relatively homogeneous products that are mass produced on a continuous basis (e.g., petroleum products, thread, computer monitors).

- Assigning an exact amount of materials, labor, and indirect costs to thousands, or even millions, of individual end products is simply not cost-effective. For this reason, process costing involves averaging the costs of production and allocating them to work-in-process and finished goods.

Process Costing Cost Flow Diagram

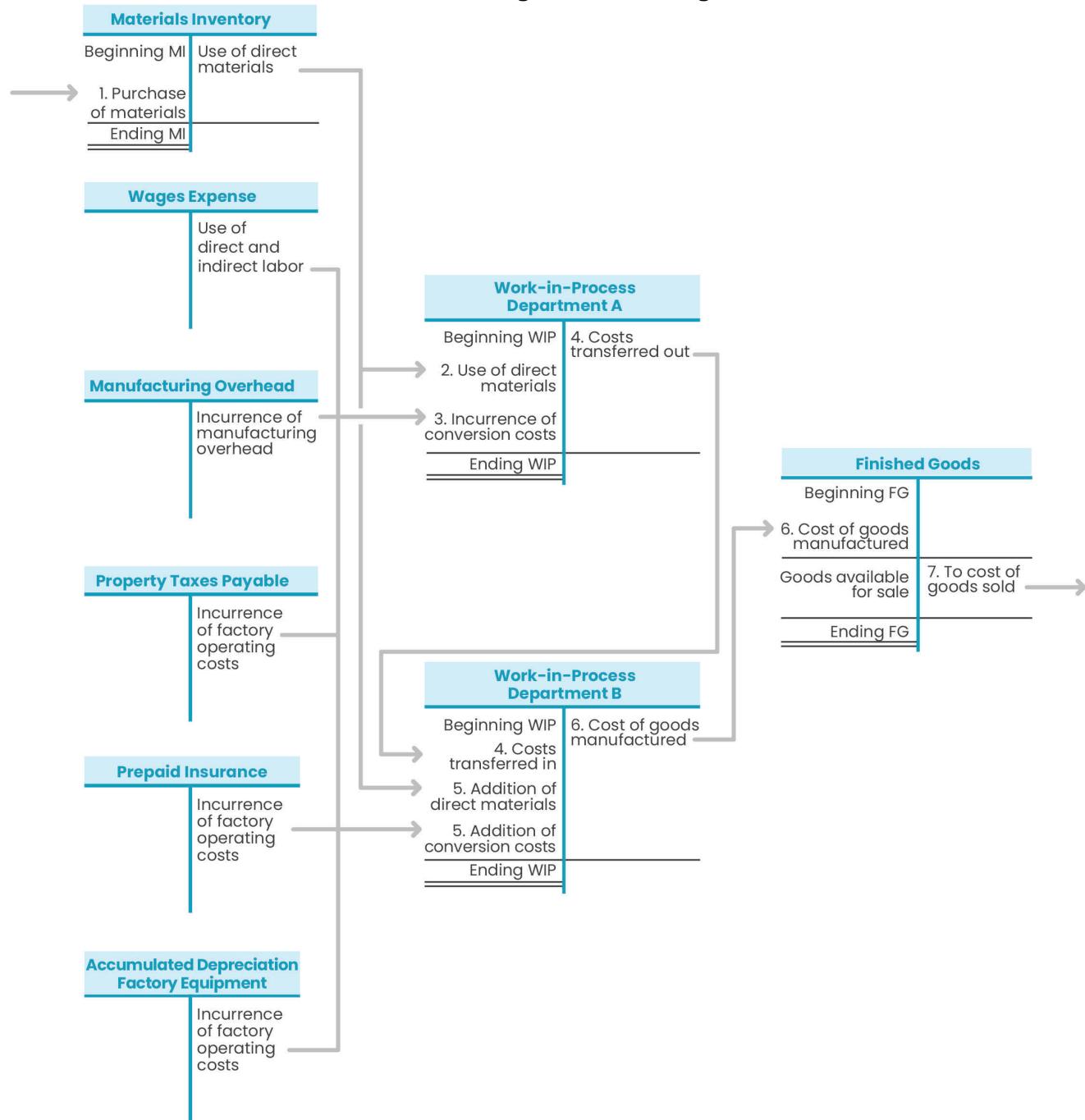


Figure 8-2

Process Costing Cost Flow

A flowchart with T-accounts can be used to illustrate the flow of costs in a process costing system. Inventory accounts are increased by transactions on the left side of the T-account and decreased by transactions on the right side of the T-account. The transaction types illustrated in Figure 8-2 are numbered to correspond with the steps outlined below.

The accumulation of costs under a process costing system is **by department rather than by project**. There will normally be a work-in-process inventory account for each department. This reflects the continuous, homogeneous nature of the manufacturing process.

Step 1: As in job-order costing, the physical inputs required for the production process are obtained from suppliers.

Step 2: **Direct materials** actually used by the first department in the process (Department A) are added to work-in-process for that department.

Step 3: **Conversion costs**, which include direct labor and manufacturing overhead used by the first department, are added to work-in-process for that department. Actual amounts are used.

Step 4: The products can move from one department to the next (from Department A to Department B).

Step 5: The second department (Department B) can add more direct materials and conversion costs.

Step 6: When processing is finished in the last department, all the costs are transferred to finished goods.

Step 7: As products are sold, the costs are transferred to cost of goods sold.

Equivalent Units of Production – Basics

Some units remain unfinished at the end of the period. For each department to account adequately for costs attached to its unfinished units, the units must be restated in terms of equivalent units of production (EUP).

- EUP are the number of complete units that could have been produced using the inputs consumed during the period.
- Cost-per-unit can be calculated using EUP (cost per EUP).

Example 8-1 EUP

One thousand work-in-process units 80% completed for direct materials and 60% for conversion costs represent 800 EUP of direct materials ($1,000 \times 80\%$) and 600 EUP of conversion costs ($1,000 \times 60\%$).



Author's Note

Calculations are not required for process costing on the CMA exam. Candidates should be able to demonstrate that they have a general understanding of process costing and the concept of equivalent units.

Spoilage in Process Costing

As with job-order costing, the cost of a normal level of spoilage is left in cost of goods sold; abnormal spoilage is recognized separately as a loss.

Recognizing the loss resulting from abnormal spoilage under process costing involves the manufacturer establishing inspection points, that is, the places in the production process where those goods not meeting specifications are pulled from the process. This is in contrast to job-order costing, in which a unit can be judged to be spoiled at any time.

- The typical arrangement is to inspect units as they are being transferred from one department to the next. This way, each department has its own amount of spoilage, calculated using its own equivalent-unit costs.

8.3 Activity-Based Costing

Use of Activity-Based Costing

Activity-based costing (ABC) is a response to the significant increase in **indirect costs** resulting from the rapid advance of technology. ABC is a refinement of an existing cost accounting system (job-order or process) for use in internal reporting and management planning and control. It is also used for external reporting to the extent its product-costing function satisfies the relevant standard setter's requirements. ABC may be used by manufacturing, service, or retail entities.

- Under a traditional (volume-based) costing system, overhead is accumulated into a single cost pool and spread evenly across all end products.
- Under ABC, indirect costs are attached to activities that are then rationally allocated to end products.

Companies use ABC because of its ability to solve costing problems that conventional cost accounting either creates or fails to address.

Traditional (Volume-Based) Costing System

The inaccurate averaging or spreading of indirect costs over products or service units that use different amounts of resources is sometimes called **peanut-butter costing**. Peanut-butter costing results in **product-cost cross-subsidization**, the condition in which the miscosting of one product causes the miscosting of other products.

The peanut-butter effect of using a traditional (i.e., volume-based) costing system can be summarized as follows:

- Direct labor and direct materials are traced to products or service units.
- A single pool of indirect costs (overhead) is accumulated for a given organizational unit.
- Indirect costs from the pool are assigned using an allocative (rather than a tracing) procedure, such as using a single overhead rate for an entire department, e.g., \$3 of overhead for every direct labor hour.
- The effect is an averaging of costs that may result in significant inaccuracy when products or service units do not use similar amounts of resources.

Example 8-2 Product-Cost Cross-Subsidization

A company produces two similar products. Both products require one unit of raw material and one hour of direct labor. Raw materials costs are \$14 per unit, and direct labor is \$70 per hour. During the month just ended, the company produced 1,000 units of Product A and 100 units of Product B. Manufacturing overhead for the month totaled \$20,000.

Using direct labor hours as the overhead allocation base, per-unit costs and profits are calculated as follows:

	Product A	Product B	Total
Raw materials	\$ 14,000	\$ 1,400	
Direct labor	70,000	7,000	
Overhead $\{ \$20,000 \times [1,000 \div (1,000 + 100)] \}$	18,182		
Overhead $\{ \$20,000 \times [100 \div (1,000 + 100)] \}$		1,818	
Total costs	\$102,182	\$10,218	\$112,400
Selling price	\$ 119.99	\$ 119.99	
Cost per unit	(102.18)	(102.18)	
Profit per unit	\$ 17.81	\$ 17.81	

The company's management accountants have determined that overhead consists almost entirely of production line setup costs, and that the two products require equal setup times. Allocating overhead on this basis yields vastly different results.

	Product A	Product B	Total
Raw materials	\$14,000	\$ 1,400	
Direct labor	70,000	7,000	
Overhead $\{ \$20,000 \times 50\% \}$	10,000		
Overhead $\{ \$20,000 \times 50\% \}$		10,000	
Total costs	\$94,000	\$18,400	\$112,400
Selling price	\$119.99	\$ 119.99	
Cost per unit	(94.00)	(184.00)	
Profit per unit	\$ 25.99	\$ (64.01)	

Rather than the comfortable profit the company believed it was making on both products using peanut-butter costing, it becomes clear that the company is losing money on every unit of Product B that it sells. The high-volume Product A has been heavily subsidizing the setup costs for the low-volume Product B.

Example 8-2 assumes a single component of overhead for clarity. In reality, overhead is made up of many components.

The peanut-butter effect of traditional overhead allocation is illustrated below.

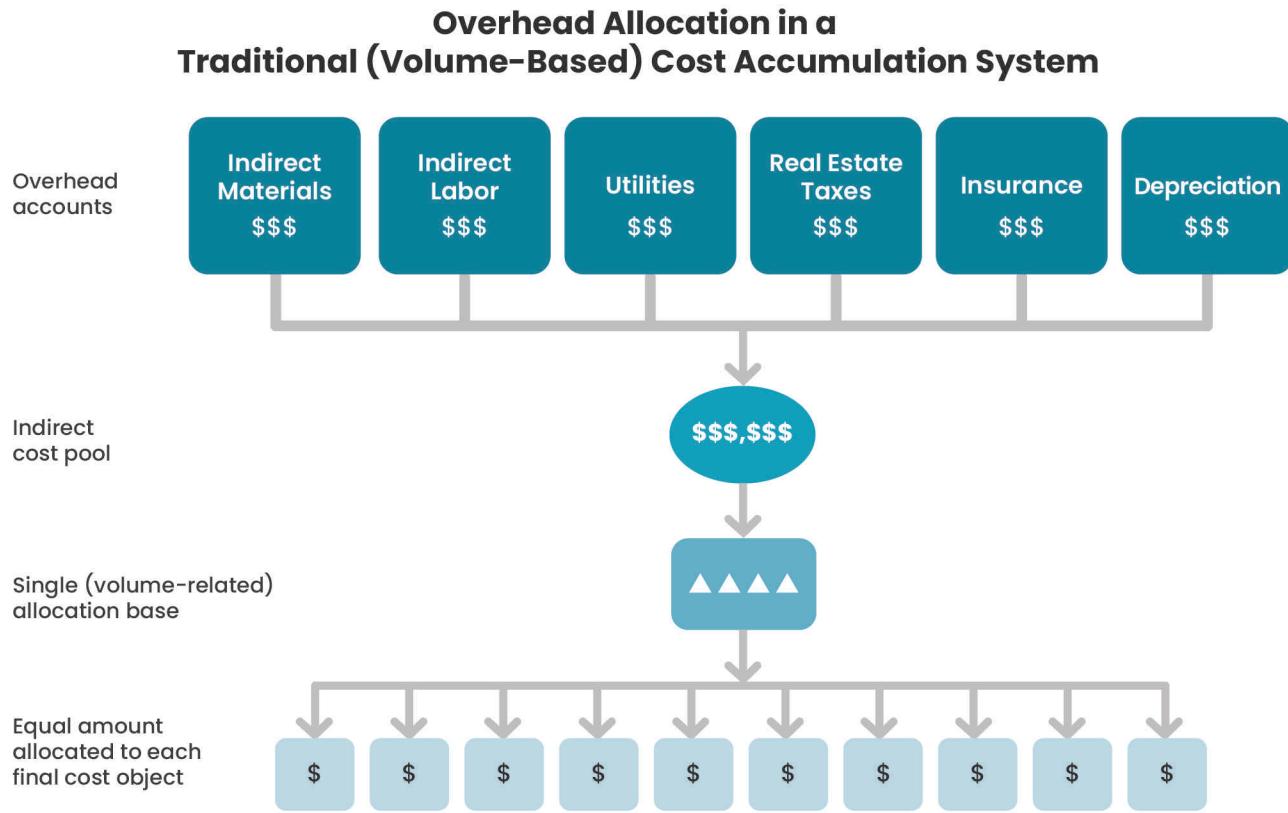


Figure 8-3

Traditional-Based Systems vs. Activity-Based Systems

Traditional-based systems were appropriate when direct costs were the bulk of manufacturing costs. However, increased automation led to increased overhead. ABC was developed to address the increasing complexity of overhead costs.

- **Traditional-based systems**, as illustrated above, involve
 - Accumulating costs in general ledger accounts (utilities, taxes, etc.),
 - Using a single cost pool to combine the costs in all the related accounts,
 - Selecting a single driver to use for the entire indirect cost pool, and
 - Allocating the indirect cost pool to final cost objects.
- **Activity-based systems**, by contrast, involve
 - Identifying organization activities that constitute overhead,
 - Assigning the costs of resources consumed by the activities, and
 - Assigning the costs of the activities to final cost objects, based on the activity that drives (causes) the costs.

Steps in Activity-Based Costing

Step 1 – Activity Analysis

An activity is a set of work actions undertaken within the entity, and a cost pool is established for each activity. Activities are classified in a hierarchy according to the level of the production process at which they take place.

- **Unit-level activities** are performed for each unit of output produced. Examples are using direct materials and using direct labor.
- **Batch-level activities** occur for each group of outputs produced. Examples are materials ordering, materials handling, and production line setup.
- **Product-sustaining (or service-sustaining) activities** support the production of a particular product (or service), irrespective of the level of production. Examples are product design, engineering changes, and testing.
- **Facility-sustaining activities** concern overall operations and therefore cannot be traced to products at any point in the production process. Examples are accounting, human resources, maintenance of physical plant, and safety and security arrangements.

Example 8-3 Identification of Activities

Fabulous Foundry uses a job-order system to accumulate costs for the custom pipe fittings of all sizes that it produces. Since the 1950s, Fabulous has accumulated overhead costs in six general ledger accounts (indirect materials, indirect labor, utilities, real estate taxes, insurance, and depreciation), combined them into a single indirect cost pool, and allocated the total to its products based on machine hours.

- At the time this system was established, overhead was a relatively small percentage of the foundry's total manufacturing costs.
- With increasing reliance on robots in the production process and computers for monitoring and control, overhead is now a greater percentage of the manufacturing costs while direct labor costs have shrunk

To obtain better data about product costs, Fabulous has decided to refine its job-order costing system by switching to activity-based costing for the allocation of overhead.

- The foundry's management accountants conducted extensive interviews with production and sales personnel to determine how the incurrence of indirect costs can be viewed as activities that consume resources.
- The accountants identified five activities and created a cost pool for each to capture the incurrence of indirect costs:

<u>Activity</u>	<u>Hierarchy</u>
Product design	Product-sustaining
Production setup	Batch-level
Machining	Unit-level
Inspection & testing	Unit-level
Customer maintenance	Facility-sustaining

Step 2 – Assign Resource Drivers to Resource Costs

Identifying resource costs in ABC is more complex than it is in volume-based overhead allocation. A separate accounting system may be necessary to track resource costs separately from the general ledger.

Once the resources have been identified, resource drivers are designated to allocate resource costs to the activity cost pools. **Resource drivers** (causes) are measures of the resources consumed by an activity.

Example 8-4 Resource Drivers

Fabulous Foundry's management accountants identified the following resources used by its indirect cost processes:

<u>Resource</u>	<u>Driver</u>
Computer processing	CPU cycles
Production line	Machine hours
Materials management	Hours worked
Accounting	Hours worked
Sales & marketing	Number of orders

Step 3 – Allocate Resource Costs to Activity Cost Pools

Once the resource drivers are determined, the dollar amount of resources per resource driver can be determined.

- One method of doing this is by dividing the total dollar amount of a resource cost by the total amount of the resource driver used by the entire entity.

Costs of resources are then allocated to activity cost pools based on the amount of resource drivers used by each activity cost pool.

Example 8-5 Allocation to Activity Pools

Fabulous Foundry's management accountants have determined that a total amount of \$1,000,000 of Materials Management was used over a total of 100,000 hours worked. Fabulous's management accountants will therefore allocate \$10 ($\$1,000,000 \div 100,000$ hours) to each activity pool for each hour of Materials Management worked for each cost pool.

Activity	Amount Allocated
Product Design	\$250,000 for 25,000 hours
Production Setup	\$270,000 for 27,000 hours
Machining	\$450,000 for 45,000 hours
Inspection & Testing	\$30,000 for 3,000 hours
Customer Maintenance	\$0 for 0 hours

This first-stage allocation is made for each resource.

- Resources will not be allocated to a cost activity that did not use them.

Step 4 – Allocate Activity Cost Pools to Final Cost Objects

The final step in enacting an ABC system is allocating the activity cost pools to final cost objects. This is termed second-stage allocation. Once the cost drivers are determined, the dollar amount of activity pool per activity driver can be determined.

- One method of doing this is by dividing the total dollar amount assigned to an activity cost pool by the total amount of the activity driver used by the entire entity.

Costs are reassigned to final-stage (or, if intermediate cost objects are used, next-stage) cost objects on the basis of activity drivers. **Activity drivers** are measures of the demands made on an activity by next-stage cost objects, such as the number of parts in a product used to measure an assembly activity.

Example 8-6 Activity Drivers

Fabulous Foundry's management accountants have designated the following drivers to associate with their corresponding activities:

Activity	Driver
Product design	Number of products
Production setup	Number of setups
Machining	Number of units produced
Inspection & testing	Number of units produced
Customer maintenance	Number of orders

Indirect Cost Assignment Diagram

The differences between traditional overhead allocation and ABC are illustrated below.

Indirect Cost Assignment in Activity-Based Costing System

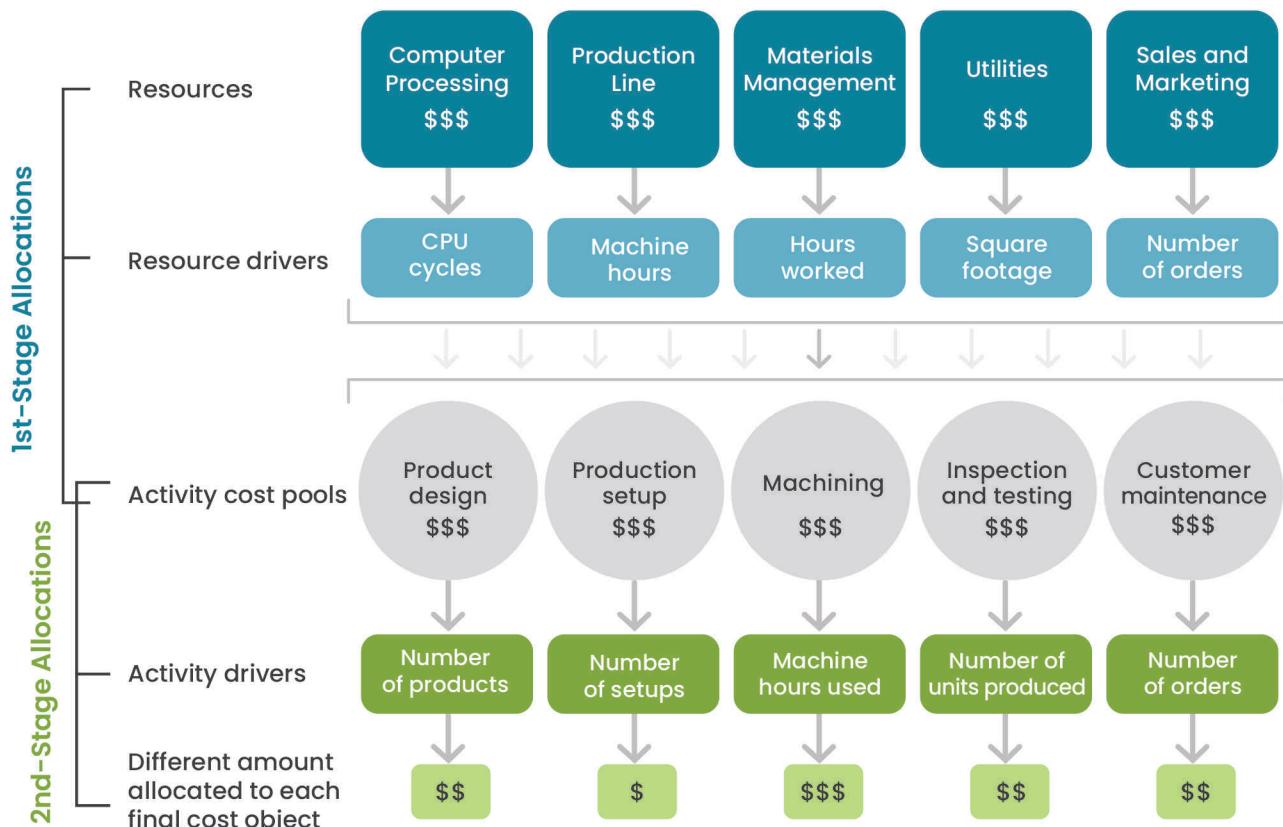


Figure 8-4

Process Value Analysis

Design of an ABC system starts with process value analysis, a comprehensive understanding of how an organization generates its output. A process value analysis involves a determination of which activities that use resources are value-adding or nonvalue-adding and how nonvalue-adding activities may be reduced or eliminated.

- A **value-adding activity** contributes to customer satisfaction or meets a need of the entity. The perception is that it cannot be omitted without a loss of the quantity, quality, or responsiveness of output demanded by the entity or its customers.
- A **nonvalue-adding activity** does not make such a contribution. It can be eliminated, reduced, or redesigned without impairing the quantity, quality, or responsiveness of the product or service desired by customers or the entity.

Activity-based management (ABM) links product costing and continuous improvement of processes through driver analysis, activity analysis, and performance measurement.

Cost Drivers

Drivers (both resource and activity) must be chosen on the basis of a cause-and-effect relationship with the resource or activity cost being allocated, not simply a high positive correlation.

- A cost object may be a job, product, process, activity, service, or anything else for which a cost measure is desired.
- Intermediate cost objects receive temporary accumulations of costs as the cost pools move from their originating points to the final cost objects.
 - For example, work-in-process is an intermediate cost object, and finished salable goods are final cost objects.

Advantages and Disadvantages of Activity-Based Costing

An advantage of ABC is that product costing is improved, making for better decision making.

- The process value analysis performed as part of ABC provides information for eliminating or reducing nonvalue-adding activities (e.g., scheduling production, moving components, waiting for the next operating step, inspecting output, or storing inventories).
 - The result is therefore not only more accurate cost assignments, especially of overhead, but also better cost control and more efficient operations.
- The real benefits of ABC occur when a company has a high level of fixed costs and produces a wide variety of products with widely varying levels of production.

Disadvantages of ABC are

- The cost of implementation.
 - Initial costs are quite high, and continuing costs of application can also be significant. Thus, if a company has a low level of fixed costs, there is little to no advantage in using ABC as compared to a simple overhead application method (such as a fixed amount per direct labor hour).
- The increased time and effort needed to
 - Maintain a separate accounting system to capture resource costs and
 - Design and implement drivers and cost pools.

Organizational Benefits

An organization most likely to benefit from ABC is one with

- A line of products or services that varies significantly in volume, diversity of activities, and complexity of operations;
- Relatively high overhead costs; or
- Operations that have undergone major technological or design changes.

Service organizations as well as manufacturers may benefit from ABC, but implementation can be difficult in these entities.

- They tend to have relatively high facility-level costs that are not readily allocable.
- Their employees perform tasks for which information is not easily accumulated.
- Output measurement is less precise than in manufacturing entities.

Nevertheless, ABC has been adopted by insurers, banks, railroads, and healthcare providers.

8.4 Life-Cycle Costing

Life-Cycle Approach

A life-cycle approach to budgeting estimates a product's revenues and expenses over its entire sales life cycle.

The product life cycle has five phases:

1. The **research and development** phase typically has no sales and high costs.
2. The **introduction** phase is characterized by few competitors. Profits are usually low in the introduction stage because of slow sales growth. Also, costs are high for sales promotion and relatively high for unit costs of production.
3. In the **growth** stage, the number of competitors increases but does not peak. The opportunity for cost reductions is at its maximum during the growth stage because production volume is increasing at a high rate. Thus, fixed costs are spread over more units of production.
4. In the **maturity** phase, sales growth declines and competitors are most numerous.
5. The number of competitors decreases in the **decline** stage.

Life-cycle costing takes a long-term view of the entire cost life cycle, also known as the value chain.

- Costs incurred before production, such as R&D and product design, are **upstream costs**.
- Costs incurred after production, such as marketing and customer service, are **downstream costs**.

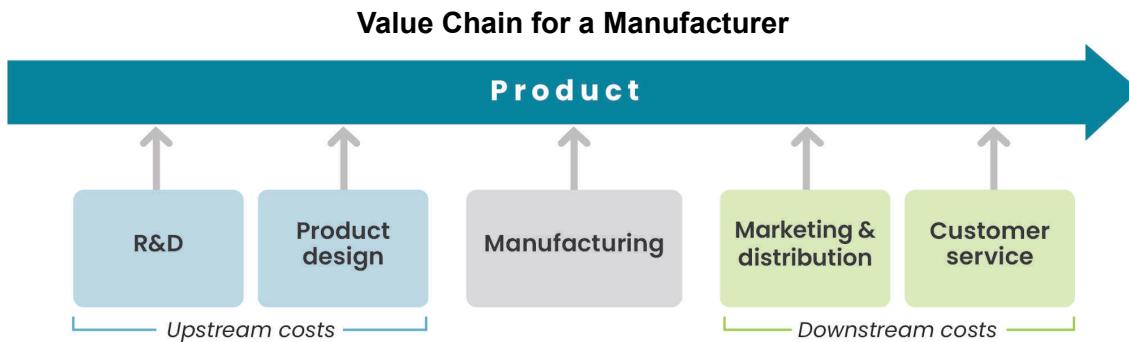


Figure 8-5

This information is important for pricing decisions because revenues must cover costs incurred in each stage of the value chain, not only production.

Potential Benefits of Life-Cycle Costing

Life-cycle costing emphasizes the relationships among costs incurred at different value-chain stages, for example, the effect of reduced design costs on future customer-service costs. Because it makes a distinction between incurring costs (actually using resources) and locking in (designing in) costs, life-cycle costing highlights the potential for cost reduction activities during the upstream phase of the value chain. It is in this phase that the greatest opportunity exists to minimize downstream costs.

Life-Cycle vs. Other Costing Methods

Traditional approaches focus on cost control (as opposed to cost reduction) during production and treat pre- and postproduction (upstream and downstream) costs as period costs that are largely ignored in determining the profitability of specific products.

- Other costs that traditional methods ignore are the after-purchase costs (operating, support, repair, and disposal) incurred by customers.
 - **Whole-life cost** is a concept closely associated with life-cycle cost. Whole-life cost equals the life-cycle cost plus after-purchase costs. Attention to the reduction of all whole-life costs through analysis and management of all value-chain activities is a powerful competitive tool because of the potential for increasing customer satisfaction.
-

Internal and External Reporting Effects

For internal management accounting purposes, the costs (such as R&D) that result in marketable products represent a life-cycle investment and must be capitalized. The reporting system should also allow for capitalization and subsequent allocation of upstream costs for management accounting purposes.

For external financial statement purposes, costs during the upstream phase must be expensed in the period incurred. As a result, organizations that focus on a product's life cycle must develop an accounting system consistent with GAAP for external financial reporting purposes.

Evaluating Management

The overall advantage of life-cycle costing is that it provides a better measure for evaluating the performance of product managers. Life-cycle costing combines all costs and revenues for all periods to provide a better view of a product's overall performance.

- Traditional financial statements, however, might report that certain products were extremely profitable because upstream costs were expensed in previous periods.
 - For example, if a substantial investment is made in the development of a new product but that product quickly becomes obsolete due to new technology, how worthwhile was the investment?

Study Unit Nine

Cost Allocation Techniques

9.1	<i>Joint Product and By-Product Costing</i>	2
9.2	<i>Overhead Allocation and Normal Costing</i>	8
9.3	<i>Allocating Service Department Costs</i>	16

This study unit is the **third of five on cost management**. The relative weight assigned to this major topic in Part 1 of the exam is **15%**. The five study units are

- Study Unit 7: Cost Management Concepts
- Study Unit 8: Cost Accumulation Systems
- **Study Unit 9: Cost Allocation Techniques**
- Study Unit 10: Supply Chain Management
- Study Unit 11: Business Process Improvement

This study unit discusses cost allocation for both financial accounting and managerial accounting. In financial accounting, cost allocation is necessary to prepare the balance sheet and income statement. In managerial accounting, cost allocation is necessary to make decisions about pricing and resource allocation. Topics covered in this study unit include

- Joint cost allocation, including
 - Joint product cost and by-product costing
 - Concepts related to the split-off point and separable costs
 - Physical measure method
 - Sales value at split-off method
 - Constant gross margin method
 - Net realizable value method
- Overhead allocation, including
 - Distinguishing between fixed and variable overhead expenses
 - Methods for determining overhead rates
 - Overapplied and underapplied overhead

- Service department cost allocation techniques, including
 - Direct method
 - Step-down method
 - Reciprocal method
 - Dual allocation method

9.1 Joint Product and By-Product Costing

Joint vs. Separable Costs

Often a manufacturing process involves processing a single input up to the point at which multiple end products (joint products) become separately identifiable, called the **split-off point**.

Joint (common) costs are those costs incurred before the split-off point; i.e., since they are not traceable to the end products, they must be allocated.

- Joint costs include direct materials, direct labor, and manufacturing overhead. Because they are not separately identifiable, they must be allocated to the individual joint products.
- For example, the cost of a tree would be a joint cost for a lumber yard.

Separable costs are those incurred beyond the split-off point, i.e., once they can be identified with a particular joint product and allocated to a specific unit of output.

By-products are products of relatively small total value that are produced simultaneously from a common manufacturing process with products of greater value and quantity (joint products).

- For example, a lumber yard might have leftover lumber and sawdust that could be sold as by-products for a small amount.

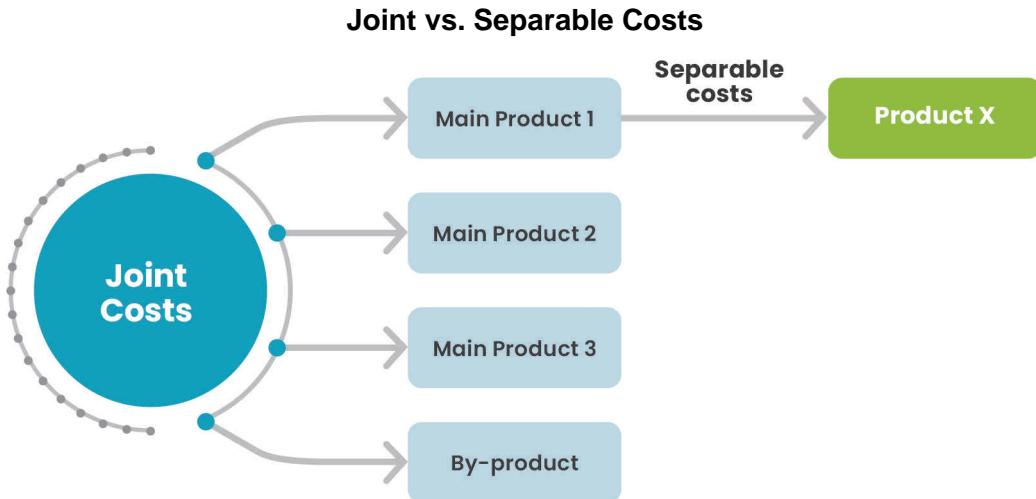


Figure 9-1

Joint Cost Allocation

Because joint costs cannot be traced to individual products, they must be allocated. The primary purpose for allocating common costs to joint products is to determine the inventory cost of joint products for financial reporting. The methods available for this allocation can be classified into two conceptual groups.

1. The **physical-measure-based approach** employs a physical measure, such as volume, weight, or a linear measure.
2. **Market-based approaches** assign a proportionate amount of the total cost to each product on a monetary basis. They include the
 - Sales-value at split-off method
 - Estimated net realizable value (NRV) method
 - Constant-gross-margin percentage NRV method

Physical-Measure-Based Approach

The **physical-unit method** (also called the physical quantities method) allocates joint production costs to each product based on their relative proportions of the measure selected.

Example 9-1 Joint Costing -- Physical-Unit Method

A refinery processes 1,000 barrels of crude oil and incurs \$100,000 of processing costs. The process results in the following outputs. Under the physical-unit method, the joint costs up to split-off are allocated as follows:

Asphalt	$\$100,000 \times (300 \text{ barrels} \div 1,000 \text{ barrels}) = \$ 30,000$
Fuel oil	$\$100,000 \times (300 \text{ barrels} \div 1,000 \text{ barrels}) = 30,000$
Diesel fuel	$\$100,000 \times (200 \text{ barrels} \div 1,000 \text{ barrels}) = 20,000$
Kerosene	$\$100,000 \times (100 \text{ barrels} \div 1,000 \text{ barrels}) = 10,000$
Gasoline	$\$100,000 \times (100 \text{ barrels} \div 1,000 \text{ barrels}) = 10,000$
Joint costs allocated	
	<u>\$100,000</u>

Advantages of the physical-unit method include

- Ease of use
- Having objective criteria for the allocation of joint costs

The physical-unit method's simplicity makes it appealing, but it does not match costs with the individual products' revenue-generating potential. It treats low-value products that are large in size as if they were valuable. As a result, a large, low-value product might always show a loss while a small, high-value product shows a profit. Thus, the physical-unit method is rarely beneficial.

Market-Based Approaches

These allocations are performed using the entire production run for an accounting period, not units sold. This is because the joint costs were incurred on all the units produced, not just those sold.

The **sales-value at split-off method** (also called the gross market value method) is based on the relative sales values of the separate products at split-off.

Example 9-2 Sales-Value at Split-Off Method

The refinery estimates that the five outputs can sell for the following prices at split-off:

Asphalt	300 barrels at \$ 60/barrel	= \$ 18,000
Fuel oil	300 barrels at \$180/barrel	= 54,000
Diesel fuel	200 barrels at \$160/barrel	= 32,000
Kerosene	100 barrels at \$ 80/barrel	= 8,000
Gasoline	100 barrels at \$180/barrel	= 18,000
Total sales value at split-off		<u>\$130,000</u>

The total expected sales value for the entire production run at split-off is thus \$130,000. Multiply the total joint costs to be allocated by the proportion of the total expected sales of each product:

Asphalt	$\$100,000 \times (\$18,000 \div \$130,000)$	= \$ 13,846
Fuel oil	$\$100,000 \times (\$54,000 \div \$130,000)$	= 41,539
Diesel fuel	$\$100,000 \times (\$32,000 \div \$130,000)$	= 24,615
Kerosene	$\$100,000 \times (\$ 8,000 \div \$130,000)$	= 6,154
Gasoline	$\$100,000 \times (\$18,000 \div \$130,000)$	= 13,846
Joint costs allocated		<u>\$100,000</u>

The **estimated NRV method** also allocates joint costs based on the relative market values of the products.

- The significant difference is that, under the estimated NRV method, all separable costs necessary to make the product salable are subtracted before the allocation is made.

Example 9-3 Joint Costing -- Estimated NRV Method

The refinery estimates final sales prices as follows:

Asphalt	300 barrels at \$ 70/barrel	= \$21,000
Fuel oil	300 barrels at \$200/barrel	= 60,000
Diesel fuel	200 barrels at \$180/barrel	= 36,000
Kerosene	100 barrels at \$ 90/barrel	= 9,000
Gasoline	100 barrels at \$190/barrel	= 19,000

From these amounts, separable costs are subtracted (these costs are given):

Asphalt	\$21,000 – \$1,000	= \$ 20,000
Fuel oil	\$60,000 – \$1,000	= 59,000
Diesel fuel	\$36,000 – \$1,000	= 35,000
Kerosene	\$ 9,000 – \$2,000	= 7,000
Gasoline	\$19,000 – \$2,000	= 17,000
Total net realizable value		<u>\$138,000</u>

Multiply the total joint costs to be allocated by the proportion of the final expected sales of each product:

Asphalt	$\$100,000 \times (\$20,000 \div \$138,000)$	= \$ 14,493
Fuel oil	$\$100,000 \times (\$59,000 \div \$138,000)$	= 42,754
Diesel fuel	$\$100,000 \times (\$35,000 \div \$138,000)$	= 25,362
Kerosene	$\$100,000 \times (\$ 7,000 \div \$138,000)$	= 5,072
Gasoline	$\$100,000 \times (\$17,000 \div \$138,000)$	= 12,319
Joint costs allocated		<u>\$100,000</u>

The **constant-gross-margin percentage NRV method** is based on allocating joint costs so that the gross-margin percentage is the same for every product.

The three steps under this method are

1. Determine the overall gross-margin percentage.
2. Subtract the appropriate gross margin from the final sales value of each product to calculate total costs for that product.
3. Subtract the separable costs to arrive at the joint cost amount.

Example 9-4 Joint Costing -- Constant-Gross-Margin Percentage

The refinery uses the same calculation of expected final sales price as under the estimated NRV method:

Asphalt	300 barrels at \$ 70/barrel	= \$ 21,000
Fuel oil	300 barrels at \$200/barrel	= 60,000
Diesel fuel	200 barrels at \$180/barrel	= 36,000
Kerosene	100 barrels at \$ 90/barrel	= 9,000
Gasoline	100 barrels at \$190/barrel	= 19,000
Total of final sales prices		<u>\$145,000</u>

The final sales value for the entire production run is thus \$145,000. From this total, the joint costs and total separable costs are deducted to arrive at a total gross margin for all products:

$$\$145,000 - \$100,000 - \$7,000 = \$38,000$$

The gross margin percentage can then be derived:

$$\$38,000 \div \$145,000 = 26.21\%$$

Deduct gross margin from each product to arrive at a cost of goods sold:

Asphalt	$\$21,000 - (\$21,000 \times 26.21\%)$	= \$15,497
Fuel oil	$\$60,000 - (\$60,000 \times 26.21\%)$	= 44,276
Diesel fuel	$\$36,000 - (\$36,000 \times 26.21\%)$	= 26,565
Kerosene	$\$ 9,000 - (\$ 9,000 \times 26.21\%)$	= 6,641
Gasoline	$\$19,000 - (\$19,000 \times 26.21\%)$	= 14,021

Deduct the separable costs from each product to arrive at the allocated joint costs:

Asphalt	$\$15,497 - \$1,000$	= \$ 14,497
Fuel oil	$\$44,276 - \$1,000$	= 43,276
Diesel fuel	$\$26,565 - \$1,000$	= 25,565
Kerosene	$\$ 6,641 - \$2,000$	= 4,641
Gasoline	$\$14,021 - \$2,000$	= 12,021
Joint costs allocated		<u>\$100,000</u>

Comparing Market-Based Approaches to the Physical-Measure-Based Approach

The three market-based approaches are far superior to the physical-measure-based approach because they produce an allocation that yields a predictable, comparable level of profitability among the products.

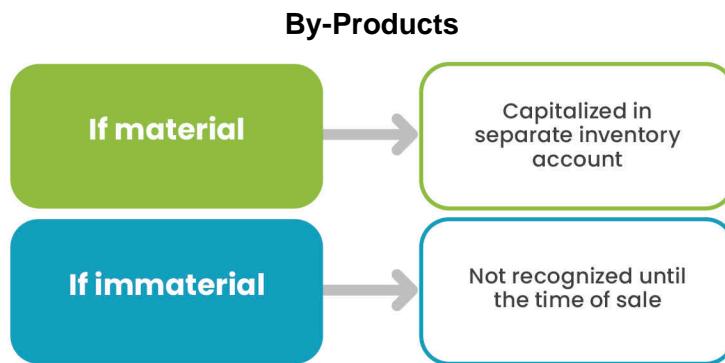
Accounting for By-Products

By-products are one or more products of relatively small total value that are produced simultaneously from a common manufacturing process with products of greater value and quantity. By-products, therefore, are defined as having a smaller market value (relative total sales value) than joint products.

The first question that must be answered in regard to by-products is: Do the benefits of further processing and bringing them to market exceed the costs?

$$\text{Selling price} - \text{Additional processing costs} - \text{Selling costs} = \text{Net realizable value}$$

- If the net realizable value is zero or negative, the by-products should be discarded as scrap.
- If the by-products are **material**, they are capitalized in a separate inventory account. The amount capitalized is the entire estimated net realizable value of the by-products generated during the period. This treatment is justifiable when a ready market for the by-products is available.
- If the by-products are **immaterial**, they are not recognized until the time of sale. The amount of miscellaneous revenue (or reduction to cost of goods sold) reported is the actual proceeds from the sale of the by-products.
- Regardless of the timing of their recognition in the accounts, by-products usually do not receive an allocation of joint costs because the cost of this accounting treatment ordinarily exceeds the benefit.



Sell-or-Process-Further Decisions

The decision to sell or process further is made based on whether the incremental revenue to be gained by further processing exceeds the incremental cost thereof. This type of decision is tested on Part 2 of the CMA exam. The joint cost of the product is irrelevant because it is a sunk cost.

9.2 Overhead Allocation and Normal Costing

Components of Manufacturing Overhead

Manufacturing overhead consists of all costs of manufacturing that are not direct materials or direct labor.

- Indirect materials are tangible inputs to the manufacturing process that cannot practicably be traced to the product, e.g., the welding compound used to put together a piece of heavy equipment.
- Indirect labor is the cost of human labor connected with the manufacturing process that cannot practicably be traced to the product, e.g., the wages of assembly line supervisors and janitorial staff.
- Factory operating costs, such as utilities, real estate taxes, insurance, depreciation on factory equipment, etc. Overhead thus consists of all costs of manufacturing that are not direct materials or direct labor.

Variable and Fixed Components

Unlike direct materials and direct labor, which are purely variable costs, overhead contains both variable and fixed components.

- **Variable overhead costs** include indirect materials, indirect labor, utilities, and depreciation expense under any method that ties depreciation to the level of output.
- **Fixed overhead costs** include real estate taxes, insurance, and depreciation expense under any method not related to the level of output. The costs of defective units, if normal, are also charged to overhead.

A key factor in budgeting overhead is production volume. For example, variable overhead costs are fixed within a relevant range and may increase if output increases substantially. Another key factor is management's judgments about the nature and amounts of costs and estimates of output.

Budgeted (estimated) overhead for the year is accumulated in two indirect cost pools (one for variable costs and one for fixed), which then are allocated to production using an approximate allocation base for each.

Example 9-5 Budgeted Estimates of Total Overhead Costs

A manufacturer is preparing its budget for the upcoming year and has compiled the following estimates of total costs:

Cost Element	Estimated Variable Overhead	Estimated Fixed Overhead
Indirect materials	\$ 80,000	
Indirect labor	46,000	
Utilities	155,000	
Real estate taxes		\$ 81,000
Insurance		54,000
Straight-line depreciation		240,000
Totals	<u>\$281,000</u>	<u>\$375,000</u>

Selecting an Allocation Base

The most important criterion in accurate cost allocations is using homogeneous cost pools. After creating cost pools, an allocation base is selected for each pool. The crucial quality of an allocation base is that it be a cost driver of the costs in the pool to be allocated.

- Recall that a cost driver should capture a cause-and-effect relationship between the level of the driver and the level of the cost being allocated.

In labor-intensive industries, direct labor hours or cost is an appropriate driver. In capital-intensive industries, machine hours is more appropriate. Still other bases may be used in an ABC system. It is therefore possible that variable and fixed overhead will employ the same allocation base.

- Overhead is usually not allocated on the value of units produced because of the lack of a cause-and-effect relationship.

Calculating the Application Rate

Once appropriate allocation bases have been selected, the predetermined overhead application rates are calculated.

$$\text{Predetermined variable overhead rate} = \frac{\text{Total estimated variable overhead}}{\text{Total estimated variable allocation base}}$$

$$\text{Predetermined fixed overhead rate} = \frac{\text{Total estimated fixed overhead}}{\text{Total estimated fixed allocation base}}$$

Estimates of the total quantity of each allocation base can be based off different capacity levels.

- **Normal capacity** is the long-term average level of activity that will approximate demand over a period that includes seasonal, cyclical, and trend variations. Deviations in a given year will be offset in subsequent years.
- **Practical capacity** is the maximum level at which output is produced efficiently. It allows for unavoidable delays in production for maintenance, holidays, etc. Practical capacity is based on realistic, attainable levels of production and input efficiency.
 - This is the most appropriate denominator level to use in selecting an overhead application rate.
- **Theoretical (ideal) capacity** is the maximum capacity assuming continuous operations with no holidays, downtime, etc.

Example 9-6 Overhead Allocation Rates

The company's best projection for the upcoming year is that 1,110,000 units will be produced and 57,000 machine hours will be expended. The overhead allocation rates can thus be calculated as follows:

Variable overhead application rate:	$\$281,000 \div 1,110,000 \text{ units of output} = \0.253 per unit
Fixed overhead application rate:	$\$375,000 \div 57,000 \text{ machine hours} = \6.579 per hour

A significant conceptual challenge is understanding the need to apply fixed overhead using an allocation base rather than simply to recognize one-twelfth of the estimated total every month.

- Since fixed costs are by their nature unchanging within the relevant range, using an allocation base at first appears to unnecessarily complicate the bookkeeping process. But, one way or another, fixed costs must be covered by selling products to customers.
- The advantage of applying fixed overhead at a predetermined rate is that an allocation base, even if only indirectly, reflects the level of productive activity.
 - If production is way down or way up in a particular month, using an allocation base will result in a fixed overhead production-volume variance, also called the denominator-level variance (discussed in more detail in Study Unit 15, Subunit 6).
 - The existence of a production-volume/denominator-level variance alerts management to the fact that fixed costs are being spread among fewer or more units, respectively, than anticipated.

Departmental vs. Corporate-Wide Rates

All the examples of overhead application so far have employed a single corporate-wide rate. This method has the benefit of simplicity. However, some production departments may be labor-intensive while others are machine-intensive. In these cases, the use of a single driver for applying overhead to every phase of production results in the miscosting of products, less effective control, and less efficient operations.

- Corporate-wide rates in such circumstances may diminish the motivation of managers to achieve goals and hinder the appropriate evaluation of their performance.
- A more accurate method is the use of departmental rates.

Example 9-7 Departmental Overhead Allocation Rates

A company is preparing its overhead budget for the coming year and has selected direct labor hours as the allocation base.

	Budgeted Overhead	Allocation Base	Overhead Application Rate
Department A	\$ 60,000		
Department B	40,000		
Total process	<u>\$100,000</u>	÷ 20,000 =	\$5.00 per direct labor hour

A study by the company's management accountants reveals that Department A heavily employs direct labor while Department B is far more automated.

- Of the total direct labor hours budgeted for the year, 15,000 are projected for Department A and only 5,000 for Department B.
- At the same time, Department A is projected to consume 8,000 machine hours while Department B is projected to use 16,000.

Instead of applying a single corporate-wide application rate, a more accurate allocation can be obtained by using a different allocation base for each production department.

	Budgeted Overhead	Allocation Base	Overhead Application Rate
Department A	\$60,000	÷ 15,000 =	\$4.00 per direct labor hour
Department B	\$40,000	÷ 16,000 =	\$2.50 per machine hour

When indirect costs represent a large proportion of total production costs, ABC, which uses cost pools for all costs (not just overhead), may be the most appropriate cost accumulation system.

Time Frame for Calculating Application Rates

Calculating new overhead application rates each interim period can result in misleading unit costs. Overhead rates are normally calculated annually.

Normal costing derives a single overhead application rate by looking at the entire year (normal costing is defined in Study Unit 7, Subunit 3).

Extended normal costing applies a normalized rate to direct costs as well as to manufacturing overhead.

The following table summarizes the use of rates in the three costing methods:

	Actual Costing	Normal Costing	Extended Normal Costing
Direct Materials	Actual	Actual	Budgeted
Direct Labor	Actual	Actual	Budgeted
Manufacturing Overhead	Actual	Budgeted	Budgeted

Recording Actual Overhead Costs

During the budget period, actual overhead costs are accumulated in the control accounts as they are incurred. The flow of costs is covered in detail in Study Unit 8, Subunit 1. Manufacturing overhead control is used to accumulate actual overhead costs.

Allocating Overhead to Work-in-Process

At the end of the period, overhead is applied to work-in-process based on the actual level of the driver (e.g., Actual machine hours \times Application rate). The transaction will increase work-in-process inventory and manufacturing overhead applied, as described in Study Unit 8, Subunit 1.

- Companies may use one manufacturing overhead applied account or separate accounts for fixed and variable costs.

Example 9-8 Overhead Application

Company X predicts the following overhead costs for the upcoming year:

Estimated variable overhead = \$400,000

Estimated fixed overhead = \$700,000

The variable overhead application base is units, and the budgeted number of units for the next year is 100,000 units. The fixed overhead application base is machine hours, and the budgeted machine hours for the next year is 280,000 hours.

The variable overhead predetermined overhead rate is \$4.00 per unit ($\$400,000 \div 100,000$ units). The fixed overhead predetermined overhead rate is \$2.50 per machine hour ($\$700,000 \div 280,000$ hours).

Actual production is 95,000 units, and the actual number of machine hours used is 300,000 hours.

Applied variable overhead = $\$4.00 \times 95,000$ hours = \$380,000

Applied fixed overhead = $\$2.50 \times 300,000$ hours = \$750,000

Over- and Underapplied Overhead

Inevitably, the overhead amounts applied throughout the year will vary from the amount actually incurred, which is only determinable once the job is complete. This variance is called over- or underapplied overhead.

Overhead Balance	Relationship
Overapplied	Applied overhead > Actual overhead cost
Underapplied	Applied overhead < Actual overhead cost

- Overapplied overhead results when product costs are overstated because the
 - Activity level was higher than expected or
 - Actual overhead costs were lower than expected.
- Underapplied overhead results when product costs are understated because the
 - Activity level was lower than expected or
 - Actual overhead costs were higher than expected.

If the amount of over- or underapplied overhead is considered **immaterial**, it can be closed directly to cost of goods sold.

Overhead Balance	When Allocated
Overapplied	Decreases cost of goods sold
Underapplied	Increases cost of goods sold

Example 9-9 Immaterial Over- or Underapplied Overhead

Using the information from Example 9-8, assume the actual variable overhead is \$385,000 and the actual fixed overhead is \$748,000.

Variable overhead is underapplied by \$5,000 (\$380,000 applied < \$385,000 actual).

Fixed overhead is overapplied by \$2,000 (\$750,000 applied > \$748,000 actual).

Because these amounts are insignificant, they are allocated only to cost of goods sold. The net impact is a \$3,000 increase to cost of goods sold (\$5,000 underapplied – \$2,000 overapplied = \$3,000 underapplied, net).

If the amount of over- or underapplied overhead is considered **material**, it should be allocated based on the relative values of work-in-process inventory, finished goods inventory, and cost of goods sold.

- This is the most accurate method for allocating over- or underapplied overhead.

Overhead Balance	When Allocated
Overapplied	Decreases cost of goods sold Decreases work-in-process inventory Decreases finished goods inventory
Underapplied	Increases cost of goods sold Increases work-in-process inventory Increases finished goods inventory

Example 9-10 Material Over- or Underapplied Overhead

Using the information from Example 9-8, assume the actual variable overhead is \$315,000 and the actual fixed overhead is \$730,000.

Variable overhead is overapplied by \$65,000 (\$380,000 applied > \$315,000 actual).

Fixed overhead is overapplied by \$20,000 (\$750,000 applied > \$730,000 actual).

Because these amounts are significant, they are allocated based on the relative values of work-in-process inventory, finished goods inventory, and cost of goods sold. The total to be allocated is \$85,000 overapplied.

Balances prior to allocation:

Work-in-process inventory	\$1,300,000	20%
Finished goods inventory	650,000	10%
Cost of goods sold	4,550,000	70%
Total	\$6,500,000	100%

Amounts allocated:

Work-in-process inventory	\$17,000 (\$85,000 × 20%)
Finished goods inventory	8,500 (\$85,000 × 10%)
Cost of goods sold	59,500 (\$85,000 × 70%)

Balances after allocation:

Work-in-process inventory	\$1,283,000 (\$1,300,000 – \$17,000)
Finished goods inventory	641,500 (\$650,000 – \$8,500)
Cost of goods sold	4,490,500 (\$4,550,000 – \$59,500)

9.3 Allocating Service Department Costs

Service (support) department costs are considered part of overhead (indirect costs). They cannot feasibly be traced to cost objects and must be allocated to the operating departments that use the services. When service departments also render services to each other, their costs may be allocated to each other before allocation to operating departments.

- Allocation of these overhead costs is necessary to determine product costs and calculate the entity's cost of goods sold and ending inventory for external financial reporting.

The three methods of service department allocation in general use are the direct method, the step-down method, and the reciprocal method.

- With the direct and reciprocal methods, the order of allocation is irrelevant.
- However, under the step-down method, some service department costs are allocated to other service departments before allocation to the operating departments, so the order of allocation does impact the calculations.

Direct Method

The direct method is the simplest. Under the direct method, service department costs are allocated directly to the producing departments without regard for services rendered by service departments to each other.

- Service department costs are allocated to production departments based on an allocation base appropriate to each service department's function.

Example 9-11 Service Cost Allocation -- Direct Method

A company has the following service department costs and allocation bases:

Service Department	Costs to Be Allocated	Allocation Base
Information Technology	\$120,000	CPU cycles
Custodial Services	40,000	Floor space
Total	\$160,000	

The production departments have the following preallocation costs and allocation base amounts:

Production Department	Preallocation Costs	CPU Cycles Used	%	Floor Space in Sq. Ft.	%
Milling	\$300,000	60,000,000	62.5%	56,000	70.0%
Finishing	200,000	36,000,000	37.5%	24,000	30.0%
Totals	\$500,000	96,000,000	100.0%	80,000	100.0%

The direct method allocates the service department costs to the production departments as follows:

	Service Departments		Production Departments		
	Information Technology	Custodial Services	Milling	Finishing	Total
Totals before allocation	\$120,000	\$40,000	\$300,000	\$200,000	\$660,000
Allocate IT (62.5%, 37.5%)	(120,000)	–	75,000	45,000	0
Allocate Custodial (70.0%, 30.0%)	–	(40,000)	28,000	12,000	0
Totals after allocation	\$ 0	\$ 0	\$403,000	\$257,000	\$660,000

Step-Down Method

Under the step-down method, some costs of services rendered by service departments are allocated to each other. This method derives its name from the procedure involved. The service departments are allocated in order. After the first department is allocated, you step down to the next allocation.



Author's Note

CMA candidates should not need to determine the order of allocation for the step-down method because CMA exam questions generally provide this information. There are many methodologies for the order of allocation, but the primary method is to allocate service departments from the one that provides the most service to other service departments down to the one that provides the least.

Example 9-12 Service Cost Allocation -- Step-Down Method

Using the data from Example 9-11, now assume the company uses the step-down method beginning with Custodial Services.

The first step is to determine the relative proportions of the three departments that will receive the first allocation (the second allocation will only be distributed to the two production departments, whose allocation bases were determined under the direct method in Example 9-11).

Allocate Custodial Services:	Floor Space in Sq. Ft.	%	Amount to Be Allocated	Departmental Allocations
To Milling	56,000	56.0%	\$40,000	\$22,400
To Finishing	24,000	24.0%	40,000	9,600
To Information Technology	20,000	20.0%	40,000	8,000
Totals	100,000	100.0%		\$40,000

The step-down allocation is performed as follows:

	Service Departments		Production Departments		
	Custodial Services	Information Technology	Milling	Finishing	Total
Totals before allocation	\$ 40,000	\$120,000	\$300,000	\$200,000	\$660,000
Allocate Custodial	(40,000)	8,000	22,400	9,600	0
Totals after first allocation	\$ 0	\$128,000	\$322,400	\$209,600	\$660,000

Allocate IT:	CPU Cycles Used	%	Amount to Be Allocated	Departmental Allocations
To Milling	60,000,000	62.5%	\$128,000	\$ 80,000
To Finishing	36,000,000	37.5%	128,000	48,000
Totals	96,000,000	100.0%		\$128,000

	Production Departments		
	Information Technology	Milling	Finishing
Totals after first allocation	\$128,000	\$322,400	\$209,600
Allocate IT	(128,000)	80,000	48,000
Totals after second allocation	\$ 0	\$402,400	\$257,600
			Total
			\$660,000

Reciprocal Method

The reciprocal method is the most complex and the most theoretically sound of the three methods. It is also known as the simultaneous solution method, cross allocation method, matrix allocation method, or double distribution method. Under the reciprocal method, services rendered by all service departments to each other are recognized.

Example 9-13 Service Cost Allocation -- Reciprocal Method

The reciprocal method requires calculating the allocation base amounts for information technology; i.e., the service department that was not allocated to the other service department under the step method (Example 9-12).

Allocate Information Technology:	CPU Cycles	
	Used	%
To Milling	60,000,000	60.0%
To Finishing	36,000,000	36.0%
To Custodial Services	4,000,000	4.0%
Totals	<u>100,000,000</u>	<u>100.0%</u>

Use linear algebra to calculate fully reciprocated information technology costs (FRITC) and fully reciprocated custodial services costs (FRCSC):

$$\begin{aligned} \text{FRITC} &= \text{Preallocation IT costs} + (\text{FRCSC} \times \text{Portion of custodial effort used by IT}) \\ &= \$120,000 + (\text{FRCSC} \times 20\%) \end{aligned}$$

$$\begin{aligned} \text{FRCSC} &= \text{Preallocation custodial costs} + (\text{FRITC} \times \text{Portion of IT effort used by custodial}) \\ &= \$40,000 + (\text{FRITC} \times 4\%) \end{aligned}$$

These algebraic equations can be solved simultaneously.

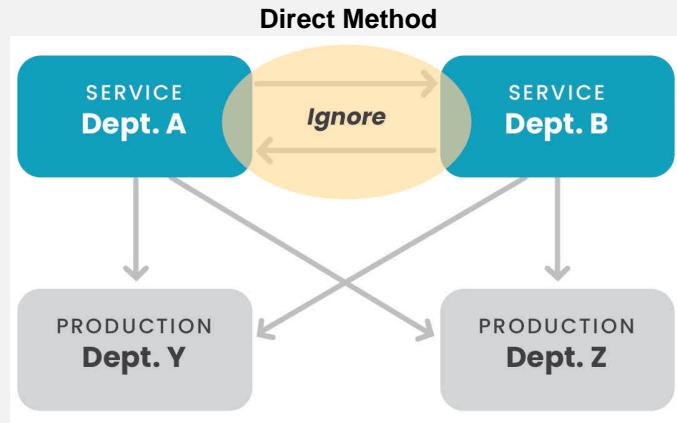
$$\begin{aligned} \text{FRITC} &= \$120,000 + (\text{FRCSC} \times 20\%) \\ &= \$120,000 + \{[\$40,000 + (\text{FRITC} \times 4\%)] \times 20\% \} \\ &= \$120,000 + [(\$40,000 + .04\text{FRITC}) \times .2] \\ &= \$120,000 + \$8,000 + .008\text{FRITC} \\ .992\text{FRITC} &= \$128,000 \\ \text{FRITC} &= \$129,032 \\ \\ \text{FRCSC} &= \$40,000 + (\text{FRITC} \times 4\%) \\ &= \$40,000 + (\$129,032 \times .04) \\ &= \$40,000 + \$5,161 \\ &= \$45,161 \end{aligned}$$

The reciprocal allocation is performed as follows:

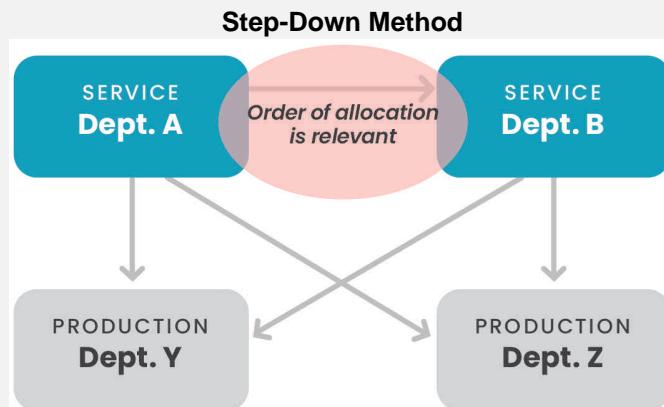
	Service Departments		Production Departments		
	Custodial Services	Information Technology	Milling	Finishing	Total
Totals before allocation	\$40,000	\$120,000	\$300,000	\$200,000	\$660,000
Allocate Custodial Services (20.0%, 56.0%, 24.0%)	(45,161)	9,032	25,290	10,839	0
Allocate Information Tech. (4.0%, 60.0%, 36.0%)	5,161	(129,032)	77,419	46,452	0
Totals after allocation	<u>\$ 0</u>	<u>\$ 0</u>	<u>\$402,709</u>	<u>\$257,291</u>	<u>\$660,000</u>

Example 9-14 Summary of Service Department Cost Allocation

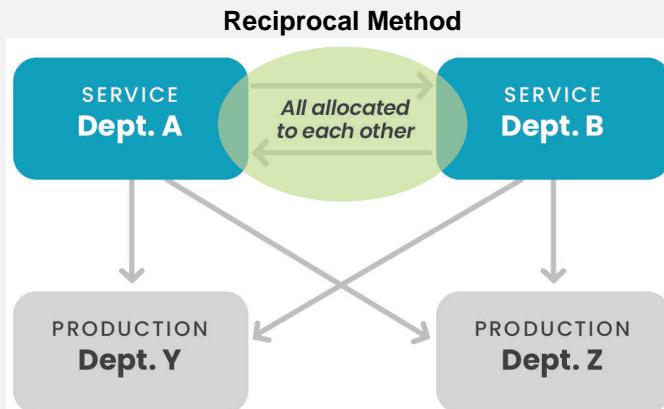
Assume Amy Company has two service departments: A and B, and two production departments: Y and Z. Under the direct method, Dept. A costs are allocated directly to Dept. Y and Dept. Z. Dept. B costs also are allocated directly to Dept. Y and Dept. Z. The services that are provided to A by B and to B by A are ignored in the direct method.



Under the step-down method, the order of allocation is relevant. One of the service department costs will first be allocated to the other. In this example, Dept. A costs are allocated first. That means that Dept. A costs will be allocated to B, Y, and Z. Then, when Dept. B costs are allocated, B costs are only allocated to the two production departments: Y and Z.



Under the reciprocal method, Dept. A costs are allocated to B, Y, and Z. Dept. B costs are allocated to A, Y, and Z.



Single-Rate vs. Dual-Rate Allocation

The previous examples employed a single rate to allocate the costs of each support department.

- A single-rate allocation combines fixed and variable costs.
- Dual rates allow variable costs to be allocated on a different basis than fixed costs.
 - The dual-rate method can be used to refine a system currently using a single rate under any of the other methods (direct, step-down, or reciprocal).

Example 9-15 Dual-Rate Service Cost Allocation

The company has decided to allocate the IT department's costs using a dual-rate method, one rate for the costs of IT's investment in hardware and software (fixed) and another rate for the costs of services provided (variable).

- The IT department has determined that \$40,000 of its total allocable costs are associated with variable costs. These will henceforth be allocated using technician and programmer hours.
- The company's technicians and programmers worked a total of 1,600 hours on projects for the Milling and Finishing Departments during the period. Variable IT costs will thus be applied at the rate of \$25 per hour ($\$40,000 \div 1,600$).
- The remaining \$80,000 of allocable IT costs are associated with the department's investment in fixed items. These costs will continue to be allocated using CPU cycles.
- Since the company's central computers consumed a total of 96 million CPU cycles doing processing for the Milling and Finishing Departments during the period, fixed IT costs will be applied at the rate of \$0.00083 per cycle ($\$80,000 \div 96,000,000$).

The dual-rate allocations will be made as follows:

Allocate to Milling:	Driver Units Consumed	Application Rate	Totals
Variable IT costs	640 hours	× \$25.00	= \$16,000
Fixed IT costs	60,000,000 cycles	× \$0.00083	= 50,000
Total			\$66,000
<hr/>			
Allocate to Finishing:	Driver Units Consumed	Application Rate	Totals
Variable IT costs	960 hours	× \$25.00	= \$24,000
Fixed IT costs	36,000,000 cycles	× \$0.00083	= 30,000
Total			\$54,000

The total amount of IT department costs has been allocated ($\$66,000 + \$54,000 = \$120,000$).

Study Unit Ten

Supply Chain Management

10.1	<i>Just-in-Time Inventory and Lean Resource Management</i>	2
10.2	<i>Enterprise Resource Planning and Outsourcing</i>	5
10.3	<i>Capacity Management</i>	12

This study unit is the **fourth of five** on **cost management**. The relative weight assigned to this major topic in Part 1 of the exam is **15%**. The five study units are

- Study Unit 7: Cost Management Concepts
- Study Unit 8: Cost Accumulation Systems
- Study Unit 9: Cost Allocation Techniques
- **Study Unit 10: Supply Chain Management**
- Study Unit 11: Business Process Improvement

This study unit discusses supply chain management. Topics covered in this study unit include

- Lean resource management
- Materials requirements planning (MRP)
- Just-in-time (JIT) systems
- Enterprise resource planning (ERP)
- Outsourcing
- Capacity

10.1 Just-in-Time Inventory and Lean Resource Management

Many companies have traditionally built parts and components for subsequent operations on a preset schedule. Such a schedule provides a cushion of inventory so that the next operation will always have parts to work with—a just-in-case method. In this respect, traditional inventory planning views inventory as an asset.

Modern inventory planning favors the **just-in-time (JIT)** model. JIT views inventory as a liability and limits output to the demand of the subsequent operation.

- JIT reduces inventory levels.
- Advantages of this system include
 - ✓ Less investment in idle assets
 - ✓ Reduction of storage space
 - ✓ Lower inventory taxes
 - ✓ Less risk of obsolescence

JIT is a reaction to the trends of global competition and rapid technological progress that have resulted in shorter product life cycles and greater consumer demand for product diversity.

- High inventory levels often mask production problems because defective parts can be overlooked when plenty of good parts are available. If only enough parts are made for the subsequent operation, however, any defects will immediately halt production.
- The focus of quality control under JIT shifts from the discovery of defective parts to the prevention of quality problems, so zero machine breakdowns (achieved through preventive maintenance) and zero defects are ultimate goals. Higher quality and lower inventory go together.

Objectives of Just-In-Time Inventory Systems

The objectives of JIT are

- Higher productivity
- Reduced order costs
- Reduced carrying costs
- Faster and less expensive setups
- Shorter manufacturing cycle times
- Improved quality
- More flexible processes

The ultimate goal is increased competitiveness and higher profits.

Features of JIT

JIT is a **pull system**; i.e., items are pulled through production by current demand, not pushed through by anticipated demand. One operation produces only what is needed by the next operation, and components and raw materials arrive just in time to be used. Demand-driven production allows **inventory levels to be minimized**. Counting, handling, and storing inventory are viewed as nonvalue-added.

- One risk of lower inventory levels is stockout (running out of inventory to meet demand).

Summary of JIT Features

- Pull system
- Low inventory levels
- Decreased number of suppliers
- Increased number of deliveries

Effects on Operations

One consequence of the lower inventory levels associated with a JIT (lean) system is elimination of the need for certain internal controls. Frequent receipt of deliveries from suppliers often means less need for a sophisticated inventory control system and for control personnel.

JIT also may eliminate central receiving areas, hard copy receiving reports, and storage areas.

Manufacturing lead time is reduced. As a result, on-time delivery performance and response to changes in markets are enhanced, and production of customized goods in small lots becomes feasible.

Production setup costs and times per lot are reduced. However, because smaller lots are used, total setup costs are not necessarily lower using a JIT production system.

The quality of parts provided by suppliers is verified by use of statistical controls rather than inspection of incoming goods. Storage, counting, and inspecting are eliminated in an effort to perform only value-adding work.

Implementing JIT

To implement a JIT inventory or lean production system, manufacturing is reorganized around what are called **manufacturing cells**.

- In a conventional plant layout, each department or function operates specialized machines that perform one task. All work moves from department to department.
- In a cellular layout, each cell is a miniature manufacturing plant. Cells are sets of machines, often grouped in semicircles, that produce a given product or product family.

Each worker in a cell must be able to operate all machines and, possibly, to perform support tasks, such as setup activities, preventive maintenance, movement of work-in-process within the cell, and quality inspection. In such a pull system, workers might often be idle if they are not multi-skilled.

A cellular organization requires workers to operate as effective teams, so employee empowerment is crucial in a JIT inventory or lean production system. Greater participation by employees is needed to achieve the objectives of continuous improvement and zero defects. Employees may, for example, have the power to stop production to correct a problem, be consulted about changes in processes, or become involved in hiring co-workers. Thus, managers in such a system usually play more of a facilitating than a support role.

Lean Manufacturing

Lean manufacturing expands the concept of JIT. The central focus is on accomplishing more with fewer resources (labor, equipment, space, etc.), providing customers with what they want, and meeting their expectations.

The five principles of lean manufacturing are described below. The phrases “lean resource management” or “the lean process” are sometimes used to imply that many of the techniques can be used by non-manufacturers.

1. **Value** involves identifying the features of the product or service that are valuable for the customer.
2. **Value stream** requires
 - Examining every process within the production of a product,
 - Identifying processes that add value, and
 - Removing processes (if possible) that do not add value.
3. **Flow and pull** incorporates designing the production process to be capable of maximizing the flow of the product initiated by the pull of customer demand (i.e., only produce what the customer wants). This is where lean manufacturing and JIT principles coincide.
4. **Empowerment** provides each employee with the knowledge and authority to make valuable and timely decisions in order to
 - Add customer value and
 - Eliminate waste from the process.
5. **Perfection** focuses on making incremental improvement in each process with perfection as the goal.

10.2 Enterprise Resource Planning and Outsourcing

Materials Requirements Planning (MRP)

MRP is a computerized system for moving materials through a production process according to a predetermined schedule.

An MRP system enables a company to efficiently fulfill the requirements of the MPS by coordinating both the manufacture of component parts for finished goods and the arrival of the raw materials necessary to create the intermediate components.

The three overriding goals of MRP are the

- Arrival of the right part
- In the right quantity
- At the right time

MRP is a **push system**; i.e., the demand for raw materials is driven by the forecasted demand for the final product, which can be programmed into the computer.

- For example, an automobile manufacturer need only tell the computer how many autos of each type are to be manufactured.
- MRP, in effect, creates schedules of when items of inventory will be needed in the production departments.
 - If parts are not in stock, the system automatically generates a purchase order on the proper date (considering lead times) so that deliveries will arrive on time.
 - The timing of deliveries is vital to avoid both production delays and a pileup of raw materials inventory that must be stored.

Example 10-1 MRP

A manufacturer has the following bill of materials for its main product AA115 (including component subunits) and current inventory quantities:

Subunit	Quantity	Component	Quantity	Part	On Hand
CM12	1	TT413	2	CM12	25
		XH511	3	PR75	35
PR75	5	LQ992	1	TT413	30
				XH511	40
				LQ992	50

The company has 20 units of finished AA115 in inventory and wishes to maintain this level throughout the year. Production of 40 units is scheduled for the upcoming month. The principal subunits that must be produced are calculated as

Subunit	Quantity per Finished Product	Production Run	Quantity Needed	Quantity On Hand	To Be Built
CM12	1	x 40	= 40	- 25	= 15
PR75	5	x 40	= 200	- 35	= 165

The parts that must be ordered from vendors can thus be calculated as follows:

Subunit	Components	Component Quantity	Subunits To Be Built	Quantity Needed	Quantity On Hand	To Be Purchased
CM12	TT413	2	x 15	= 30	- 30	= 0
	XH511	3	x 15	= 45	- 40	= 5
PR75	LQ992	1	x 165	= 165	- 50	= 115

-- Continued on next page --

Example 10-1 -- Continued

The lead times required are

Product	Action	Weeks						Lead Time
		1	2	3	4	5	6	
AA115	Due Date						40	1 week
	Place Order					40		
PR75	Due Date					165		3 weeks
	Place Order		165					
LQ992	Due Date		115					1 week
	Place Order	115						
CM12	Due Date					15		2 weeks
	Place Order			15				
TT413	Due Date			0				1 week
	Place Order		0					
XH511	Due Date			5				2 weeks
	Place Order	5						

When items of inventory will be needed is determined by their lead time and the lead times of other component items or procedures. **Lead time** is the amount of time between when a process starts and when it is completed.

- Once it is known how many of a final product is necessary, the lead times of all the included components and processes can be used to create a schedule outlining when certain items and components must be ordered or produced so that the final product will be completed on time.

The benefits of MRP are

- ✓ Reduced idle time
- ✓ Lower setup costs
- ✓ Lower inventory carrying costs
- ✓ Increased flexibility in responding to market changes

Manufacturing Resource Planning (MRP II)

MRP II is a closed-loop manufacturing system that integrates all facets of a manufacturing business, including production, sales, inventories, schedules, and cash flows. Because manufacturing resource planning encompasses materials requirements planning, MRP is a component of an MRP II system.

Traditional Enterprise Resource Planning (ERP)

MRP is a common function contained in ERP.

- Although ERP and MRP are similar, they are not interchangeable since ERP includes functions not included in MRP.
- An ERP system allows a company to determine what hiring decisions might need to be made or whether a company should invest in new capital assets.
 - A company that merely needed to maintain inventory and materials levels would only need to implement an MRP system.

The traditional ERP system is one in which subsystems share data and coordinate their activities. ERP is intended to integrate enterprise-wide information systems across the organization (accounting, supply chain management, treasury, etc.) by creating one database linked to all of the entity's applications.

- The subsystems in a traditional ERP system are internal to the organization. Thus, they often are called **back-office functions**. The information produced is principally (but not exclusively) intended for internal use by the organization's managers.
- Because ERP software is costly and complex, it is usually installed only by the largest enterprises. However, mid-size organizations are increasingly likely to buy ERP software.

ERP connects all **functional financial and non-financial subsystems** (human resources, the financial accounting system, production, marketing, distribution, purchasing, receiving, order processing, shipping, etc.) and also connects the organization with its suppliers and customers.

- ERP facilitates demand analysis and materials requirements planning.
- By decreasing lead times, it improves just-in-time inventory management.
- ERP's coordination of all operating activities permits flexible responses to shifts in supply and demand.

The **advantages** of developing a traditional ERP system are similar to those derived from business process reengineering.

- Using ERP software that reflects industry best practices forces the linked subunits in the organization not only to redesign and improve their processes but also to conform to one standard.
- An organization may wish to undertake a reengineering project before choosing ERP software. The project should indicate what best practices already exist in the organization's processes. This approach may be preferable for a unique enterprise in a highly differentiated industry.
 - Carrying out a reengineering project before installing an ERP system defines what process changes are needed and which vendor software should be used.
 - If the organization is not especially unique, vendor software probably is already based on industry best practices.
- The processes reflected in the ERP software may differ from the organization's, thereby highlighting how the organization's processes might be improved.

The **disadvantages** of traditional ERP are its extent and complexity.

- Customizing the ERP software is expensive and difficult, and it may result in bugs and awkwardness when adopting upgrades.
 - Implementing an ERP system is likely to encounter significant resistance because of its comprehensiveness. Most employees will have to change ingrained habits and learn to use new technology. Thus, successful implementation requires effective change management.
-

Current Generation of ERP

The current generation of ERP software (ERP II) has added **front-office functions**, which provide the capability for smooth (and instant) interaction with the business processes of **external** parties such as customers, suppliers, shareholders or other owners, creditors, and strategic allies (e.g., the members of a trading community or other business association). Accordingly, an ERP II system has the following interfaces with its back-office functions:

- **Supply-chain** management applications for an organization focus on relationships extending from its suppliers to its final customers. Issues addressed include distribution channels, warehousing and other logistical matters, routing of shipments, and sales forecasting.
 - In turn, one organization's supply chain is part of a linked chain of multiple organizations. This chain stretches from the producers of raw materials, to processors of those materials, to entities that make intermediate goods, to assemblers of final products, to wholesalers, to retailers, and lastly to consumers.
 - Supply chain management involves a two-way exchange of information. For example, a customer may be able to track the progress of its order, and the supplier may be able to monitor the customer's inventory. Thus, the customer has better information about order availability, and the supplier knows when the customer's inventory needs replenishment.
- **Customer relationship** management applications extend to customer service, finance-related matters, sales, and database creation and maintenance.
 - Integrated data is helpful in better understanding customer needs, such as product preference or location of retail outlets. Thus, the organization may be able to optimize its sales forecasts, product line, and inventory levels.
 - ▶ Business intelligence software is used to analyze customer data.
- **Partner relationship** management applications connect the organization not only with such partners as customers and suppliers but also with owners, creditors, and strategic allies (for example, other members of a joint venture).
 - Collaborative business partnerships may arise between competitors or between different types of organizations, such as a manufacturer partnering with an environmental group. Special software may be helpful to the partners in sharing information, developing a common strategy, and measuring performance.

Advantages of a Current-Generation ERP System

- ✓ Lower inventory costs
- ✓ Better management of liquid assets
- ✓ Reduced labor costs and greater productivity
- ✓ Enhanced decision making
- ✓ Elimination of data redundancy, centralization of data, and protection of data integrity
- ✓ Avoidance of the costs of other means of addressing needed IT changes
- ✓ Increased customer satisfaction
- ✓ More rapid and flexible responses to changed circumstances
- ✓ More effective supply chain management
- ✓ Integration of global operations
- ✓ Standardization and simplification of the decision-making process

Disadvantages of a Current-Generation ERP System

- ⊖ Losses from an unsuccessful implementation, e.g., sales declines
 - ⊖ Purchasing hardware, software, and services
 - ⊖ Data conversion from legacy systems to the new integrated system (although conversion software may help)
 - ⊖ Training
 - ⊖ Design of interfaces and customization
 - ⊖ Software maintenance and upgrades
 - ⊖ Salaries of employees working on the implementation
-

Challenges

Implementation of ERP may take years and cost millions. A poor implementation may cause the project to fail regardless of software quality. However, more rapid and less costly implementation may be possible if no customization is done. Implementation includes the following three steps:

1. The initial step is to perform strategic planning and to organize a project team that is representative of affected employee groups.
2. The second step is to choose ERP software and a consulting firm.
 - One possibility is to choose the software before the consultants because the first decision may affect the second.
 - Another option is to hire consultants to help with the selection of the software. The organization then may hire other consultants to help with implementation.
3. The third and longest step is preimplementation of selected software.
 - The length of the process design phase is a function of the extent of (1) reengineering and (2) customization of the software.
 - Data conversion may be delayed because all departments must agree on the meaning of every data field, i.e., what values will be considered valid for that field.
 - The ERP system and its interfaces must be tested.

Implementation (“going live”) is not the final step. Follow-up is necessary to monitor the activities of employees who have had to change their routines. For example, a mistake caused by reverting to the old method of entering a sales order may have pervasive consequences in a new integrated system: a credit check, rescheduling of production, and ordering of materials.

Training should be provided during implementation not only regarding technical matters but also to help employees understand the reasons for process changes. For example, the employees who enter sales orders should know what the effects will be throughout the system.

Outsourcing

Outsourcing is the management or day-to-day execution of an entire business function by a third-party service provider. Outsourced services may be provided on or off premises, in the same country, or in a separate country.

- Outsourcing enables a company to focus on its core business rather than having to be concerned with marginal activities. For example, payroll preparation is often outsourced because a company does not want to maintain a full-time staff to perform what is only a weekly or monthly activity.

Business process outsourcing is the outsourcing of back office and front office functions typically performed by white-collar and clerical workers. Examples of these functions include data processing, accounting, human resources, and medical coding and transcription.

- **Insourcing** is the transfer of an outsourced function to an internal department of a company to be managed entirely by company employees. The term has also been used to describe a foreign company’s locating of facilities in a host country where it employs local workers.
- **Cosourcing** is performance of a business function by both internal staff and external resources, such as consultants or outsourcing vendors, who have specialized knowledge of the business function.

Benefits of outsourcing include

- ✓ Reliable service
- ✓ Reduced costs
- ✓ Avoidance of the risk of obsolescence
- ✓ Access to technology

Limitations include

- ✗ Dependence on an outside party
- ✗ Loss of control over a necessary function

10.3 Capacity Management

Capacity Levels

Theoretical capacity is the optimal level of output that can be completed with zero downtime and zero waste.

- Budgeting and planning based on theoretical capacity is not recommended because it is not reasonable to assume zero downtime (i.e., no maintenance) and zero waste.

Practical capacity is the highest level of output that can reasonably be attained taking into account both planned and unplanned downtime (e.g., set-up costs, maintenance, breakdowns, etc.) and expected waste.

- Budgeting and planning based on practical capacity aligns the allocation of fixed costs with normal production activity. Any variance can be a signal for a change in demand for the product, an issue with production, etc.

Normal capacity is the average level of output that can be completed over a period of time.

Capacity Planning

Capacity planning is an element of strategic planning that is closely related to capital budgeting. The IMA's Statement on Management Accounting *Measuring the Cost of Capacity* (issued in March 1996) states that maximizing the value created within an organization starts with understanding the nature and capabilities of all of the company's resources. According to that statement, effective capacity cost management requires

- Investment Analysis
 - In the short run, optimizing capital decisions and the effective and flexible use of investments that have already been made
 - Helping minimize requirements for future investment
 - Providing useful costing information on current process costs versus those proposed in current or future investment proposals

- Capacity Assessment
 - Closing any gap between market demands and a firm's capabilities.
 - ▶ At times, the firm may have excess capabilities; at others, shortages may exist. These capabilities may be physical, human, technological, or financial.
 - Supporting the establishment of capacity usage measurements that identify the cost of capacity and its impact on business cycles and overall company performance.
 - Identifying the capacity required to meet strategic and operational objectives and to estimate current available capacity.
 - Detailing the opportunity cost of unused capacity and suggesting ways to account for that cost.
 - Creating a common language for, and understanding of, capacity cost management.
 - Capacity should be defined from several different perspectives. Managing the cost of that capacity starts when a product or process is first envisioned. It continues through the subsequent disposal of resources downstream.
- Manufacturing Process Assessment
 - Maximizing the value delivered to customers
 - Supporting effective matching of a firm's resources with current and future market opportunities
 - Eliminating waste in the short, intermediate, and long run
 - Supporting change efforts by providing pre-decision information and analysis on the potential resource and cost implications of a planned change

Capacity planning is part of the capital budgeting process. Estimating capacity levels for future periods allows for the acquisition of more capacity when needed or disposal of capacity that is not expected to be utilized.

Capacity level influences product costing, pricing decisions, and financial statements. Excess capacity has a cost. Having excess capacity means that a company will either have to charge higher prices for its products or report lower income on its financial statements.

Study Unit Eleven

Business Process Improvement

11.1	<i>Value-Chain Analysis</i>	2
11.2	<i>Other Process Improvement Tools</i>	6

This study unit is the **fifth of five** on **cost management**. The relative weight assigned to this major topic in Part 1 of the exam is **15%**. The five study units are

- Study Unit 7: Cost Management Concepts
- Study Unit 8: Cost Accumulation Systems
- Study Unit 9: Cost Allocation Techniques
- Study Unit 10: Supply Chain Management
- **Study Unit 11: Business Process Improvement**

This study unit discusses business process improvement. Topics covered in this study unit include

- Value chain analysis
- Value-added activities
- Business process reengineering
- Best practice analysis
- Benchmarking
- Continuous improvement
- Costs of quality

11.1 Value-Chain Analysis

Value and Customers' Perceptions

To remain on the market, a product must provide value to the customer and a profit to the seller.

- Customers assign value to a product. The producer can affect the customers' perception of value by differentiating the product and lowering its price.
- The producer's profit is the difference between its costs and the price it charges for the product. By keeping costs low, the producer has more flexibility in pricing.

The relationship of these three aspects of value creation can be graphically depicted as follows:

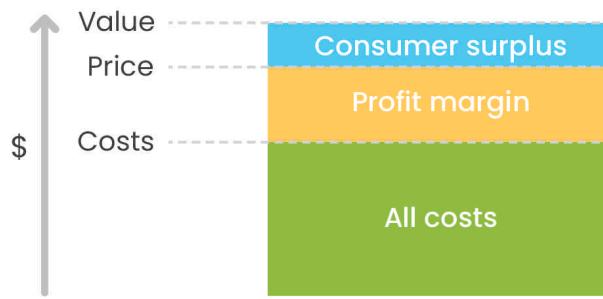


Figure 11-1

Value-Added and Nonvalue-Added Activities

A value-added activity increases the value of a product or service to the customer. Examples include assembling the product and shipping it to the customer.

- In contrast to conventional financial statements, value-chain financial statements treat value-added activities as product costs (i.e., as inventoriable costs).

A nonvalue-added activity does not increase the value of a product or service to the customer even if this activity is necessary. Examples include inspection for testing and inventory storage costs.

The Value Chain

The value chain is a model for depicting the way in which every function in a company adds value to the final product. The IMA's Statement on Management Accounting (SMA) *Value Chain Analysis for Assessing Competitive Advantage* (issued in March 1996) says, "The value chain approach for assessing competitive advantage is an integral part of the strategic planning process."

A value chain depicts how costs and customer value accumulate along a chain of activities that lead to an end product or service. A value chain consists of the internal processes or activities a company performs: R&D, design, production, marketing, distribution, and customer service.

Another view is that the value chain consists of all of the value-creating activities leading to the ultimate end-use product delivered into the final consumers' hands. In other words, a value chain is a firm's overall chain of value-creating (value-added) processes.

Customer retention is an important objective of value-adding and profit-maximizing processes because the customer base is a key intangible asset. Furthermore, high customer loyalty depends on the effectiveness of an organization's core business processes.

Customer relationship management optimizes customer equity by managing information about individuals and their "touchpoints" for the purpose of maximizing customer loyalty. This process involves more than merely attracting customers and satisfying them.

Primary activities deal with the product directly. Support activities lend aid to the primary activity functions. The value chain can be graphically depicted as follows:

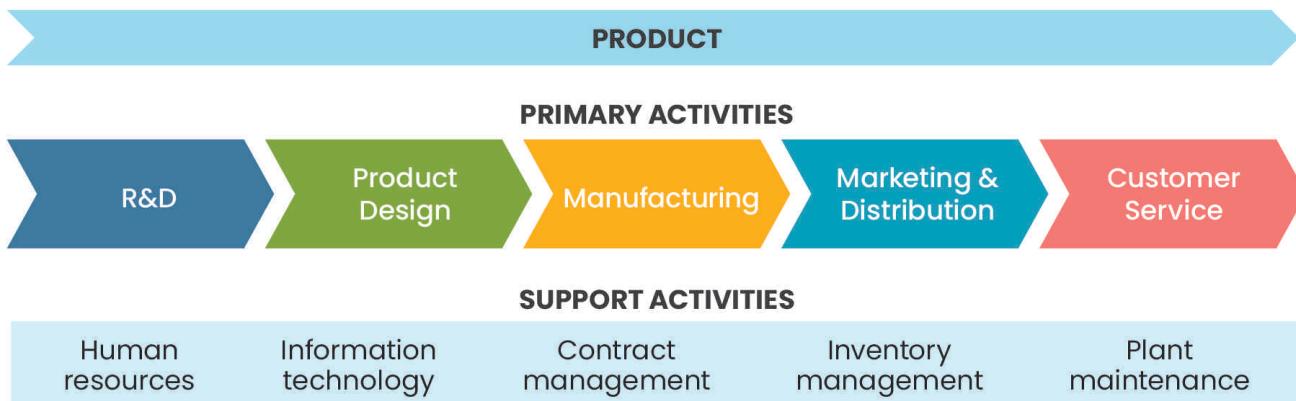


Figure 11-2

Value-Chain Analysis

Value-chain analysis is a strategic analysis tool that allows a firm to focus on those activities that are consistent with its overall strategy. Value-chain analysis allows a firm to decide which parts of the value chain it wants to occupy and how each activity then contributes to the firm's competitive advantage by adding customer value or by reducing costs.

Because the value chain identifies and connects the organization's strategic activities, value-chain analysis improves the firm's knowledge of its relations with customers, suppliers, and competitors. It also facilitates the strategic determination of the phase(s) of the industry's value chain in which the firm should operate. The two steps in value-chain analysis are the following:

1. The **first step** in a value-chain analysis is to identify the firm's value-creating activities.
2. The **second step** is to determine how each value-creating activity can produce a competitive advantage for the firm. This step has four substeps.
 - a. Identify the firm's competitive advantage (e.g., cost reduction, product differentiation) so that the firm's position in the industry's value chain can be clarified.
 - b. Identify the ways in which the firm's value-creating activities can generate additional customer value.
 - c. Identify activities that are candidates for cost reduction or, in the case of non-core competencies, outsourcing.
 - d. Identify value-adding ways in which the firm's remaining activities can be linked.

Value-chain analysis is a team effort. Management accountants need to collaborate with engineering, production, marketing, distribution, and customer service professionals to focus on the strengths, weaknesses, opportunities, and threats identified in the value-chain analysis results.

- Value-chain analysis offers an excellent opportunity to integrate strategic planning and management accounting to guide the firm to survival and growth.
-

The Supply Chain

The supply chain is the flow of materials and services from their original sources to final consumers. It usually encompasses more than one firm.

- Firms seeking to improve performance and reduce costs must analyze all phases of the supply chain as well as the value chain. Thus, a firm must reduce the cost of, and increase the value added by, its purchasing function.

Purchasing is the management function that concerns the acquisition process. It includes choice of vendors, contract negotiation, the decision whether to purchase centrally or locally, and value analysis. The process is initiated by purchase requisitions issued by the production control function.

Supply-chain analysis and coordination should extend to all parties in the chain, from initial sources of materials to retailers. Coordination has special relevance to inventory management. By sharing information among all parties, demand uncertainty is reduced at each level, with consequent decreases of inventory at each level, minimization of stockouts, and avoidance of overproduction and rush orders.

Value-chain and supply-chain analysis should be used to meet customer requirements for better performance regarding such critical success factors as

- Cost reduction,
 - Efficiency,
 - Continuous improvement of quality to meet customer needs and wants,
 - Minimization or elimination of defects,
 - Faster product development and customer response times, and
 - Constant innovation.
-

Value Engineering

Value chain analysis requires value engineering. Value engineering is a means of reaching targeted cost levels. It is a systematic approach to assessing all aspects of the value chain cost buildup for a product. The purpose is to minimize costs without sacrificing customer satisfaction.

- Value engineering requires distinguishing between cost incurrence and **locked-in costs**.
 - Cost incurrence is the actual use of resources.
 - Locked-in (designed-in) costs will result in use of resources in the future as a result of past decisions.
 - Value engineering emphasizes controlling costs at the design stage before they are locked in.

Life-cycle costing (discussed in Study Unit 8, Subunit 4) is sometimes used as a basis for cost planning and product pricing. Life-cycle costing estimates a product's revenues and expenses over its expected life cycle. The result is to highlight upstream and downstream costs in the cost-planning process that often receive insufficient attention. Emphasis is on the need to price products to cover all costs, not just production costs.

11.2 Other Process Improvement Tools

Process Analysis

Process analysis is a means of linking a firm's internal processes to its overall strategy.

Types of processes include:

- Continuous, such as candy bars produced by machinery
- Batch, such as beer brewing
- Hybrid, in which both continuous and batch processes are used
- Make-to-stock, such as automobile assembly
- Make-to-order, such as deli sandwich making

Process Interdependence

The degree of interdependence among the stages in a process is referred to as "tightness."

- A tight process is one in which a breakdown in one stage brings the succeeding stages to a halt. This is characteristic of continuous processes that do not have buffer work-in-process inventories.
- A loose process is one in which subsequent stages can continue working after a breakdown in a previous stage. This is characteristic of batch processes and any others with extensive work-in-process inventories.

Bottlenecks

Very few processes run at precisely the same speed in every stage. One part of the process is almost always the slowest, referred to as the "bottleneck." If capacity is added at that point, the bottleneck simply shifts to the next slowest operation.

Process Value Analysis

Process value analysis is a comprehensive understanding of how an organization generates its output. It involves a determination of which activities that use resources are value-adding or nonvalue-adding and how the latter may be reduced or eliminated.

Continuous Improvement Process (CIP)

A continuous improvement process is an ongoing effort involving management and workers to improve products, services, or processes.

- The purpose of CIP is the identification, reduction, and elimination of suboptimal processes to improve efficiency.
 - Ideal standards (discussed in Study Unit 13, Subunit 2) are associated with production under optimal conditions.
- CIP efforts can lead to “incremental” improvement over time or “breakthrough” improvement all at once.
- Delivery (customer valued) processes are constantly evaluated and improved in light of their efficiency, effectiveness, and flexibility.

Kaizen is the Japanese word for the continuous pursuit of improvement in every aspect of organizational operations.

- For example, a budget prepared on the Kaizen principle projects costs based on future improvements. The possibility of such improvements must be determined, and the cost of implementation and the savings therefrom must be estimated.

Activity Analysis

An activity analysis determines what is done, by whom, at what cost in time and other resources, and the value added by each activity.

- A **value-added activity** is necessary to remain in business. For example, a manufacturer would deem the conversion of raw materials into salable products a value-added activity.
- A **value-added cost** is incurred to perform a value-added activity without waste. Most types of direct labor would be considered value-added cost because the costs are being incurred to directly produce the product.
- A **nonvalue-added activity** is unnecessary and should be eliminated. The act of generating nonsalable final products is a nonvalue-added activity.
 - An example of a nonvalue-added activity is where inventory has to be moved long distances from one work station to another in a production process. Similarly, inventory that has to wait in line before being processed is a waste. This is why just-in-time (JIT) inventory systems (discussed in Study Unit 10, Subunit 1) have proved popular: JIT eliminates much of the waste in a production process.
- A **nonvalue-added cost** is caused by a nonvalue-added activity or inefficient performance of a value-added activity. The costs of raw materials and direct labor expended on products that fail inspection would be considered nonvalue-added costs.

Financial and nonfinancial **measures of activity performance** address efficiency, quality, and time. The purpose is to assess how well activities meet customer demands.

- To satisfy customer needs and wants, activities should be efficient (a favorable input-to-output ratio) so that customers are willing to pay the prices charged.
- Activities should produce defect-free output (high quality), and that output should be produced in a timely manner (with less resource usage and in response to customer requirements).

The selection of value-added activities in each place of the value chain reflects the firm's determination of its competitive advantage and its choice of competitive strategy. For example, different design strategies require different activities and costs. A firm might choose to be the low-cost producer of an undifferentiated product rather than compete on the basis of superior product quality.

One aspect of process analysis is the management of time. Product development time is a crucial factor in the competitive equation. A company that is first in the market with a new product has obvious advantages. Reducing development time is also important because product life cycles are becoming shorter. Companies need to respond quickly and flexibly to new technology, changes in consumer tastes, and competitive challenges.

Business Process Reengineering (BPR)

BPR is a complete rethinking of how business functions are performed to provide value to customers, that is, radical innovation instead of mere improvement, and a disregard for current jobs, hierarchies, and reporting relationships. Technological advances have increased the popularity of business process reengineering.

A **process** is how something is accomplished in a firm. It is a set of activities directed toward the same objective. **Reengineering** is process innovation and core process redesign. Instead of improving existing procedures, it finds new ways of doing things. Thus, reengineering should be contrasted with process improvement, which consists of incremental but constant changes that improve efficiency.

- BPR techniques eliminate many traditional controls. They exploit modern technology to improve productivity and decrease the number of clerical workers. The emphasis is on developing controls that are automated and self-correcting and require minimal human intervention.
- The emphasis therefore shifts to monitoring internal control so management can determine when an operation may be out of control and corrective action is needed.
 - Most BPR techniques also assume that humans will be motivated to work actively in improving operations when they are full participants in the process.

Part of the BPR process involves looking at possible alternatives and determining the cost of those possible alternatives compared to the costs of maintaining the same processes. To do this, the management accountant must determine

- The cost to reengineer the process, and
- The expected savings.

Some desirable alternatives may actually increase total costs.

- For example, more expensive materials could lead to higher product quality. While this will increase total costs, it may be necessary to maintain/increase market share.
 - In situations like these, the management accountant would determine the savings attributed to possible alternatives compared to maintaining the same processes.

After determining the cost and savings of BPR, the company must look at all of its goals and needs overall to determine if it should invest in a possible alternative.

Example 11-1 BPR Cost and Savings

It currently takes 3 people working for 10 hours each at a rate of \$15 per hour to produce 10 units of Product P. For \$350, the company has the option of purchasing a machine that will allow the same 3 people to produce 10 units of Product P in 5 hours.

It currently costs \$450 ($3 \text{ people} \times 10 \text{ hours} \times \15 per hour) to produce 10 units of Product P. If the company purchases the machine, it will cost \$225 ($3 \text{ people} \times 5 \text{ hours} \times \15 per hour) to produce 10 units of Product P for a savings of \$225 ($\$450 - \225). Since this company will continually save \$225 every 10 hours, the company should probably purchase the machine.

Best Practice Analysis

Best practice analysis identifies the industry strategies, tactics, methods, and processes of the most successful companies to determine what makes them successful. Using best practice analysis, a company benchmarks itself against the competition.

Benchmarking

The IMA's Statement on Management Accounting (SMA) *Effective Benchmarking* describes techniques for improving the effectiveness of benchmarking, which is a means of helping companies with productivity management and business process reengineering.

- “Benchmarking involves continuously evaluating the practices of best-in-class organizations and adapting company processes to incorporate the best of these practices.” It “analyzes and measures the key outputs of a business process or function against the best and also identifies the underlying key actions and root causes that contribute to the performance difference.”
- Benchmarking is an ongoing process that entails quantitative and qualitative measurement of the difference between the company’s performance of an activity and the performance by the best in the world. The benchmark organization need not be a competitor.

The first phase in the benchmarking process is to select and prioritize benchmarking projects.

- An organization must understand its critical success factors and business environment to identify key business processes and drivers and to develop parameters defining what processes to benchmark.
- The criteria for selecting what to benchmark relate to the reasons for the existence of a process and its importance to the entity’s mission, values, and strategy. These reasons relate in large part to satisfaction of end users or customer needs.

The next phase is to organize benchmarking teams.

- A team organization is appropriate because it permits an equitable division of labor, participation by those responsible for implementing changes, and inclusion of a variety of functional expertise and work experience.
- Team members should have knowledge of the function to be benchmarked, respected positions in the company, good communication skills, teaming skills, motivation to innovate and to support cross-functional problem solving, and project management skills.

The benchmarking team must thoroughly investigate and document internal processes.

- The organization should be seen as a series of processes, not as a fixed structure. A process is “a network of related and independent activities linked by the outputs they exchange.” One way to determine the primary characteristics of a process is to trace the path a request for a product or service takes through the organization.
- The benchmarking team must also develop a family of measures that are true indicators of process performance and a process taxonomy, that is, a set of process elements, measures, and phrases that describes the process to be benchmarked.

Researching and identifying best-in-class performance is often the most difficult phase.

- The critical steps are setting up databases, choosing information-gathering methods (internal sources, external public domain sources, and original research are the possible approaches), formatting questionnaires (lists of questions prepared in advance), and selecting benchmarking partners.

The data analysis phase entails identifying performance gaps, understanding the reasons they exist, and prioritizing the key activities that will facilitate the behavioral and process changes needed to implement the benchmarking study’s recommendations. Sophisticated statistical analysis and other methods may be needed when the study involves many variables, testing of assumptions, or presentation of quantified results.

Leadership is most important in the implementation phase of the benchmarking process because the team must be able to justify its recommendations. The process improvement teams must manage the implementation of approved changes.

Benchmarking is a way for a company to learn its strengths and weaknesses by comparison to similar companies. Additional benefits of benchmarking include

- ✓ Best practices are identified and defined.
- ✓ Alternative solutions are evaluated.
- ✓ The competitive position is strengthened.
- ✓ The company goals are questioned.
- ✓ More people are held responsible for their performance.

Costs of Quality

The IMA's Statement on Management Accounting *Managing Quality Improvements* describes four categories of costs of quality: prevention, appraisal, internal failure, and external failure. The organization should attempt to minimize its total cost of quality.

Conformance costs include prevention and appraisal, which are both financial measures of internal performance.

- **Prevention** attempts to avoid defective output. These costs include preventive maintenance, employee training, review of equipment design, and evaluation of suppliers. Providing quality training to employees should reduce all types of quality costs.
- **Appraisal** encompasses such activities as statistical quality control programs, inspection, and testing.

Nonconformance costs include costs of internal failure (a financial measure of internal performance) and external failure costs (a financial measure of customer satisfaction).

- **Internal failure** costs occur when defective products are detected before shipment.
 - Examples are scrap, rework, tooling changes, downtime, redesign of products or processes, lost output, reinspection and retesting, expediting of operations after delays, lost learning opportunities, and searching for and correcting problems.
- The costs of **external failure** or lost opportunity include lost profits from a decline in market share as dissatisfied customers make no repeat purchases, return products for refunds, cancel orders, and communicate their dissatisfaction to others.
 - External failure costs are incurred for customer service complaints; rejection, return, repair, or recall of products or services; warranty obligations; product liability claims; and customer losses.
 - ▶ Given the wide variety of causes of external failure, the best solution is to provide all employees with training about the importance of providing quality to customers.
 - Environmental costs are also external failure costs, e.g., fines for nonadherence to environmental law and loss of customer goodwill.
 - ▶ To minimize environmental damage and its resulting costs, the International Organization for Standardization has issued **ISO 14000 standards** to promote the reduction of environmental damage by an organization's products, services, and operations and to develop environmental auditing and performance evaluation systems.

Study Unit Twelve

Analysis, Forecasting, and Strategy

12.1	<i>Correlation and Regression</i>	2
12.2	<i>Learning Curve Analysis</i>	6
12.3	<i>Expected Value and Sensitivity Analysis</i>	8
12.4	<i>Strategic Management</i>	13
12.5	<i>Strategic Planning</i>	22

This study unit is the **first of three on planning, budgeting, and forecasting**. The relative weight assigned to this major topic in Part 1 of the exam is **20%**. The three study units are

- **Study Unit 12: Analysis, Forecasting, and Strategy**
- Study Unit 13: Budgeting -- Concepts and Methodologies
- Study Unit 14: Budgeting -- Calculations and Pro Forma Financial Statements

This study unit discusses two specific areas of Section B of the CMA exam: forecasting techniques and strategic planning. Detailed references for the ICMA's Learning Outcome Statements (LOSs) are included in Appendix D. Topics covered in this study unit include

- Forecasting techniques:
 - Simple regression
 - Multiple regression
 - Learning curve analysis
 - Expected value techniques
- Strategic planning:
 - Porter's generic strategies
 - Porter's five forces
 - The BCG growth-share matrix

12.1 Correlation and Regression

Forecasting Methods

Forecasts are the basis for business plans and budgets. Forecasts are used to project product demand, inventory levels, cash flow, etc.

- **Qualitative methods** of forecasting rely on the manager's experience and intuition.
- **Quantitative methods** use mathematical models and graphs.
 - When some factor in the organization's environment is plotted on the x-axis, the technique is causal relationship forecasting.
 - When time periods are plotted on the x-axis, the technique is time-series analysis.

Correlation Analysis

Correlation analysis is the foundation of any quantitative method of forecasting. Correlation is the strength of the linear relationship between two variables, expressed mathematically in terms of the **coefficient of correlation (r)**. It can be graphically depicted by plotting the values for the variables on a graph in the form of a scatter diagram.

- The value of r ranges from 1 (perfect direct relationship) to -1 (perfect inverse relationship). The more the scatter pattern resembles a straight line, the greater the absolute value of r .
 - **Perfect direct relationship ($r = 1$)**

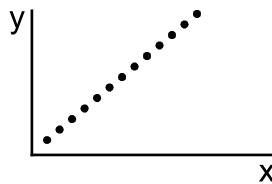


Figure 12-1

- Perfect inverse relationship ($r = -1$)

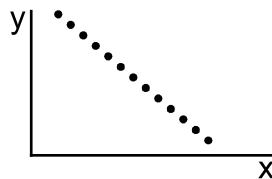


Figure 12-2

- Strong direct relationship ($r = 0.7$)

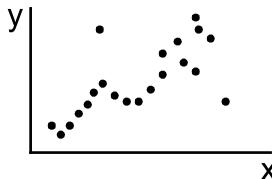


Figure 12-3

- No linear relationship ($r = 0$)

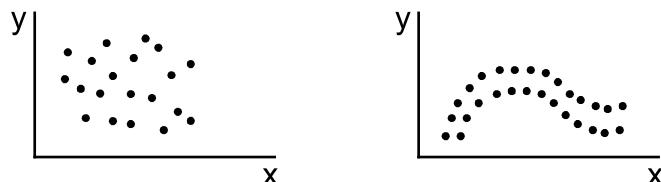


Figure 12-4

Note from the right-hand graph of the pair above that a coefficient of correlation of zero does not mean the variables have no relationship, only that any relationship cannot be expressed as a linear equation.

The **coefficient of determination (r^2)**, or the coefficient of correlation squared, is a measure of how good the fit between the two variables is. Mathematically, the coefficient of determination is the proportion of the total variation in the dependent variable that is accounted for by the independent variable.

Example 12-1 Coefficient of Determination

A car dealership determines that new car sales are a function of disposable income with a coefficient of correlation of .8.

This is equivalent to stating that 64% (.8²) of the variation of new car sales from the average can be explained by changes in disposable income.

Regression Analysis

Regression analysis, also called least-squares analysis, is the process of deriving the linear equation that describes the relationship between two variables with a nonzero coefficient of correlation.

- **Simple regression** is used given one independent variable.
- The simple regression equation is the algebraic formula for a straight line:

If:
 $y = a + bx$
 a = the y-intercept
 b = the slope of the regression line
 (i.e., the regression coefficient)
 x = the independent variable

- The best straight line that fits a set of data points is derived using calculus to minimize the sum of the squares of the vertical distances of each point to the line (thus the name least-squares method).

Example 12-2 Simple Regression

A firm has collected observations on advertising expenditures and annual sales.

Advertising (\$000s)	Sales (\$000,000s)
71	26.3
31	13.9
50	19.8
60	22.9
35	15.1

Solving with the least-squares method reveals that expected sales equal \$4.2 million plus 311.741 times the advertising expenditure.

$$y = \$4,200,000 + 311.741x$$

The observations are graphed as follows:

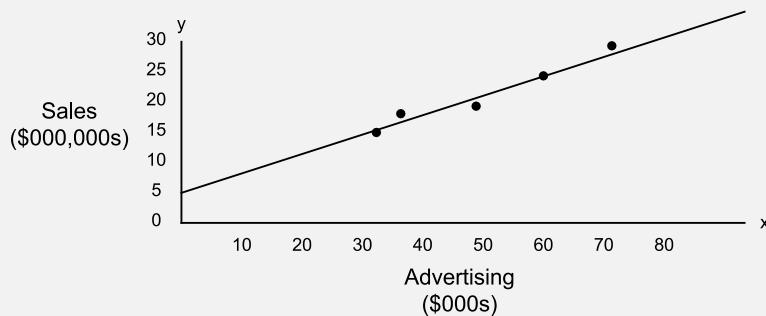


Figure 12-5

The firm can now project the amount it will have to spend on advertising to generate \$32,000,000 in sales.

$$\begin{aligned} y &= \$4,200,000 + 311.741x \\ \$32,000,000 &= \$4,200,000 + 311.741x \\ 311.741x &= \$27,800,000 \\ x &= \$89,177 \end{aligned}$$

- **Multiple regression** is used when there is more than one independent variable.
 - Example 12-2 relating advertising to sales is clearly unrealistic. Sales are dependent upon more than just advertising expenditures.
 - Multiple regression allows a firm to identify many factors (independent variables) and to weight each one according to its influence on the overall outcome.

$$y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + \text{etc.}$$

- **Logistic regression** is a statistical model that is used for classification and predictive analytics and is discussed in Study Unit 20, Subunit 2.

Assumptions of the linear regression model include the following:

- The linear relationship established for x and y is only valid across the **relevant range** (i.e., the range within which per-unit variable costs remain constant and fixed costs are not changeable). The user must identify the relevant range and ensure that (s)he does not project the relationship beyond it.
 - A negative y-intercept in the simple regression equation usually indicates that it is outside the relevant range.
- The values of y around the regression line for a given value of x have a normal distribution and a mean of zero. The values of y also must be statistically independent.

Benefits and Limitations of Regression Analysis

- Regression analysis is particularly valuable for budgeting and cost accounting purposes.
 - Regression analysis is almost a necessity for computing the fixed and variable portions of mixed costs for flexible budgeting. The y-intercept is the fixed portion and the slope of the regression line is the variable portion.
- Regression analysis assumes that **past relationships** can be validly projected into the future. A limitation of the regression method is that it can only be used when cost patterns remain unchanged from prior periods.
- Regression does not determine causality. Although x and y move together, the apparent relationship may be caused by some other factor.
 - For instance, car wash sales volume and sunny weather are strongly correlated, but car wash sales do not cause sunny weather.

12.2 Learning Curve Analysis

Learning Curves

Learning curve analysis reflects the increased rate at which people perform tasks as they gain experience. The time required to perform a given task becomes progressively shorter during the early stages of production.

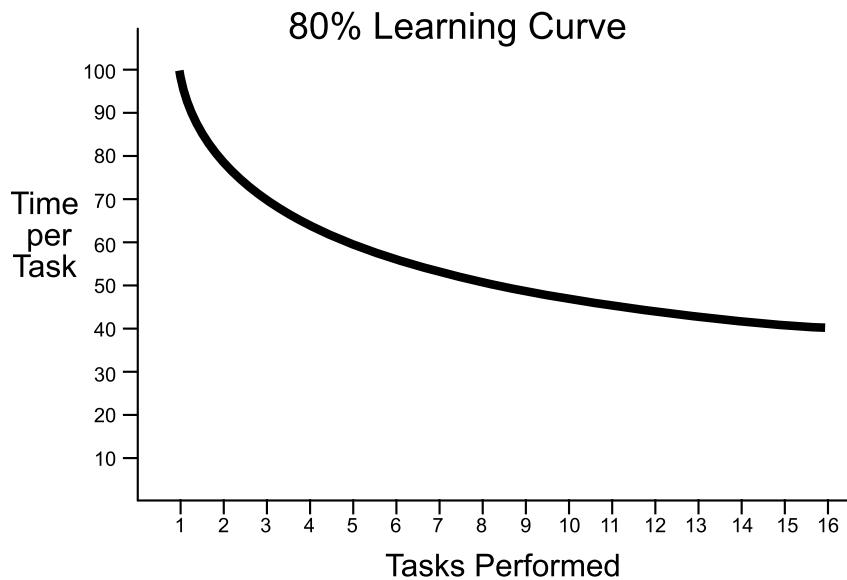


Figure 12-6

The curve is usually expressed as a percentage of reduced time each time **cumulative production doubles**.

- When determining whether cumulative production doubles, it is important to look at units produced as well as batch numbers.

Example 12-3 Learning Curve

A firm produces units in batches of 100 and experiences an 80% learning curve.

Batch	Cumulative Units Produced	Doubling
1	100	
2	200	1 st doubling from 100 to 200
3	300	
4	400	2 nd doubling from 200 to 400
5	500	
6	600	
7	700	
8	800	3 rd doubling from 400 to 800

The **cumulative average-time learning model** projects the reduction in the cumulative average time it takes to complete a certain number of tasks.


Author's Note

In practice, the most common percentage used is 80%. However, on the CMA exam, be prepared to see a variety of percentages. The cumulative average method is the method tested on the exam.

Example 12-4 Learning Curves of 70%, 80%, and 90%

The following table illustrates learning curves for a product whose first unit takes 100 minutes to produce:

Batch	Cumulative Units Produced	70% Cumulative Average Time per Unit	80% Cumulative Average Time per Unit	90% Cumulative Average Time per Unit
1 (Unit 1)	1	100	100	100
2 (Unit 2)	2	70 ($100 \times 70\%$)	80 ($100 \times 80\%$)	90 ($100 \times 90\%$)
3 (Units 3-4)	4	49 ($70 \times 70\%$)	64 ($80 \times 80\%$)	81 ($90 \times 90\%$)
4 (Units 5-8)	8	34.3 ($49 \times 70\%$)	51.2 ($64 \times 80\%$)	72.9 ($81 \times 90\%$)
5 (Units 9-16)	16	24.01 ($34.3 \times 70\%$)	40.96 ($51.2 \times 80\%$)	65.61 ($72.9 \times 90\%$)

The time listed in the cumulative average time per unit column is an average of all the units produced up to that point.

Note that with an 80% learning curve upon completion of the final batch (units 9-16), the average had come down to 40.96 minutes per unit.

For it to reach this level from the 51.2 minutes it had reached at the end of the fourth batch (units 5-8), the average of the units in the fifth batch alone must have been 30.72 minutes [$(40.96 \text{ minutes} \times 2) - 51.2 \text{ minutes}$].

With more sophisticated quantitative techniques, a more accurate average can be calculated of the units within each "batch."


Success Tip

CMA candidates need to be alert as to the nature of the question being asked. Sometimes the question might ask, "What is the average time per unit after two units?" From the table in Example 12-4, with an 80% learning curve, you can see that the answer is 80. Alternatively, sometimes the question asks, "What is the time to produce the second unit?" The answer would be 60. Since the first unit took 100 minutes and the average for the two units is 80 minutes (a total of 160), the second unit must have taken only 60 minutes.

Limitation

The limitation of the learning curve in practice is the difficulty in knowing the shape of the curve. There is no question that the learning curve effect exists, but companies typically do not know what percentage they should use in calculations until after it is too late to use the information effectively. As a result, many companies simply assume an 80% learning curve and make decisions accordingly.

12.3 Expected Value and Sensitivity Analysis

Expected Value

Expected value is a means of associating a dollar amount with each of the possible outcomes of a **probability distribution**. It should be distinguished from a **deterministic** approach, which assumes that a value is known with certainty.

- The outcome yielding the highest expected monetary value (which may or may not be the most likely one) is the optimal alternative.
 - The **decision** alternative is under the manager's control.
 - The **state of nature** is the future event whose outcome the manager is attempting to predict.
 - The **payoff** is the financial result of the combination of the manager's decision and the actual state of nature.
- The expected value of an event is calculated by multiplying the probability of each outcome by its payoff and summing the products.

Example 12-5 Expected Value

An investor is considering the purchase of two identically priced pieces of property. The value of the properties will change if a road, currently planned by the state, is built.

The following are estimates that road construction will occur:

Future State of Nature (SN)	Event	Probability
SN 1	No road is ever built.	.1
SN 2	A road is built this year.	.2
SN 3	A road is built more than 1 year from now.	.7

The following are estimates of the values of the properties under each of the three possible events:

Property	SN 1	SN 2	SN 3
Bivens Tract	\$10,000	\$40,000	\$35,000
Newnan Tract	\$20,000	\$50,000	\$30,000

The expected value of each property is determined by multiplying the probability of each state of nature by the value under that state of nature and adding all of the products.

	Expected Value
Bivens Tract: .1(\$10,000) + .2(\$40,000) + .7(\$35,000)	= \$33,500
Newnan Tract: .1(\$20,000) + .2(\$50,000) + .7(\$30,000)	= \$33,000

Thus, Bivens Tract is the better investment.

The calculation shown in Example 12-5 is often referred to as a **payoff table**. The difficult aspect of constructing a payoff table is the determination of all possible outcomes of decisions and their probabilities. Thus, a probability distribution must be established.

- The assigned probabilities may reflect prior experience with similar decisions, the results of research, or highly subjective estimates.
- It is important to capture all values when constructing a payoff table. Otherwise, results may be inaccurate.
 - For example, unsold items may be sold for scrap or may require storage costs. Failure to account for these and other factors will skew results.

Example 12-6 Expected Value -- Scrap Option

A vendor can order 10, 20, or 30 hats. The probabilities of demand are as follows:

Demand	Probability
10	60%
20	30%
30	10%

Each hat can be sold for \$5. Unsold hats can be sold as scrap for \$1. The expected profit or loss if the ability to sell unsold hats as scrap is included when calculating the payoff table is as follows:

Decision	States of Nature			Expected Value
	Demand = 10	Demand = 20	Demand = 30	
10 hats	\$50	\$ 50	\$ 50	\$50
20 hats	60	100	100	76
30 hats	70	110	150	90

$$\begin{aligned} \$50 &= [.6 \times \$50] + [.3 \times \$50] + [.1 \times \$50] \\ \$76 &= [.6 \times \$60] + [.3 \times \$100] + [.1 \times \$100] \\ \$90 &= [.6 \times \$70] + [.3 \times \$110] + [.1 \times \$150] \end{aligned}$$

The expected profit or loss if the ability to sell unsold hats as scrap is **not** included when calculating the payoff table is as follows:

Decision	States of Nature			Expected Value
	Demand = 10	Demand = 20	Demand = 30	
10 hats	\$50	\$ 50	\$ 50	\$50
20 hats	50	100	100	70
30 hats	50	100	150	75

$$\begin{aligned} \$50 &= [.6 \times \$50] + [.3 \times \$50] + [.1 \times \$50] \\ \$70 &= [.6 \times \$50] + [.3 \times \$100] + [.1 \times \$100] \\ \$75 &= [.6 \times \$50] + [.3 \times \$100] + [.1 \times \$150] \end{aligned}$$

In this example, failing to include the option to sell unsold hats for \$1 results in much more similar expected values across the different decisions. Even though the result is the same, the goal is to provide the most accurate and useful information for decision-making purposes.

The expected value criterion is likely to be adopted by a decision maker who is risk neutral. However, other circumstances may cause the decision maker to be risk averse or even risk seeking.

Advantages and Disadvantages

- The **benefit** of expected value analysis is that it allows a manager to apply scientific management techniques to applications that would otherwise be guesswork.
 - Although exact probabilities may not be known, the use of expected value analysis forces managers to evaluate decisions in a more organized manner. At the least, managers are forced to think of all of the possibilities that could happen with each decision.
- A **limitation** of expected value is that it is based on repetitive trials, whereas in reality, most business decisions involve only one trial.

Example 12-7 Expected Value -- Risk Aversion

A dealer in luxury yachts may order 0, 1, or 2 yachts for this season's inventory. The dealer projects demand for the season as follows:

Demand	Probability
0 yachts	10%
1 yacht	50%
2 yachts	40%

The cost of carrying each excess yacht is \$50,000, and the gain for each yacht sold is \$200,000. The profit or loss resulting from each combination of decision and outcome is thus as follows:

Decision	States of Nature			Expected Value
	Demand = 0	Demand = 1	Demand = 2	
Stock 0 yachts	\$ 0	\$ 0	\$ 0	\$ 0
Stock 1 yacht	(50,000)	200,000	200,000	175,000
Stock 2 yachts	(100,000)	150,000	400,000	225,000

$$\begin{aligned} \$175,000 &= [.1 \times -\$50,000] + [.5 \times \$200,000] + [.4 \times \$200,000] \\ \$225,000 &= [.1 \times -\$100,000] + [.5 \times \$150,000] + [.4 \times \$400,000] \end{aligned}$$

In this example, a risk-averse decision maker may not wish to accept the risk of losing \$100,000 by ordering two yachts.

Example 12-8 Expected Value -- Impossible Value

A company wishes to launch a communications satellite. The probability of launch failure is .2, and the value of the satellite if the launch fails is \$0. The probability of a successful launch is .8, and the value of the satellite would then be \$25,000,000. The expected value is calculated as follows:

$$.2(\$0) + .8(\$25,000,000) = \$20,000,000$$

But \$20,000,000 is not a possible value for a single satellite; either it flies for \$25,000,000 or it crashes for \$0.

Perfect Information

Perfect information is the certain knowledge of which state of nature will occur. The **expected value of perfect information (EVPI)** is the additional expected value that could be obtained if a decision maker knew ahead of time which state of nature would occur.

- The maximum anyone should be willing to pay for perfect information is the expected value of perfect information.



Author's Note

Candidates are not required to calculate the expected value of perfect information on the CMA exam.

Sensitivity Analysis

Sensitivity analysis is the process of evaluating the effect of changes in variables on the optimum solution. Such analysis helps management analyze alternatives and estimate the consequences of possible prediction errors. Sensitivity analysis reveals how sensitive expected value calculations are to the accuracy of the initial estimates.

- Sensitivity analysis is useful in determining whether expending additional resources to obtain better forecasts is justified.
 - If a change in the probabilities assigned to the various states of nature results in large changes in the expected values, the decision maker is justified in expending more effort to make better predictions about the outcomes.
- The benefit of sensitivity analysis is that managers can see the effect of changed assumptions on the final objective.

Example 12-9 Expected Value -- Probability Combinations

The yacht dealer in the expected value computation illustrated in Example 12-7 is testing different combinations of probabilities. All three of the scenarios depicted here yield the same decision (stock two yachts for the season):

Decision Alternatives	States of Nature	Payoff	Original		First Alternative		Second Alternative	
			Probability	Expected Value	Probability	Expected Value	Probability	Expected Value
Stock 0 Yachts	Demand = 0	\$ 0	0.1	\$ 0	0.5	\$ 0	0.333	\$ 0
	Demand = 1	0	0.5	0	0.1	0	0.333	0
	Demand = 2	0	0.4	0	0.4	0	0.333	0
				<u><u>\$ 0</u></u>		<u><u>\$ 0</u></u>		<u><u>\$ 0</u></u>
Stock 1 Yacht	Demand = 0	(50,000)	0.1	(5,000)	0.5	(25,000)	0.333	(16,650)
	Demand = 1	200,000	0.5	100,000	0.1	20,000	0.333	66,600
	Demand = 2	200,000	0.4	80,000	0.4	80,000	0.333	66,600
				<u><u>\$175,000</u></u>		<u><u>\$ 75,000</u></u>		<u><u>\$116,550</u></u>
Stock 2 Yachts	Demand = 0	(100,000)	0.1	(10,000)	0.5	(50,000)	0.333	(33,300)
	Demand = 1	150,000	0.5	75,000	0.1	15,000	0.333	49,950
	Demand = 2	400,000	0.4	160,000	0.4	160,000	0.333	133,200
				<u><u>\$225,000</u></u>		<u><u>\$125,000</u></u>		<u><u>\$149,850</u></u>

However, the following combination indicates that only one yacht should be stocked:

Decision Alternatives	States of Nature	Payoff	Third Alternative	
			Probability	Expected Value
Stock 0 Yachts	Demand = 0	\$ 0	0.1	\$ 0
	Demand = 1	0	0.8	0
	Demand = 2	0	0.1	0
			<u><u>\$ 0</u></u>	
Stock 1 Yacht	Demand = 0	(50,000)	0.1	\$ (5,000)
	Demand = 1	200,000	0.8	160,000
	Demand = 2	200,000	0.1	20,000
			<u><u>\$175,000</u></u>	
Stock 2 Yachts	Demand = 0	(100,000)	0.1	\$ (10,000)
	Demand = 1	150,000	0.8	120,000
	Demand = 2	400,000	0.1	40,000
			<u><u>\$150,000</u></u>	

Clearly, the more accurately the dealer is able to anticipate demand, the more profit (s)he will make. In this case, the dealer considers it worthwhile to expend further resources gathering more data about market conditions for yachts.

12.4 Strategic Management

Strategic management sets overall objectives for an entity and guides the process of reaching those objectives. It is the responsibility of upper management.

Strategic planning is the design and implementation of the specific steps and processes necessary to reach the overall objectives.

Strategic management and strategic planning are thus closely linked. By their nature, strategic management and strategic planning have a long-term planning horizon.

Steps in the Strategic Management Process

Strategic management is a five-stage process:

1. The board of directors drafts the organization's mission statement.
2. The organization performs a situational analysis, also called a SWOT analysis.
3. Based on the results of the situational analysis, upper management develops strategies describing how the mission will be achieved.
4. Strategic plans are implemented through the execution of component plans at each level of the entity.
5. Strategic controls and feedback are used to monitor progress, isolate problems, and take corrective action. Over the long term, feedback is the basis for adjusting the original mission and objectives.



Figure 12-7

The **mission statement** summarizes the entity's reason for existing. It provides the framework for formulation of the company's strategies. Missions tend to be most effective when they consist of a single sentence.

- Missions are usually stated in general terms. Setting specific objectives in the mission statement can limit an entity's ability to respond to a changing marketplace.

Mission vs. Vision

A mission statement and a vision statement serve different purposes for a company but are sometimes confused with each other. A mission statement describes what a company wants to achieve now, while a **vision statement** outlines what a company wants to achieve in the future.

- The mission statement concentrates on the present; it defines the customers and critical processes, and it explains the desired level of performance.
- The vision statement focuses on the future; it is a source of inspiration and motivation. It often describes not just the future of the organization, but the future of the industry or society in which the organization operates. It answers the question, “Where do we want to be in the future?”
- A mission statement describes how a company will achieve its vision. It defines the entity’s purpose and primary objectives and answers the question, “What do we do, and what makes us different?”

SWOT Analysis

The **situational analysis** is most often called a SWOT analysis because it identifies the entity’s strengths, weaknesses, opportunities, and threats.

- **Strengths and weaknesses** are usually identified by considering the entity’s capabilities and resources (its internal environment).
 - What the entity does particularly well or has in greater abundance are its core competencies. But many entities may have the same core competencies (cutting-edge IT, efficient distribution, etc.).
 - An entity gains a competitive advantage in the marketplace by developing one or more distinctive competencies, i.e., competencies that are unlike those of its competitors.
- **Opportunities and threats** exist in the entity’s external environment. They are identified by considering
 - Macroenvironment factors (economic, demographic, political, legal, social, cultural, and technical) and
 - Microenvironment factors (suppliers, customers, distributors, competitors, and other competitive factors in the industry).
- The SWOT analysis tends to highlight the basic factors of cost, quality, and the speed of product development and delivery.

PEST Analysis

Another tool for situational evaluation is PEST analysis. It is a strategic management tool that helps a company identify the external, macroeconomic factors affecting its business. The analysis includes the following:

- **Political** (e.g., political stability and government regulations)
- **Economic** (e.g., the rate of inflation, economic growth rates, and foreign exchange rates)
- **Social** (e.g., cultural trends, demographics, and lifestyle trends)
- **Technological** (e.g., innovation trends and new technologies that could create opportunities or could disrupt the company's business model)



SWOT analysis and PEST analysis are also covered in Study Unit 16, Subunit 4, "The Balanced Scorecard."

Author's Note

Strategies

Based on the results of the situational analysis, upper management develops a **group of strategies** describing how the mission will be achieved. The strategies answer such questions as

- "Which lines of business will we be in?"
- "How do we penetrate and compete in the international marketplace?"
- "How will this line of business reach its objectives that contribute to achievement of the overall entity's mission?"
- "How do we perform each strategic business unit's basic processes (materials handling, assembly, shipping, human resources, customer relations, etc.) as efficiently as possible?"

Implementing the chosen strategies involves every employee at every level of the entity. Incentive systems and employee performance evaluations must be designed so that they encourage employees to focus their efforts on achieving the entity's objectives.

- This approach requires communication among senior managers, who devise strategies; middle managers, who supervise and evaluate employees; and human resources managers, who must approve evaluation and compensation plans.

As plans are executed at each organizational level, **strategic controls and feedback** allow management to determine the degree of progress toward the stated objectives.

- For controls to be effective, standards against which performance can be measured must be established. Then, the results of actual performance must be measured against the standards and reported to the appropriate managers.
 - If performance is unsatisfactory, managers take corrective action.
- Results are sent to higher-level management for continual refinement of the strategies.

Porter's Five Competitive Forces

Business theorist Michael E. Porter has developed a model of the structure of industries and competition. It includes an analysis of the five competitive forces that determine long-term profitability as measured by long-term return on investment.

This analysis includes an evaluation of the basic economic and technical characteristics that determine the strength of each force and the attractiveness of the industry. The competitive forces are depicted in the diagram below and discussed in detail on the following pages.



Figure 12-8

Rivalry Among Established Firms

Rivalry among existing firms will be intense when an industry contains many strong competitors. Price-cutting, large advertising budgets, and frequent introduction of new products are typical. The intensity of rivalry and the threat of entry vary with the following factors:

- The stage of the industry life cycle, e.g., rapid growth, growth, maturity, decline, or rapid decline
 - Growth is preferable to decline. In a declining or even a stable industry, a firm's growth must come from winning other firms' customers, thereby strengthening competition.
- The distinctions among products (product differentiation) and the costs of switching from one competitor's product to another
 - Less differentiation tends to heighten competition based on price, with price cutting leading to lower profits. But high costs of switching suppliers weaken competition.
- Whether fixed costs are high in relation to variable costs
 - High fixed costs indicate that rivalry will be intense. The greater the cost to generate a given amount of sales revenues, the greater the investment intensity and the need to operate at or near capacity. Hence, price cutting to sustain demand is typical.
- Capacity expansion
 - If the size of the expansion must be large to achieve economies of scale, competition will be more intense. The need for large-scale expansion to achieve production efficiency may result in an excess of industry capacity over demand.

Threat of New Entrants

The prospects of long-term profitability depend on the industry's barriers to entry.

- Factors that increase the threat of entry are the following:
 - Economies of scale (and learning curve effects) are not significant.
 - Brand identity of existing products is weak.
 - Costs of switching suppliers are low.
 - Existing firms do not have the cost advantages of vertical integration.
 - Product differences are few.
 - Access to existing suppliers is not blocked, and distribution channels are willing to accept new products.
 - Capital requirements are low.
 - Exit barriers are low.
 - The government's policy is to encourage new entrants.

- The most favorable industry condition is one in which entry barriers are high and exit barriers are low.
 - When the threat of new entrants is minimal and exit is not difficult, returns are high, and risk is reduced in the event of poor performance.
 - Low entry barriers keep long-term profitability low because new firms can enter the industry, increasing competition and lowering prices and the market shares of existing firms.

Bargaining Power of Customers

As the threat of buyers' bargaining power increases, the appeal of an industry to potential entrants decreases. Buyers seek lower prices, better quality, and more services. Moreover, they use their purchasing power to obtain better terms, possibly through a bidding process. Thus, buyers affect competition.

- Buyers' bargaining power varies with the following factors:
 - When purchasing power is concentrated in a few buyers or when buyers are well organized, their bargaining power is greater. This effect is reinforced when sellers are in a capital-intensive industry.
 - High (low) switching costs decrease (increase) buyers' bargaining power.
 - The threat of backward (upstream) vertical integration, that is, the acquisition of a supply capacity, increases buyers' bargaining power.
 - Buyers are most likely to bargain aggressively when their profit margins are low and a supplier's product accounts for a substantial amount of their costs.
 - Buyers are in a stronger position when the supplier's product is undifferentiated.
 - The more important the supplier's product is to buyers, the less bargaining power they have.

Bargaining Power of Suppliers

As the threat of suppliers' bargaining power increases, the appeal of an industry to potential entrants decreases. Accordingly, suppliers affect competition through pricing and the manipulation of the quantity supplied.

- Suppliers' bargaining power is greater when
 - Switching costs are substantial.
 - Prices of substitutes are high.
 - They can threaten forward (downstream) vertical integration.
 - They provide something that is a significant input to the value added by the buyer.
 - Their industry is concentrated, or they are organized.
- Buyers' best responses are to develop favorable, mutually beneficial relationships with suppliers or to diversify their sources of supply.

Threat of Substitutes

The threat of substitutes limits price increases and profit margins. The greater the threat, the less attractive the industry is to potential entrants.

- Substitutes are types (not brands) of goods and services that have the same purposes, for example, plastic and metal or minivans and SUVs. Hence, a change in the price of one such product (service) causes a change in the demand for its substitutes.
- Structural considerations affecting the threat of substitutes are
 - Relative prices
 - Costs of switching to a substitute
 - Customers' inclination to use a substitute

Generic Competitive Analysis (Strategies) Model

Strategies with a Broad Competitive Scope

Cost leadership is the generic strategy of entities that seek competitive advantage through lower costs and that have a broad competitive scope.

Differentiation is the generic strategy of entities that seek competitive advantage through providing a unique product and that have a broad competitive scope.

Strategies with a Narrow Competitive Scope

Cost focus is the generic strategy of entities that seek competitive advantage through lower costs and that have a narrow competitive scope (a regional or smaller market).

Focused differentiation is the generic strategy of entities that seek competitive advantage through providing a unique product and that have a narrow competitive scope (a regional or smaller market).



Figure 12-9

The Growth-Share Matrix

Since a large firm may be viewed as a portfolio of investments in the form of strategic business units (SBUs), techniques of portfolio analysis have been developed to aid management in making decisions about resource allocation, new business startups and acquisitions, downsizing, and divestitures.

One of the models most frequently used for competitive analysis was created by the Boston Consulting Group (BCG). This model, the growth-share matrix, has two variables. The market growth rate (MGR) is on the vertical axis, and the firm's relative market share (RMS) is on the horizontal axis.

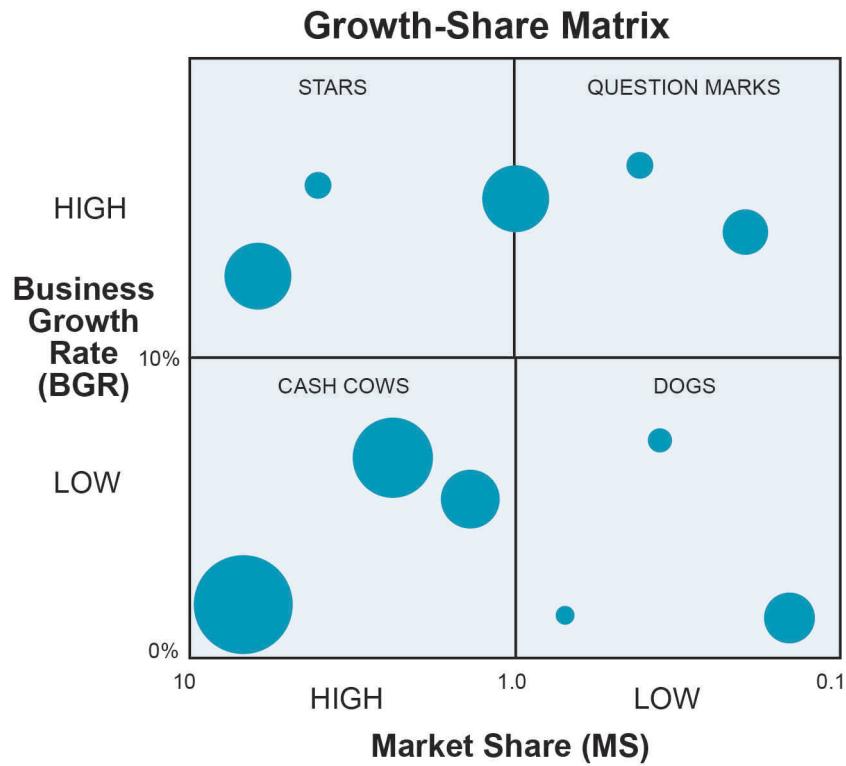


Figure 12-10

- The annual MGR is stated in constant units of the currency used in the measurement. It reflects the maturity and attractiveness of the market and the relative need for cash to finance expansion.
- The RMS reflects the SBU's competitive position in the market segment. It equals the SBU's absolute market share divided by that of its leading competitor.

The growth-share matrix has four quadrants. The firm's SBUs are commonly represented in their appropriate quadrants by circles. The size of a circle is directly proportional to the SBU's sales volume.

1. **Dogs** (low RMS, low MGR) are weak competitors in low-growth markets. Their net cash flow (plus or minus) is modest.
2. **Question marks** (low RMS, high MGR) are weak competitors and poor cash generators in high-growth markets. They need large amounts of cash not only to finance growth and compete in the market, but also to increase RMS.
 - If RMS increases significantly, a question mark may become a star. If not, it becomes a dog.
3. **Cash cows** (high RMS, low MGR) are strong competitors and cash generators. A cash cow ordinarily enjoys high profit margins and economies of scale. Financing for expansion is not needed, so the SBU's excess cash can be used for investments in other SBUs. However, marketing and R&D expenses should not necessarily be slashed excessively.
 - Maximizing net cash inflow might precipitate a premature decline from cash cow to dog.
4. **Stars** (high RMS, high MGR) are strong competitors in high growth markets. Such an SBU is profitable but needs large amounts of cash for expansion, R&D, and meeting competitors' attacks. Net cash flow (plus or minus) is modest.

A portfolio of SBUs should not have too many dogs and question marks or too few cash cows and stars.

Each SBU should have objectives, a strategy should be formulated to achieve those objectives, and a budget should be allocated.

- A **hold strategy** is used for strong cash cows.
- A **build strategy** is necessary for a question mark with the potential to be a star.
- A **harvest strategy** maximizes short-term net cash inflow. Harvesting means zero-budgeting R&D, reducing marketing costs, not replacing facilities, etc. This strategy is used for weak cash cows and possibly question marks and dogs.
- A **divest strategy** is normally used for question marks and dogs that reduce the firm's profitability. The proceeds of sale or liquidation are then invested more favorably.
 - A harvest strategy may undermine a future divestiture by decreasing the fair value of the SBU.

The life cycle of a successful SBU is reflected by its movement within the growth-share matrix. The progression is from question mark to star, cash cow, and dog. Accordingly, a firm should consider an SBU's current status and its probable progression when formulating a strategy.

12.5 Strategic Planning

Planning is the determination of what is to be done and of how, when, where, and by whom it is to be done. Plans serve to direct the activities that all organizational members must undertake and successfully perform to move the organization from where it is to where it wants to be (accomplishment of its objectives).

Planning must be completed before undertaking any other managerial function. Forecasting is the basis of planning because it projects the future.

Planning establishes the means to reach organizational ends (objectives).

- This means-end relationship extends throughout the organizational hierarchy and ties together the parts of the organization so that the various means all focus on the same end.
- One organizational level's ends provide the next higher level's means.

The Planning Process

Long-range (strategic) planning includes **strategic budgeting**. A strategic budget describes the long-term position and objectives of an entity within its environment.

- Generally, timeframes range from 3 to 5 years, depending on what is best for the company; longer timeframes are not uncommon. Such planning is difficult because of uncertainty about future events and conditions.
- Strategic plans tend to be general and exclude operational detail.
- An entity must complete its strategic plan before any specific budgeting can begin. The strategic plan states the means by which an entity expects to achieve its stated mission.

Strategic planning embodies the concerns of senior management. It is based on a strategic analysis that includes the following:

- Identifying and specifying organizational objectives.
- Evaluating the strengths (competitive advantages) and weaknesses of the organization and its competitors.
- Assessing risk levels.

- Identifying and forecasting the effects of external (environmental) factors relevant to the organization.
 - For example, market trends, changes in technology, international competition, and social change may provide opportunities, impose limitations, or represent threats.
 - Forecasting is the basis of planning because it projects the future. A variety of quantitative methods are used in forecasting.
- Deriving the best strategy for reaching the objectives, given the organization's strengths and weaknesses and the relevant future trends.
- Capital budgeting, a planning process for choosing and financing long-term projects and programs.
- Capacity planning, an element of planning closely related to capital budgeting that includes, among other things, consideration of business combinations or divestitures.

Contingency planning involves having alternative strategies in place (i.e., disaster recovery plans or business continuity plans) as a way of preparing for unexpected emergencies or other disruptions to operations.

- The primary purpose for a contingency plan is to ensure that operations continue with minimal interruption, losses, or damages.
- Disaster recovery plans are covered in detail in Study Unit 18, Subunit 3.

Scenario planning involves projecting plausible future events (i.e., economic conditions, political environment, scientific and technological developments, etc.) and developing alternative strategies for each one of them to ensure operations continue.

Management Objectives

The primary task of management is to carry on operations effectively and efficiently.

- **Effectiveness** is the degree to which the objective is accomplished. **Efficiency** is maximizing the output for a given quantity of input.
- Effectiveness is sometimes called “doing the right things,” and efficiency is known as “doing things right.”
- Trade-offs are frequently made between efficiency and effectiveness.

Objectives should be clearly and specifically stated, communicated to all concerned parties, and accepted by those affected.

Policies, Procedures, and Rules

The next step in the planning process is the development of policies, procedures, and rules. These elements are necessary at all levels of the organization and overlap both in definition and in practice.

- Intermediate and operational plans are translated into policies, procedures, and rules, which are standing plans for repetitive situations.
 - Policies and procedures provide **feedforward control** because they anticipate and prevent problems and provide guidance on how an activity should be performed to best ensure that an objective is achieved. Types of controls are covered in detail in Study Unit 18, Subunit 1.
 - **Policies** are general statements that guide thinking and action in decision making. Policies may be explicitly published by, or implied by the actions of, management.
 - A strong organizational culture means that the organization's key values are intensely held and widely shared. In this case, the need for formal written policies is minimized.
 - **Procedures** are specific directives that define how work is to be done.
 - **Rules** are specific, detailed guides that restrict behavior.
-

Goal Congruence

Goal congruence ensures the harmonization of objectives, procedures for achieving these objectives, operational planning, and strategic planning are working as a whole in order to realize the company goals. Planning activities must be designed to encourage goal congruence at various levels of management.

Characteristics of successful strategic plans include but are not limited to

- ✓ Clarity of purpose and realistic goals
- ✓ Monitoring, measurement, and feedback
- ✓ Discipline and commitment
- ✓ Leadership

Study Unit Thirteen

Budgeting -- Concepts and Methodologies

13.1	<i>Roles of Budgets and the Budgeting Process</i>	2
13.2	<i>Budgeting and Standard Costs</i>	10
13.3	<i>The Master Budget</i>	12
13.4	<i>Budget Methodologies</i>	14

This study unit is the **second of three** on **planning, budgeting, and forecasting**. The relative weight assigned to this major topic in Part 1 of the exam is **20%**. The three study units are

- Study Unit 12: Analysis, Forecasting, and Strategy
- **Study Unit 13: Budgeting -- Concepts and Methodologies**
- Study Unit 14: Budgeting -- Calculations and Pro Forma Financial Statements

This study unit discusses the budgeting concepts and methodologies tested on the CMA exam. Topics covered in this study unit include

- The role of the budget
- Participation in the budget process
- Budgetary slack
- Time frames for budgets
- Characteristics of a successful budgeting process
- Controllability
- Limitations of the budgeting process
- Developing standards
- Ideal versus practical standards
- The master budget process
- Project budgets
- Activity-based budgeting
- Zero-based budgeting
- Continuous budgeting

13.1 Roles of Budgets and the Budgeting Process

A budget can be used for many different purposes, including planning, control, motivation, communication, and goal congruence.

The budget is a **planning** tool—a written plan for the future that forces management to evaluate the assumptions and the objectives identified in the budgetary process.

- Companies that prepare budgets anticipate problems before they occur.
 - EXAMPLE: If a company runs out of critical raw material, it may have to shut down. At best, it will incur extremely high freight costs to have the needed materials rushed in. The company with a budget will have anticipated the shortage and planned around it.
- A firm that has no goals may not always make the best decisions. A firm with a goal in the form of a budget will be able to plan.

The budget is a **control** tool—a strategy for constraining costs by setting cost guidelines. Guidelines reveal the efficient or inefficient use of company resources.

- A manager is less apt to spend money for things that are not needed if (s)he knows that all costs will be compared with the budget. (S)he will be accountable if controllable costs exceed budgeted amounts.
- Budgets can also reveal the progress of highly effective managers. Consequently, employees should not view budgets negatively. A budget is just as likely to provide a boost to a manager's career as it is to be detrimental.
- Managers can also use a budget as a personal self-evaluation tool.

Budgetary slack (i.e., underestimating revenues or overestimating expenses), however, must be avoided if a budget is to have its desired effects. The natural tendency of a manager is to negotiate for a less stringent measure of performance so as to avoid unfavorable variances from expectations.

For the budgetary process to serve effectively as a control function, it must be integrated with the accounting system and the organizational structure. Such integration enhances control by transmitting data and assigning variances to the proper organizational subunits.

The budget is a **motivational** tool—a way to encourage employees to do a good job.

- Employees are particularly motivated if they help prepare the budget. A manager who is asked to prepare a budget for his or her department will work hard to stay within the budget.
- A budget must be seen as realistic by employees before it can become a good motivational tool.
- Unfortunately, the budget is not always viewed in a positive manner. Some managers view a budget as a restriction. Employees are more apt to have a positive feeling toward a budget if some degree of flexibility is allowed.

The budget is a **communication** tool—a means of telling employees what goals the firm is attempting to accomplish.

- A budget functions as an aid to planning, coordination, and control. Thus, a budget helps management allocate resources efficiently and ensure that subunit objectives are consistent with those of other subunits and of the organization.
 - For the budget to function in these roles, senior management must be involved with the process. This involvement does not extend to dictating exact numerical contents of the budget because senior management lacks detailed knowledge of daily operations.
- If the firm does not have an overall budget, each department might think the firm has different goals.
 - For example, the sales department may want to keep as much inventory as possible so that no sales will be lost, but the company treasurer may want to keep the inventory as low as possible in order to conserve cash reserves. If the budget specifies the amount of inventory, all employees can work toward the same objectives.

The budget is a **goal congruence** tool—a method to ensure that all departments and employees at all levels of responsibility are notified of the company's goals. Everyone is working toward the same end objective.

- For example, the strategic plan and the capital budget must be congruent with the operational planning in the master budget.

The Budget as a Formal Quantification of Management's Plans

Corporations have goals for market share, profitability, growth, dividend payout, etc. Not-for-profit organizations also have goals, such as increased number of free meals served, lowered recidivism rate among offenders, etc. These goals cannot be achieved without careful planning about the allocation of resources and the expected results.

A budget lays out in specific terms an organization's expectations about the consumption of resources and the resulting outcomes.

Budgeting's Role in the Overall Planning and Evaluation Process

Planning is the process by which an organization sets specific goals for itself and sets about pursuing those goals. Planning is an organization's response to the saying "If you don't know where you're going, any path will take you there."

- The starting point for any organization's planning process is the formulation of its **mission statement**. The mission statement, formulated by the board and senior management, embodies the organization's reason for existing.
 - EXAMPLE: Increase shareholder value by providing global telecommunications services.
- Next, the organization draws up its **strategic plan** containing the means by which the firm expects to fulfill its stated mission.
 - To a great extent, the strategy is made up of **long-term objectives**, a set of specific, measurable goals.
 - EXAMPLE: Hold a 35% market share of U.S. cell phone users within 5 years.
- Once the long-term objectives are in place, the **priorities** of the organization will be clear.
 - Awareness of priorities is crucial for the **allocation of limited resources**.
 - EXAMPLE: How many cell towers, each of which require the outlay of construction and maintenance costs, will provide the optimum amount of coverage.
- **Short-term objectives** flow directly from the priorities.
 - EXAMPLE: Determine the appropriate number of cell towers needed and where they can feasibly be placed in the Metro Atlanta region.
 - The planning process coordinates the efficient allocation of organizational resources.



To **evaluate progress** toward success in each of these stages, quantification is necessary. This is the role of the various types of budgets.

- Not all quantification is in monetary terms. To extend the previous example, although cell towers obviously have a dollar cost, they must be simply counted as well.
- **Comparing actual results to the budget** allows the organization as a whole to evaluate its performance and managers to do the same on an individual level. The budget is therefore a strategic control.

Participation in the Budget Process

Participation in the budget preparation process is up and down the organization.

- The budget process begins with the mission statement formulated by the **board of directors**.
- **Senior management** translates the mission statement into a strategic plan with measurable, realizable goals.
- A **budget committee/department** composed of top management is formed to draft the budget calendar and budget manual. The budget committee/department also reviews and approves the departmental budgets submitted by operating managers.
 - A budget director's primary responsibility is to compile the budget and manage the budget process.
- **Middle and lower management** receive their budget instructions, draw up their departmental budgets in conformity with the guidelines, and submit them to the budget committee.

Top-down (authoritative) budgeting is imposed by upper management and therefore has less chance of acceptance by those on whom the budget is imposed.

- This approach has the advantage of ensuring consistency across functional areas. It is also far less complex and time-consuming than coordinating input from middle and lower levels.
- Even having a budget set by an outside consulting firm is usually considered a top-down approach because the firm was hired by top management. The consultant may not fully understand the company's processes, and employees not fully involved in the process may react negatively.

Bottom-up (participative) budgeting is characterized by general guidance from the highest levels of management, followed by extensive input from middle and lower management. Because of this level of participation within the company, there is usually a greater chance of acceptance and optimal decision making.

- Disadvantages of participative standards setting include its time and money costs. In addition, the quality of participation is affected by the goals, values, beliefs, and expectations of those involved.

	Advantages	Disadvantages
Top-down budgeting	<ul style="list-style-type: none"> ● Ensures consistency across all functional areas ● Is far less complex and time-consuming than coordinating input from the middle and lower levels 	<ul style="list-style-type: none"> ● An imposed budget is much less likely to promote a sense of commitment
Bottom-up budgeting	<ul style="list-style-type: none"> ● Encourages employees to have a sense of ownership of the output of the process, resulting in acceptance of, and commitment to, objectives expressed in the budget ● Enables employees to relate performance to rewards or penalties ● Provides a broader information base (middle- and lower-level managers often are far better informed about operational realities than senior managers) 	<ul style="list-style-type: none"> ● Higher costs in time and money ● Quality of participation is affected by the objectives, values, beliefs, and expectations of those involved ● Creation of budgetary slack

Participation in developing a budget may result in budget **padding**, also known as budgetary slack.

- **Budgetary slack** is the excess of resources budgeted over the resources necessary to achieve organizational goals. This practice results in the underestimation of revenues and overestimation of expenses. This must be avoided if a budget is to have its desired effects.
 - The natural tendency of a manager is to negotiate for a less stringent measure of performance so as to avoid unfavorable variances from expectations.
- Management may create slack by overestimating costs and underestimating revenues.
 - A firm may decrease slack by emphasizing the consideration of all variables, holding in-depth reviews during budget development, and allowing for flexibility in making additional budget changes.
 - A manager who expects his or her request to be reduced may inflate the amount.
 - If a budget is to be used as a performance evaluator, a manager asked for an estimate may provide one that is easily attained.
- Slack can have both positive and negative effects on the budgeting process.
 - Slack can reduce the budget's planning benefits, since the budget may not be entirely accurate.
 - ▶ For example, a cash budget might show that \$500,000 needs to be borrowed this month, whereas that amount is not really needed because managers were just being cautious.
 - Alternatively, lack of slack may discourage managers from implementing new programs or might cause managers to avoid routine maintenance when the budget does not show funds available in a particular period.

Time Frames for Budgets

Each phase of the organization's planning cycle has its own budget with an appropriate **time frame**.

- **Strategic** plans and budgets most concern senior managers and have time frames of up to 10 years or more.
- **Intermediate** plans and budgets most concern middle managers and have time frames of up to 2 years.
- **Operational** plans and budgets most concern lower-level managers and generally have time frames of 1 month to 1 year.

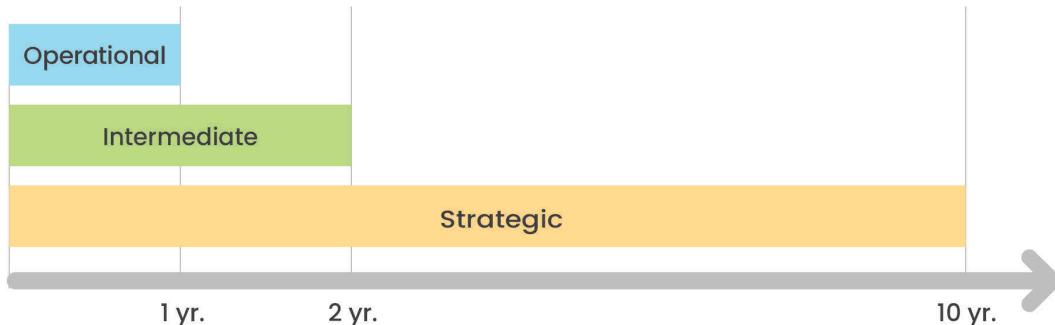


Figure 13-1

Characteristics of a Successful Budgeting Process

A successful budgeting process should include adequate planning time and a detailed calendar to produce the budgets in a timely manner. For a budget to be useful, it must be finalized when the fiscal year begins. This often calls for months of preparation, since the overall goals and baseline assumptions must be announced before functional areas and individual departments can begin formulating their numbers.

- The preparation of a complete organizational budget usually takes several months. A firm with a calendar year end may start the budget process in September, anticipating its completion by the first of December.
- The **budget planning calendar** is the schedule of activities for the development and adoption of the budget. It includes a list of dates indicating when specific information is to be provided to others by each information source.
 - Because all of the individual departmental budgets are based on forecasts prepared by others and the budgets of other departments, it is essential to have a planning calendar to integrate the entire process.

The budget manual is another element of successful budgeting. Everyone involved in preparing the budget at all levels must be educated on the detailed procedures for preparing and submitting their part of the overall budget.

- Because of the number of component departments, budgets must be prepared in a standard format.
 - In addition, all concerned must be informed of the ultimate goals that are being pursued and the baseline assumptions that have been laid down. A budget may, for example, begin with a blanket mandate to raise revenues by 6.5% or to cut expenses across all departments by 2%.
- Distribution instructions are vital because of the interdependencies of a master budget.
 - One department's budget may be dependent on another's, and functional areas must be aggregated from their constituent department budgets. The distribution instructions coordinate these interdependencies.

Acceptance at all levels is important to the budgeting process. Participative budgeting has a much greater chance of acceptance by those affected and thus of achieving ultimate success than does a budget that is imposed from above.

- The support of top management is crucial to budgeting efforts. This is because the single most important factor in ensuring the success of a budget process is for senior management to demonstrate that it takes the project seriously and considers it vital to the organization's future.

Effects of External Factors on the Budgeting Process

Decisions about a firm's strategy, and in turn about its budget, are dependent upon **general economic conditions** and their expected trends as well as the availability of financial resources.

- For instance, if the economy is entering a period of lower demand, a manufacturer will not project increased sales. If costs are not changeable, the company may budget losses for the short term to hold on to market share.

Industry situation includes the company's current market share, governmental regulatory measures, the labor market, and the activities of competitors.

- For instance, if input costs are rising in a firm's industry, the budget must reflect that reality; profit margins and cash flows will not be the same as in prior years. Also, a company in or near bankruptcy will face a different financial situation than would the market leader.
-

The Concept of Controllability

Controllability is a key concept in the use of budgets and other standards to evaluate performance. Controllability is the extent to which a manager can influence activities and related revenues and costs.

Controllable costs are those that are under the discretion of a particular manager. Noncontrollable costs are those to which another level of the organization has committed, removing the manager's discretion.

Controllability can be difficult to isolate because few costs or revenues are under the sole influence of one manager. Also, separating the effects of current management's decisions from those of former management is difficult.

- If responsibility exceeds the extent to which a manager can influence an activity, the result may be reduced morale, a decline in managerial effort, and poor performance.
- The principle of controllability must be kept in mind when the budget is used as the basis for managerial evaluation.

Revisions to the Budget

Often an organization will find that the assumptions under which the budget was prepared undergo significant change during the year. A policy must be in place to accommodate revisions to the budget resulting from these changes.

- Accommodation of change is a key characteristic of successful budgeting. If such a policy is not in place, managers can come to believe they are being held to a budget that is no longer possible to achieve, and morale can suffer.

Information gained during the year as actual results and variances are reported can be used to help the company take corrective action. The following five steps make up a control loop:

1. Establishing standards of performance (the budget)
 2. Measuring actual performance
 3. Analyzing and comparing performance with standards
 4. Devising and implementing corrective actions
 5. Reviewing and revising the standards
-

Criticisms and Limitations of the Budgeting Process

Lower-level managers and other workers often feel that management makes across-the-board cuts when early budget iterations show that planned expenses are too high.

- The reason may be that management either does not take the time to examine specific areas of the budget closely or is unwilling to make tough decisions about where cuts need to be made.

Budgeting is usually based on a year's time span and the component months and quarters of that year, which is an artificial time horizon. However, innovation and rapid responses should not be limited by an artificial deadline imposed by a budget.

A budget is supposed to be an active document and should be used regularly with budget-to-actual comparisons being analyzed monthly, or even weekly. Unfortunately, some managers develop a budget and then wait until the end of the year to make evaluations. The use of a rolling, or continuous, budget helps avoid this problem.

Many companies are reluctant to change a budget. Even the best budget needs to be changed occasionally to respond to changes in the organization's operating environment.

13.2 Budgeting and Standard Costs

The Use of Cost Standards

Standard costs are **predetermined expectations** about how much a unit of input, a unit of output, or a given activity should cost.

- The use of standard costs in budgeting allows the standard-cost system to alert management when the actual costs of production differ significantly from the standard.

A standard cost is not just an average of past costs but an objectively determined estimate of what a cost should be. Standards may be based on accounting, engineering, or statistical quality control studies.

- Because of the impact of fixed costs in most businesses, a standard costing system is usually not effective unless the company also has a flexible budgeting system (flexible budgeting systems are covered in Study Unit 15, Subunit 2).

Developing Standards

Activity analysis identifies, describes, and evaluates the activities that go into producing a particular output. Determining the resources and steps that go into the production process aids in the development of standard costs.

- Each operation requires its own unique set of inputs and preparations. Activity analysis describes what these inputs are and who performs these preparations.
 - Inputs include the amounts and kinds of equipment, facilities, materials, and labor. Engineering analysis, cost accounting, time-and-motion study, and other approaches may be useful.
- **Historical data** may be used to set standards by firms that lack the resources to engage in the complex task of activity analysis.

For **direct materials**, there is often a direct relationship between unit price and quality. In establishing its cost standards, a manufacturer must decide whether it will use an input that is

- Cheaper per unit but will ultimately result in using more because of low quality or
- More expensive per unit but will ultimately result in using less because of lower waste and spoilage.

For **direct labor**, the complexity of the production process and the restrictions on pay scales imposed by union agreements have the most impact on formulating cost standards. Human resources also must be consulted to help project the costs of benefits.

Standards can be set using the **authoritative** (top-down) approach or the **participative** (bottom-up) approach.

- A form of the bottom-up approach that involves line managers and their supervisors, accountants, engineers, and other interested employees before standards are accepted by top management is also called the **team development approach**.

Ideal vs. Practical Standards

Ideal (theoretical) standards are standard costs that are set for production under optimal conditions. For this reason, they are also called perfection or maximum efficiency standards.

- They are based on the work of the most skilled workers with no allowance for waste, spoilage, machine breakdowns, or other downtime.
- Often called “tight” standards, they can have positive behavioral implications if workers are motivated to strive for excellence. However, they are not widely used because they can have negative behavioral effects if the standards are perceived as impossible to attain.
- Ideal standards have been adopted by some companies that apply continuous improvement and other total quality management principles.
- Ideal standards are ordinarily replaced by currently attainable standards for cash budgeting, product costing, and budgeting departmental performance. Otherwise, accurate financial planning will be impossible.

Practical (currently attainable) standards are defined as the performance that is expected to be achieved by reasonably well-trained workers with an allowance for normal spoilage, waste, and downtime.

- An alternative interpretation is that practical standards represent possible but difficult-to-attain results.
- Compared to ideal standards, practical standards serve as a better motivating target for manufacturing personnel.

13.3 The Master Budget

Master Budget Process -- Graphical Depiction

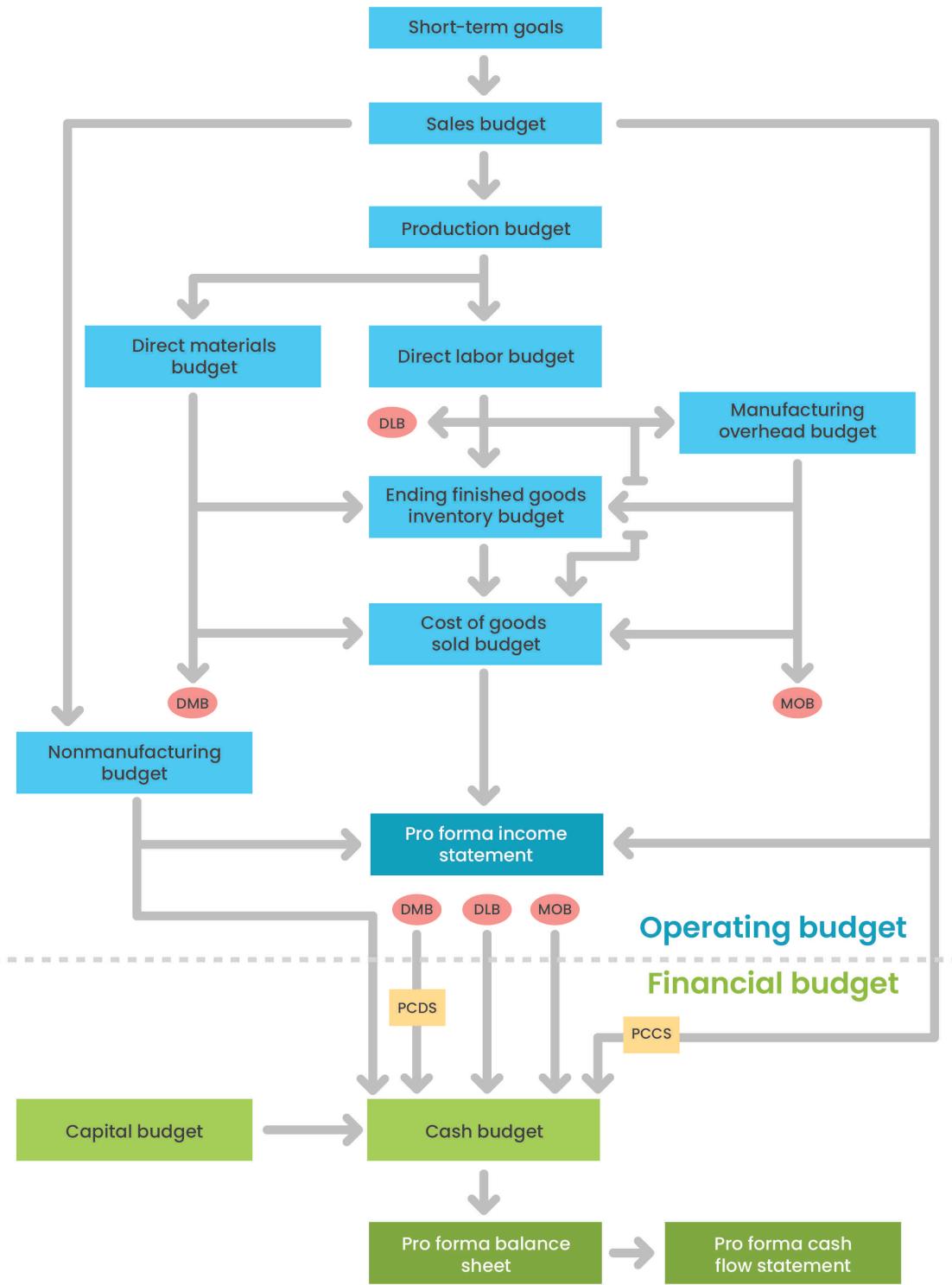


Figure 13-2

PCDS = projected cash disbursements schedule

PCCS = projected cash collection schedule



This study unit provides a brief overview of the master budget process. CMA candidates are expected to be able to prepare budgets based on relevant information (i.e., standard costs, discussed in Subunit 13.2). Take care to know the budget cycle and, especially, the order in which each budget is prepared.

Master Budget

The master budget, also called the **comprehensive budget** or **annual profit plan**, encompasses the organization's **operating and financial plans** for a specified period (ordinarily a year or single operating cycle).

The importance of carefully drafting the budget calendar is that it includes specific dates when each department must submit its budget to the next designated department.

- For example, the production budget cannot be prepared until after the sales budget. The direct materials budget and the direct labor budget cannot be prepared until after the production budget has been completed.

Operating Budget

In the operating budget, the emphasis is on obtaining and using current resources. It contains the

- Sales budget
- Production budget
- Direct materials budget
- Direct labor budget
- Employee fringe benefits budget
- Manufacturing overhead budget
- Ending finished goods inventory budget
- Cost of goods sold budget
- Nonmanufacturing budget
 - Research and development budget
 - Design budget
 - Marketing budget
 - Distribution budget
 - Customer service budget
 - Administrative budget
- Pro forma income statement

Budgeting calculations and details of these listed budgets are covered in Study Unit 14.

Financial Budget

In the financial budget, the emphasis is on obtaining the funds needed to purchase operating assets. It contains the

- Capital budget (completed before operating budget is begun)
- Projected cash disbursement schedule
- Projected cash collection schedule
- Cash budget
- Pro forma balance sheet
- Pro forma statement of cash flows

Budgeting calculations and details of these listed budgets are covered in Study Unit 14.

13.4 Budget Methodologies



Success Tip

CMA candidates must know how to both apply and select a specific budgeting method. They may also be required to explain a specific action, such as why a method should be selected. All topics are eligible to be tested on the multiple-choice section, the essay section, or both.

Project Budget

A project budget consists of all the costs expected to attach to a particular project, such as the design of a new airliner or the building of a single ship. While the project is obviously part of the company's overall line of business, the costs and profits associated with it are significant enough to be tracked separately.

A project will typically use resources from many parts of the organization, e.g., design, engineering, production, marketing, accounting, and human resources. All of these aspects of the project budget must align with those of the firm's master budget.

Example 13-1 Project Budget

Function	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Totals
Design	\$ 800,000	\$ 200,000	\$ --	\$ --	\$1,000,000
Engineering	500,000	1,200,000	400,000	--	2,100,000
Production	--	2,100,000	1,500,000	1,500,000	5,100,000
Marketing	--	100,000	200,000	200,000	500,000
Accounting	100,000	100,000	100,000	100,000	400,000
Human Resources	20,000	20,000	20,000	20,000	80,000
Totals	\$1,420,000	\$3,720,000	\$2,220,000	\$1,820,000	\$9,180,000

Activity-Based Budgeting

Activity-based budgeting applies activity-based costing principles (Study Unit 8, Subunit 3) to budgeting. Its greatest effect is on the application of **indirect costs**.

- A traditional budgeting system accumulates all indirect costs into a single pool and allocates them to products based on a cost driver such as volume or machine hours.

Example 13-2 Traditional Budgeting

A manufacturer produces two valves, a simple one and a complex one. It has budgeted production costs for the upcoming year using a traditional budgeting system:

Cost Category	Simple Valve		Complex Valve		
	Total	Per Unit	Total	Per Unit	Total
Direct materials	\$ 450,000	\$ 9.00	\$270,000	\$27.00	\$ 720,000
Direct labor	240,000	4.80	78,000	7.80	318,000
Total direct costs	\$ 690,000	\$13.80	\$348,000	\$34.80	\$1,038,000
Allocated indirect costs	720,000	14.40	234,000	23.40	954,000
Total manufacturing costs	\$1,410,000	\$28.20	\$582,000	\$58.20	\$1,992,000

Activity-based budgeting involves defining the activities that drive indirect costs.

- A cost pool is established for each activity, and a cost driver is identified for each pool.
 - The key to successful activity-based budgeting is selecting a driver for each pool that has a direct cause-and-effect relationship with the level of activity in that pool.
- The budgeted cost for each pool is determined by multiplying the demand for the activity by the estimated cost of a unit of the activity.

Example 13-3 Indirect-Cost Assignment

The manufacturer in Example 13-2 has designed an indirect-cost assignment system based on the following pools and drivers:

Indirect cost pool	Driver
Product design	Engineering hours
Production setup	Number of batches
Machining	Machine hours
Inspection & testing	Number of valves
Customer maintenance	Salesperson hours

Since activity-based budgeting employs multiple indirect cost pools, it provides far greater detail regarding indirect costs than traditional functional or spending-category budgeting (which only employs a single pool).

Example 13-4 Activity-Based Budgeting

Note that while the amounts of indirect costs assigned to the two products in Examples 13-2 and 13-3 are different, indirect costs in total are (necessarily) the same as under the traditional system:

Cost Category	Estimated Driver Level	Cost per Unit of Driver	Simple Valve		Complex Valve			Total	
			50,000		10,000				
			Total	Per Unit	Total	Per Unit			
Direct materials			\$ 450,000	\$ 9.00	\$270,000	\$27.00	\$ 720,000		
Direct labor			240,000	4.80	78,000	7.80	318,000		
Total direct costs			\$ 690,000	\$13.80	\$348,000	\$34.80	\$1,038,000		
Indirect cost assignment:									
Product design:									
Simple valve	1,000	×	\$23.75	=	\$ 23,750	\$ 0.48			
Complex valve	2,800	×	23.75	=			\$ 66,500	\$ 6.65	
Production setup:									
Simple valve	219	×	21.00	=	4,600	0.09			
Complex valve	20	×	21.00	=			420	0.04	
Machining:									
Simple valve	2,000	×	3.25	=	6,500	0.13			
Complex valve	19,000	×	3.25	=			61,750	6.18	
Inspection & testing:									
Simple valve	50,000	×	12.50	=	625,000	12.50			
Complex valve	10,000	×	12.50	=			125,000	12.50	
Customer maintenance:									
Simple valve	1,500	×	17.60	=	26,400	0.53			
Complex valve	800	×	17.60	=			14,080	1.41	
Total indirect costs			\$ 686,250	\$13.73	\$267,750	\$26.78	\$ 954,000		
Total manufacturing costs			\$1,376,250	\$27.53	\$615,750	\$61.58	\$1,992,000		

Zero-Based Budgeting

Zero-based budgeting (ZBB) is a budget and planning process in which each manager must justify his or her department's entire budget every budget cycle.

ZBB differs from the traditional concept of **incremental budgeting**, in which the current year's budget is simply adjusted to allow for changes planned for the coming year.

- The managerial advantage of incremental budgeting is that the manager has to put forth less effort to justify changes in the budget.

Under ZBB, a manager must build the budget every year from a base of zero. All expenditures must be justified regardless of variance from previous years. The objective is to encourage periodic reexamination of all costs in the hope that some can be reduced or eliminated.

- ZBB requires managers to justify each expenditure for each budget period and to review each cost component from a cost-benefit perspective.
- The major limitation of ZBB is that it requires more time and effort to prepare than a traditional budget.

Continuous (Rolling) Budgeting

A continuous (rolling) budget is one that is revised on a regular (continuous) basis.

- Typically, a company continuously extends such a budget for an additional month or quarter in accordance with new data as the current month or quarter ends.
- For example, if the budget cycle is 1 year, a budget for the next quarter will be available continuously as each quarter ends.

Example 13-5 Rolling Budget

Product Line	Fiscal Year 1				Four Quarter Totals
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	
Feed	\$ 12,000	\$ 10,000	\$ 10,000	\$ 14,000	\$ 46,000
Animal health	2,000	1,200	800	1,000	5,000
Fertilizer	80,000	75,000	20,000	10,000	185,000
Crop protectants	74,000	76,000	41,000	11,000	202,000
Petroleum	120,000	20,000	14,000	100,000	254,000
Farm supplies	15,000	45,000	55,000	20,000	135,000
Totals	\$303,000	\$227,200	\$140,800	\$156,000	\$827,000

Product Line	Fiscal Year 1			Fiscal Year 2	Four Quarter Totals
	2nd Quarter	3rd Quarter	4th Quarter		
Feed	\$ 10,000	\$ 10,000	\$ 14,000	\$ 9,000	\$ 43,000
Animal health	1,200	800	1,000	2,200	5,200
Fertilizer	75,000	20,000	10,000	90,000	195,000
Crop protectants	76,000	41,000	11,000	90,000	218,000
Petroleum	20,000	14,000	100,000	85,000	219,000
Farm supplies	45,000	55,000	20,000	10,000	130,000
Totals	\$227,200	\$140,800	\$156,000	\$286,200	\$810,200

- The principal advantage of a rolling budget is that it requires managers to always be thinking ahead.
- The disadvantage is the amount of time managers must constantly spend on budget preparation.

Study Unit Fourteen

Budgeting -- Calculations and Pro Forma Financial Statements

14.1	<i>Sales Forecasts and the Sales Budget</i>	3
14.2	<i>Operating Budget Calculations -- Production and Direct Materials</i>	4
14.3	<i>Operating Budget Calculations -- Others</i>	6
14.4	<i>The Capital Budget and Projecting Cash Collections</i>	12
14.5	<i>Cash Disbursements and the Cash Budget</i>	14
14.6	<i>Pro Forma Financial Statements</i>	17

This study unit is the **third of three on planning, budgeting, and forecasting**. The relative weight assigned to this major topic in Part 1 of the exam is **20%**. The three study units are

- Study Unit 12: Analysis, Forecasting, and Strategy
- Study Unit 13: Budgeting -- Concepts and Methodologies
- **Study Unit 14: Budgeting -- Calculations and Pro Forma Financial Statements**

This study unit discusses the budgeting theories and calculations tested on the CMA exam. Topics covered in this study unit include

- Detailed budgets within the master budget
- Budget calculations



Success Tip

A budget is a realistic plan for the future that is expressed in quantitative terms. It is many tools in one: a planning tool, a control tool, a communication tool, and a motivational tool. As such, the area of budgeting, as tested on the CMA exam, is a composite of theory and calculations. Some budgeting calculations have many steps, making budgeting problems among the most-missed questions on the CMA exam. However, budgeting should not be viewed as a difficult subject; the concepts are easy. Numerical questions simply require close attention to detail.

Budgeting Process

Each step in the budgeting process shown below is detailed in its associated subunit.

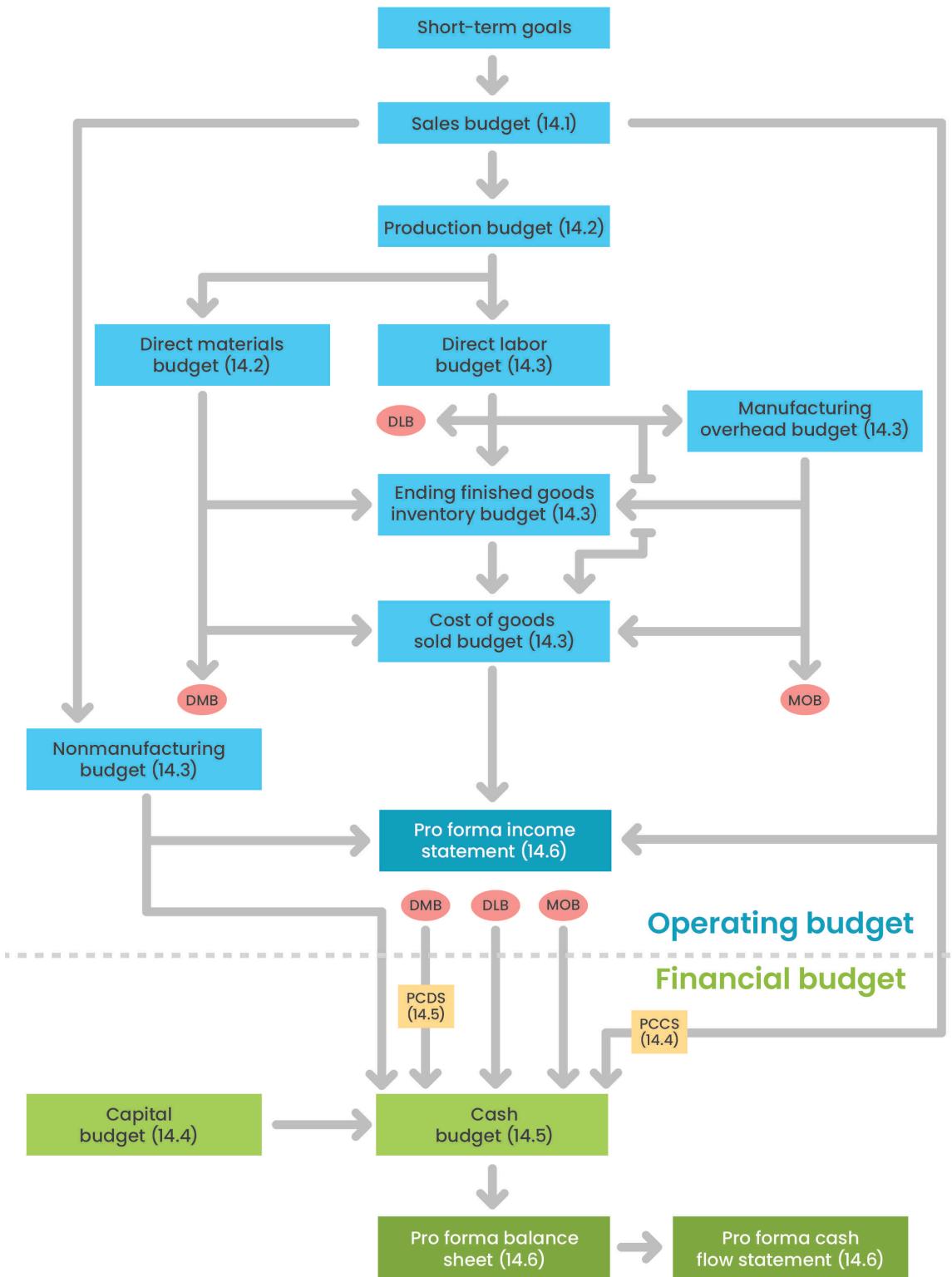


Figure 14-1

PCDS = projected cash disbursements schedule

PCCS = projected cash collections schedule

14.1 Sales Forecasts and the Sales Budget

Sales Forecasts

The sales budget is the first budget prepared in the master budget because sales volume affects production and purchasing levels, operating expenses, and cash flows. Expectations about sales drive the entire budget process.

- The sales forecast starts by looking back at historical trends and seeks to determine a pattern so that next year's sales can be predicted. Managers will also forecast sales many years into the future in order to plan more effectively.

Sales Budget

The sales budget is an outgrowth of the sales forecast. The sales forecast distills recent sales trends, overall conditions in the economy and industry, market research, activities of competitors, and credit and pricing policies. For example,

- A company may determine that demand is highly elastic for its mature products and that growth will come only from new product introductions and from cost savings on existing products.
- At the same time, the company determines that a tight monetary policy on the Fed's part must cause the firm to tighten its credit standards.
- Simultaneously, a competitor that the firm knows is a low-cost producer is also considering moving into the markets that the budgeting company is considering.
- All of these factors must be taken into account when forming expectations about product sales for the coming budget cycle.

The sales budget must specify both projected unit sales and dollar revenues.

Example 14-1 Sales Budget

The demand for this firm's product is elastic, so the price cut in June is expected to boost sales.

	April	May	June	2nd Quarter Totals	Ref.
Projected sales in units	<u>1,000</u>	<u>1,200</u>	<u>1,800</u>	<u>4,000</u>	<u>SB1</u>
Selling price	× \$400	× \$400	× \$380		
Projected total sales	<u><u>\$400,000</u></u>	<u><u>\$480,000</u></u>	<u><u>\$684,000</u></u>	<u><u>\$1,564,000</u></u>	<u><u>SB2</u></u>

14.2 Operating Budget Calculations -- Production and Direct Materials

Production Budget

The production budget starts with the unit data from the sales budget. To minimize finished goods carrying costs and obsolescence, the levels of production are dependent upon the projections contained in the sales budget.

- The production budget is concerned with **units only**. Product pricing is not a consideration since the goal is purely to plan output and inventory levels and the necessary manufacturing activity.

Example 14-2 Production Budget						
	Source	April	May	June	2nd Quarter Totals	Ref.
Projected sales in units	SB1	1,000	1,200	1,800		
Add: Desired ending inventory (10% of next month's sales)		120	180	200		
Total needed		1,120	1,380	2,000		
Less: Beginning inventory		(100)	(120)	(180)		
Units to be produced		1,020	1,260	1,820	4,100	PB

Direct Materials Budget

The direct materials budget follows directly from the production budget. It is concerned with both units and input prices.

- To minimize raw materials carrying costs and obsolescence, the purchasing of inputs is tied closely to the projections contained in the production budget.

Example 14-3 Two Direct Materials Budgets

Note that in the third month, the process is expected to experience improved efficiency with regard to Raw Material A. A price break on Raw Material B is expected.

Raw Material A	Source	April	May	June	2nd Quarter Totals	Ref.
Units to be produced	PB	1,020	1,260	1,820		
Raw material per finished product		x 4	x 4	x 3		DMB1
Total units needed for production		4,080	5,040	5,460		
Raw material cost per unit		x \$12	x \$12	x \$12		DMB2
Cost of units used in production		\$48,960	\$60,480	\$65,520	\$174,960	DMB3
Add: Desired units in ending inventory (20% of next month's need)		1,008	1,092	1,600		
Total needs		5,088	6,132	7,060		
Less: Beginning inventory		(400)	(1,008)	(1,092)		
Raw material to be purchased		4,688	5,124	5,968		
Raw material cost per unit		x \$12	x \$12	x \$12		
Cost of raw material to be purchased		\$56,256	\$61,488	\$71,616		DMB4

Raw Material B	Source	April	May	June	2nd Quarter Totals	Ref.
Units to be produced	PB	1,020	1,260	1,820		
Raw material per finished product		x 2	x 2	x 2		DMB5
Total units needed for production		2,040	2,520	3,640		
Raw material cost per unit		x \$10	x \$10	x \$8		DMB6
Cost of units used in production		\$20,400	\$25,200	\$29,120	\$74,720	DMB7
Add: Desired units in ending inventory (20% of next month's need)		504	728	900		
Total needs		2,544	3,248	4,540		
Less: Beginning inventory		(200)	(504)	(728)		
Raw material to be purchased		2,344	2,744	3,812		
Raw material cost per unit		x \$10	x \$10	x \$8		
Cost of raw material to be purchased		\$23,440	\$27,440	\$30,496		DMB8

14.3 Operating Budget Calculations -- Others

Direct Labor Budget

The direct labor budget depends on wage rates, amounts and types of production, numbers and skill levels of employees to be hired, etc.

Example 14-4 Direct Labor Budget

No new efficiencies are expected, and the wage rate is set by contract with the union.

	Source	April	May	June	2nd Quarter Totals	Ref.
Units to be produced	PB	1,020	1,260	1,820		
Direct labor hours per unit		x 2	x 2	x 2		DLB1
Projected total direct labor hours		2,040	2,520	3,640		DLB2
Direct labor cost per hour		x \$18.64	x \$18.64	x \$18.64		
Total projected direct labor cost*		\$38,026	\$46,973	\$67,850	\$152,849	DLB3

*NOTE: For the remaining calculations, please round to the nearest whole number.

Employee Fringe Benefits

The **cost of fringe benefits** must be derived once the cost of wages has been determined.

- Whether employee fringes are included in direct labor costs or treated as overhead, the effect on cost of goods sold is the same. Both ways include the amounts in variable manufacturing costs.

Example 14-5 Employee Fringe Benefit Projection

	Source	April	May	June	2nd Quarter Totals	Ref.
Projected direct labor wages	DLB3	\$38,026	\$46,973	\$67,850	\$152,849	
Employer FICA match (7.65%)		2,909	3,593	5,191	11,693	
Health insurance (12.1%)		4,601	5,684	8,210	18,495	
Life insurance (5%)		1,901	2,349	3,393	7,643	
Pension matching (4%)		1,521	1,879	2,714	6,114	
Total projected direct labor cost		\$48,958	\$60,478	\$87,358	\$196,794	DLB4

The full per-hour cost of labor can now be determined. This will be used in determining the costs embedded in units remaining in ending finished goods inventory.

Because a first-in, first-out (FIFO) assumption is used for all inventories and only units produced in June are expected to remain at the end of June, the calculation is only necessary for June's data.

$$\frac{\text{Total projected direct labor cost}}{\$87,358} \div \frac{\text{Total projected direct labor hours}}{3,640} = \frac{\text{Full direct labor cost per hour}}{\$24} \quad \text{Ref. DLB5}$$

Variable Overhead

The **manufacturing overhead budget** reflects the nature of overhead as a mixed cost, i.e., one that has a variable component and a fixed component.

Variable overhead contains those elements that vary with the level of production. Examples include (1) indirect materials, (2) indirect labor, and (3) variable factory operating costs (e.g., electricity).

Example 14-6 Variable Overhead Budget

Note that variable overhead will be applied to finished goods on the basis of direct labor hours.

Variable overhead	Source	April	May	June	2nd Quarter Totals	Ref.
Projected total direct labor hours	DLB2	2,040	2,520	3,640		
Variable OH rate per direct labor hour		x \$2	x \$2	x \$2		MOB1
Projected variable overhead		\$4,080	\$5,040	\$7,280	\$16,400	MOB2

Fixed Overhead

Fixed overhead contains those elements that remain the same regardless of the level of production. Examples include (1) real estate taxes, (2) insurance, and (3) depreciation.

Example 14-7 Fixed Overhead Budget

Note that fixed overhead will be applied based on the number of units produced.

Fixed overhead	Source	April	May	June	2nd Quarter Totals	Ref.
Projected fixed overhead		\$9,000	\$9,000	\$9,000	\$27,000	MOB3
Projected unit production	PB	$\div 1,020$	$\div 1,260$	$\div 1,820$		
Fixed OH applied per unit		<u>\$ 8.82</u>	<u>\$ 7.14</u>	<u>\$ 4.95</u>		MOB4

Ending Finished Goods Inventory Budget

The ending finished goods inventory budget can be prepared now that the components of finished goods cost have been projected.

- The end result will have a direct impact on the pro forma balance sheet (discussed in Subunit 14.6). The higher the amount of costs capitalized in finished goods, the higher will be the firm's projected asset balance at year end.

Example 14-8 Unit-Cost Calculation

Since a first-in, first-out (FIFO) assumption is used for all inventories and only units produced in June are expected to remain at the end of June, this calculation uses June's data.

	Source	Qty.	Source	Input cost	Cost per finished unit
Production costs in ending inventory:					
Direct materials -- raw material A	DMB1	3	DMB2	\$12.00	\$ 36.00
Direct materials -- raw material B	DMB5	2	DMB6	8.00	16.00
Direct labor	DLB1	2	DLB5	24.00	48.00
Variable overhead	DLB1	2	MOB1	2.00	4.00
Fixed overhead	--	1	MOB4	4.95	4.95
Finished goods cost					<u>\$108.95</u>

Now the total amount of cost embedded in ending inventory can be derived.

$$\frac{\text{Total FIFO cost per finished unit}}{\$108.95} \times \frac{\text{Projected units at June 30}}{200} = \frac{\text{Projected ending inventory}}{\$21,790} \quad \text{Ref. EFGIB}$$

Cost of Goods Sold Budget

The cost of goods sold budget combines the results of the projections for the three major inputs (materials, labor, overhead).

- The result directly affects the pro forma income statement (discussed in Subunit 14.6). Cost of goods sold is the single largest reduction to revenues for a manufacturer.

Example 14-9 Cost of Goods Sold Budget for the Quarter

	<u>Source</u>	<u>Ref.</u>
Beginning finished goods inventory		\$ 16,200
Manufacturing costs:		
Direct materials used -- A	DMB3	\$174,960
Direct materials used -- B	DMB7	74,720
Direct labor employed	DLB4	196,794
Variable overhead	MOB2	16,400
Fixed overhead	MOB3	<u>27,000</u>
Cost of goods manufactured		<u>489,874</u>
Cost of goods available for sale		<u>\$506,074</u>
Ending finished goods inventory	EFGIB	<u>(21,790)</u>
Cost of goods sold		<u>\$484,284</u>
		CGSB

Budgeted gross margin, the amount left over from sales revenue after the cost of the product, can now be calculated.

	<u>Source</u>
Sales	SB2
Cost of goods sold	CGSB
Gross margin	<u>\$1,079,716</u>

The calculation of gross margin is required for external financial reporting. Cost of goods sold for this purpose must be derived using absorption (full) costing (discussed in Study Unit 7, Subunit 4), i.e., by including all manufacturing costs, both variable and fixed.

For internal reporting, variable (direct) costing (also discussed in Study Unit 7, Subunit 4), which includes only variable costs in cost of goods sold, is more useful than absorption costing.

Variable Costing and Contribution Margin

Contribution margin is the amount left over from sales after subtracting variable costs.

- Contribution margin is the amount available for “contributing” to the covering of fixed costs and providing a profit (a more detailed discussion of absorption and variable costing can be found in Study Unit 7, Subunit 4).
- Although it is impermissible for external financial reporting, contribution margin is more useful to management accountants because it more accurately reveals the change in profitability resulting from a given change in output.

Cost of goods sold calculated on a variable-costing basis includes **only** those costs that vary directly with the level of production.

$$\text{Total sales} - \text{Total variable expenses} = \text{Total contribution margin}$$

Contribution margin per unit can be calculated using the per-unit sales and variable costs, or the total contribution margin can be divided by the total number of units.

Nonmanufacturing Budget

The nonmanufacturing budget consists of the individual budgets for R&D, design, marketing, distribution, customer service, and administrative costs.

- The development of separate R&D, design, marketing, distribution, customer service, and administrative budgets reflects a **value chain approach** (discussed in Study Unit 11, Subunit 1).
- An alternative is to prepare a single **selling and administrative budget** for nonproduction costs.

The variable and fixed portions of selling and administrative costs (S&A) must be treated separately.

- Some S&A costs vary directly and proportionately with the level of sales. For example, as more product is sold, sales representatives must travel more miles and serve more customers.
- Other S&A expenses, such as sales support staff, are fixed; they must be paid no matter the level of sales.

Example 14-10 Nonmanufacturing Costs Budget

Note the separate treatment of the variable and fixed portions.

	<u>Source</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>2nd Quarter Totals</u>	<u>Ref.</u>
Variable nonmanufacturing costs:						
Projected sales in units	SB1	1,000	1,200	1,800		
Variable S&A expenses (\$3 per unit sold)		$\times \quad \$3$	$\times \quad \$3$	$\times \quad \$3$		
Total variable nonmanufacturing costs		\$ 3,000	\$ 3,600	\$ 5,400	\$ 12,000	
Fixed nonmanufacturing costs:						
Research and development		\$ 8,000	\$ 8,000	\$ 8,000	\$ 24,000	
Design		4,000	4,000	4,000	12,000	
Marketing		7,000	7,000	7,000	21,000	
Distribution		10,000	10,000	10,000	30,000	
Customer service		11,000	11,000	11,000	33,000	
Administrative		50,000	50,000	50,000	150,000	
Total fixed nonmanufacturing costs		\$90,000	\$90,000	\$90,000	\$270,000	
Total nonmanufacturing costs		\$93,000	\$93,600	\$95,400	\$282,000	NMB

As the variable portion of S&A costs increases, contribution margin is decreased.

Note that management can make tradeoffs among elements of selling and administrative expenses that can affect contribution margin. For example, use of fixed advertising expense will increase contribution margin, while the same sales level might be reached using variable sales commissions, a method that would reduce contribution margin.

Pro Forma Operating Income

If the projected level of operating income is insufficient, the various components of the operating budget can be adjusted.

Example 14-11 Pro Forma Operating Income

	<u>Source</u>	
Sales	SB2	\$1,564,000
Cost of goods sold	CGSB	(484,284)
Gross margin		\$1,079,716
Nonmanufacturing costs	NMB	(282,000)
Operating income		\$ 797,716

14.4 The Capital Budget and Projecting Cash Collections

Capital Budget

The capital budget concerns financing of major expenditures for long-term assets and must therefore have a multi-year perspective. Productive machinery must be acquired to enable the company to achieve its projected levels of output.

Procedures for ranking projects according to their risk and return characteristics are necessary because every organization has finite resources.

The capital budget has a direct impact on the cash budget (discussed in Subunit 14.5) and the pro forma financial statements (discussed in Subunit 14.6).

A **capital expenditures budget** is a listing of all desired expenditures for long-lived assets. It will have two or more columns.

- The first column is for the upcoming budget year and will be incorporated into the operating budget.

Example 14-12 Capital Expenditures Budget

Following is an example of a capital expenditures budget.

Planned Cash Outflows	Year 1	Year 2	Year 3	Year 4	Year 5
Equipment	\$30,000				
Forklift		\$40,000			\$45,000
Delivery truck		\$50,000			
Computers		\$10,000	\$10,000		
Storage facility				\$100,000	
Parking lots		\$20,000			\$40,000

Notice that the first column represents planned cash outflows for the upcoming Year 1 budget. The Year 1 data will be incorporated into the master budget preparation for the current upcoming year (Year 1).

The remaining columns (Years 2-5) are for future years. These columns are not incorporated into the current operating budget but serve as a starting point for subsequent years' capital expenditures budgets.

The capital budget impacts the pro forma balance sheet (discussed in Subunit 14.6).

- Principal and interest on debt acquired to finance capital purchases require regular cash outflows. The acquired debt also appears in the liabilities section of the pro forma balance sheet.
- At the same time, the output produced by the new productive assets generates regular cash inflows. In addition, the new assets themselves appear in the assets section of the pro forma balance sheet.

Cash Collections Schedule

The projected cash collections schedule is used to estimate the inflows of cash from customer payments. The cash collections schedule is prepared and used on the cash budget (covered in Subunit 14.5).

Example 14-13 Cash Collections Schedule

Note the assumption that 5% of sales will prove to be uncollectible.

Projected February sales		\$180,000			
Projected March sales		\$220,000			
	Source	April	May	June	Ref.
Projected sales	SB2	\$400,000	\$480,000	\$684,000	
Cash collections from sales:					
From 2nd prior month sales (30%)		54,000	66,000	120,000	
From prior month sales (50%)		110,000	200,000	240,000	
From current month sales (15%)		60,000	72,000	102,600	
Total cash collections from sales		\$224,000	\$338,000	\$462,600	PCCS

14.5 Cash Disbursements and the Cash Budget

A cash disbursements schedule for raw materials is prepared to budget cash outflows and is used in the company's cash budget.

Example 14-14 Materials Cash Disbursements Schedule

March raw materials purchases -- A		\$45,000			
March raw materials purchases -- B		\$17,000			
Projected raw materials cost -- A	Source DMB4	April \$56,256	May \$61,488	June \$71,616	Ref.
Cash payments for purchases of A:					
For prior month purchases (40%)		18,000	22,502	24,595	
For current month purchases (60%)		33,754	36,893	42,970	
Total cash disbursements for A		<u>\$51,754</u>	<u>\$59,395</u>	<u>\$67,565</u>	PCDS1
Projected raw materials cost -- B	Source DMB8	April \$23,440	May \$27,440	June \$30,496	
Cash payments for purchases of B:					
For prior month purchases (40%)		6,800	9,376	10,976	
For current month purchases (60%)		14,064	16,464	18,298	
Total cash disbursements for B		<u>\$20,864</u>	<u>\$25,840</u>	<u>\$29,274</u>	PCDS2

Cash Budget Preparation

The cash budget combines the results of the operating budget with the cash collections schedule (covered in Subunit 14.4) and cash disbursement schedule to produce a comprehensive view of the sources and uses of cash.

- The cash budget is used to plan outside financing activities. For example, if the budget shows a cash deficit at some future date, the firm can plan ahead to borrow the necessary funds or sell stock.
- The cash budget also is used to plan the investing of excess cash.
- Dividend policy can also be planned using the cash budget. Dividend payment dates should correspond to a time when the firm has excess cash.

Cash budgets are prepared not only for annual and quarterly periods but also for monthly and weekly periods. They are particularly important for organizations operating in seasonal industries.

- The factors needed to prepare a cash forecast include all other elements of the budget preparation process, plus consideration of collection policies, bad debt estimates, changes in the economy, and anticipation of non-routine transactions.
- Factors should be considered for short-term and long-term cash forecasting (i.e., nonroutine property purchases and sales).

Credit and purchasing policies have a direct impact on the cash budget. Loose credit policies toward customers' credit result in delayed cash receipts. Taking advantage of purchase discounts results in accelerated cash outlays.

Example 14-15 Cash Budget

The last section deals with the anticipated handling of a cash deficit.

	Source	April	May	June
Beginning cash balance		\$ 50,000	\$100,000	\$130,767
Cash collections from sales	PCCS	224,000	338,000	462,600
Cash available for disbursement		\$274,000	\$438,000	\$593,367
Cash disbursements:				
For raw material A	PCDS1	\$ 51,754	\$ 59,395	\$ 67,565
For raw material B	PCDS2	20,864	25,840	29,274
For direct labor	DLB4	48,958	60,478	87,358
For variable overhead	MOB2	4,080	5,040	7,280
For fixed overhead	MOB3	9,000	9,000	9,000
For nonmanufacturing costs	NMB	93,000	93,600	95,400
For equipment purchases	Cap. Budg.	0	0	30,000
Total disbursements		\$227,656	\$253,353	\$325,877
Surplus of cash available over disbursements		\$ 46,344	\$184,647	\$267,490
Desired ending cash balance		(100,000)	(100,000)	(100,000)
Surplus (deficiency) of cash		\$ (53,656)	\$ 84,647	\$167,490
		April	May	June
Financing:				
Borrowings		\$ 53,656	\$ 0	\$ 0
Repayments:				
Principal		0	(53,656)	0
Interest		0	(224)	0
Net financing		\$ 53,656	\$ (53,880)	\$ 0
Ending cash balance		\$100,000	\$130,767	\$267,490

Example 14-16 Cash Budget

Following is a cash budget for a company that had budgeted sales of \$9,000 for January, \$9,700 for February, and \$13,950 for March.

Cash Budget For Quarter Ending March 31				
	<u>January</u>	<u>February</u>	<u>March</u>	<u>Total</u>
Beginning cash balance	\$ 80	\$ 20	\$ 1,957	\$ 80
Receipts:				
Collection from sales*	<u>6,800</u>	<u>9,350</u>	<u>11,825</u>	<u>27,975</u>
Total cash available	<u>\$6,880</u>	<u>\$9,370</u>	<u>\$13,782</u>	<u>\$28,055</u>
Payments:				
Purchases**	\$3,150	\$2,760	\$ 3,960	\$ 9,870
Sales salaries	1,350	1,455	2,093	4,898
Supplies	360	388	558	1,306
Utilities	120	110	100	330
Administrative salaries	1,800	1,800	1,800	5,400
Advertising	80	80	80	240
Equipment purchases	0	820	3,000	3,820
Total payments	<u>\$6,860</u>	<u>\$7,413</u>	<u>\$11,591</u>	<u>\$25,864</u>
Ending balance	<u>\$ 20</u>	<u>\$1,957</u>	<u>\$ 2,191</u>	<u>\$ 2,191</u>

* Sales are 50% cash sales and 50% on credit (net 30 days). Thus, 50% of each month's sales are collected in the month of the sale and 50% are collected in the following month. For example, the February collections were calculated as follows:

50% of January sales	\$4,500
50% of February sales	4,850
	<u>\$9,350</u>

** Purchases are on terms of net 30 days. Thus, purchases are paid for in the month following the purchase. The amount paid in February (\$2,760) was the total purchases for January.

14.6 Pro Forma Financial Statements

Pro Forma Statement of Income

Pro forma is a Latin phrase meaning “according to form.” It can be loosely translated to mean “as if.” Financial statements are referred to as pro forma when they reflect projected, rather than actual, results.

- The pro forma income statement is used to decide whether the budgeted activities will result in an acceptable level of income. If the initial pro forma income shows a loss or an unacceptable level of income, adjustments can be made to the component parts of the master budget.
- Other strategic objectives can also be observed from the pro forma income statement, such as a target gross margin percentage.

Example 14-17 Pro Forma Income Statement

Manufacturing Company Pro Forma Statement of Income 2nd Quarter		
Sales		\$1,564,000
Beginning finished goods inventory	\$ 16,200	
Add: Cost of goods manufactured	<u>489,874</u>	
Goods available for sale	<u>\$506,074</u>	
Less: Ending finished goods inventory	<u>(21,790)</u>	
Cost of goods sold	<u>(484,284)</u>	
Gross margin	<u>\$1,079,716</u>	
Less: Selling and administrative expenses	<u>(282,000)</u>	
Operating income	<u>\$ 797,716</u>	
Add: Other revenues and gains	15,000	
Less: Other expenses and losses	<u>(10,000)</u>	
Earnings before interest and taxes	<u>\$ 802,716</u>	
Less: Interest expense	<u>(224)</u>	
Earnings before income taxes	<u>\$ 802,492</u>	
Less: Income taxes (40%)	<u>(320,997)</u>	
Net income	<u>\$ 481,495</u>	



Author's Note

Preparing pro forma financial statements is very similar to preparing historical financial statements. Candidates may find this is a good time to review Study Units 1 through 6 on external financial reporting.

Revenue and cost assumptions can be changed and their effects on pro forma net income observed.

Example 14-18 Pro Forma Income Statement -- Change in Gross Margin

The company has projected gross margin to be 69% of sales ($\$1,079,716 \div \$1,564,000$). If gross margin is changed to 75% of sales ($\$1,564,000 \times .75 = \$1,173,000$), the pro forma income statement will reflect a different bottom line.

Manufacturing Company Pro Forma Statement of Income 2nd Quarter	
Sales	\$1,564,000
Cost of goods sold	<u>(391,000)</u>
Gross margin	\$1,173,000
Less: Selling and administrative expenses	<u>(282,000)</u>
Operating income	\$ 891,000
Add: Other revenues and gains	<u>15,000</u>
Less: Other expenses and losses	<u>(10,000)</u>
Earnings before interest and taxes	\$ 896,000
Less: Interest expense	<u>(224)</u>
Earnings before income taxes	\$ 895,776
Less: Income taxes (40%)	<u>(358,310)</u>
Net income	<u>\$ 537,466</u>

Percentage of Sales Method

After sales are forecasted, future financial statements must be forecasted. The most common method is the percent of sales method.

- Under this method, many items on the income statement and balance sheets are assumed to increase proportionately to sales.
- Other items may be based off historical data (i.e., interest expense may remain constant due to contracts previously entered into) or be based off forecasted net sales (i.e., cost of goods sold will be 60% of net sales).

Example 14-19 Percentage of Sales Method

LisaCo's Actual Year 5 and Projected Year 6 Income Statement
(millions of dollars)

	Actual Year 5	Forecast Basis	Year 6 Forecast
Sales	\$4,000	$1.11 \times \text{Year 6 sales}$	\$4,440
Cost of goods sold	(3,200)	80% of net sales	(3,552)
Gross margin	\$ 800		\$ 888
Selling and administrative expenses	(300)	$1.11 \times \text{Year 6 sales}$	(333)
Operating income	\$ 500		\$ 555
Other revenue	200	Same as last year	200
Earnings before interest and taxes (EBIT)	\$ 700		\$ 755
Interest	(100)	Same as last year	(100)
Earnings before taxes (EBT)	\$ 600		\$ 655
Taxes (40%)	(240)		(262)
Net income	\$ 360		\$ 393

Notes

- Sales and selling and administrative expenses are expected to increase by 11% in the next year.
- Cost of goods sold is expected to remain at 80% of net sales.
- Other revenue and interest expense are expected to remain constant.

Pro Forma Balance Sheet

The pro forma balance sheet is prepared using the cash and capital budgets and the pro forma income statement.

- The pro forma balance sheet is the beginning-of-the-period balance sheet updated for projected changes in cash, receivables, payables, inventory, etc.
- If the balance sheet indicates that a contractual agreement may be violated, the budgeting process must be repeated.
 - For example, some loan agreements require that stockholders' equity be maintained at some percentage of total debt or that current assets be maintained at a given multiple of current liabilities.

Pro Forma Statement of Cash Flows

The pro forma statement of cash flows is normally the last statement prepared. The pro forma statement of cash flows is intended to help users evaluate the firm's liquidity, solvency, and financial flexibility.

The pro forma statement of cash flows classifies cash receipts and disbursements depending on whether they are from operating, investing, or financing activities.

Financial Projections and Ratio Analysis

Pro forma financial statements are of interest to parties outside the organization as well as inside. Banks and stock analysts in particular want to know what the firm believes its results will be.

Projections help the bank assess whether the company anticipates satisfying the requirements of debt covenants.

- Typically, a firm's financing agreement with its bank requires that its debt ratio remain below a certain threshold and that its coverage ratios remain above a threshold.
 - The debt ratio is the portion of the firm's capital structure that consists of debt, i.e., total liabilities divided by total assets.
 - The most common coverage ratio is times interest earned, i.e., earnings before interest and taxes divided by interest expense.
- Projection of satisfactory levels of these ratios provide the bank some assurance that the firm will remain solvent for the foreseeable future.

Study Unit Fifteen

Cost and Variance Measures

15.1	<i>Variance Analysis Overview</i>	2
15.2	<i>Static and Flexible Budget Variances</i>	7
15.3	<i>Direct Materials Variances</i>	11
15.4	<i>Direct Labor Variances</i>	15
15.5	<i>Mix and Yield Variances</i>	17
15.6	<i>Overhead Variances</i>	20
15.7	<i>Comprehensive Example</i>	26
15.8	<i>Sales Variances</i>	29

This study unit is the **first of two on performance management**. The relative weight assigned to this major topic in Part 1 of the exam is **20%**. The two study units are

- **Study Unit 15: Cost and Variance Measures**
- Study Unit 16: Responsibility Accounting and Performance Measures

This study unit discusses the concepts and calculations related to variance analysis. CMA candidates should understand standard costing and how to compare budgeted results to actual results. Topics covered in this study unit include

- Favorable and unfavorable variances
- Management by exception
- Flexible budgets
- Static budgets
- Flexible budget variances
- Sales volume variances
- Direct materials variances
- Direct labor variances
- Mix and yield variances
- Overhead variances
- Sales variances

**Author's Note**

Performance reporting is a major topic on the CMA exam. Factors to be analyzed for control and performance evaluation include revenues, costs, profits, and investment in assets. Variance analysis based on flexible budgets and standard costs is heavily tested, as is responsibility accounting for revenue, cost, investment, and profit centers. The balanced scorecard (explained in Study Unit 16) is included in this discussion.

15.1 Variance Analysis Overview

A budget communicates to employees the organization's operational and strategic objectives. The budget quantifies the operational steps that ultimately lead to the achievement of strategic objectives.

A performance evaluation system must be used to monitor progress toward the budget's objectives. Feedback should be timely so that managers can take corrective action.

- Information sent to top management is ordinarily more highly aggregated and less timely than that communicated to managers at operational levels.
 - Top managers are concerned with the organization's overall financial results and long-term prospects and are responsible for the strategic planning function.
- Lower-level reports contain more quantitative information of an operational nature, e.g., production data.

Variance Analysis

Variance analysis is the basis of any performance evaluation system using a budget.

Variances are the differences between the amounts budgeted and the amounts actually incurred (or earned in the case of revenues).

- A primary reason for calculating variances is to notify management whenever an unusual event has occurred.
- Management uses this information to improve future performance forecasts and take early corrective action (e.g., changing a business process).

Variances may be favorable or unfavorable. Whether a variance is favorable or unfavorable depends on how it affects income.

- A **favorable variance** increases income.
- An **unfavorable variance** decreases income.
- Favorable variances are labeled with an F and unfavorable variances are labeled with a U.

Variance	Relationship
Favorable	Actual revenues > Budgeted revenues Actual costs < Budgeted costs
Unfavorable	Actual revenues < Budgeted revenues Actual costs > Budgeted costs

Example 15-1 Unfavorable Variance

Under efficient conditions, a worker should complete one unit of product per hour. If workers are normally paid \$6 per hour, the standard labor cost per unit is \$6 per unit. If the actual per-unit amounts for a 1-week period were 1.1 hours at \$6.25 per hour, or \$6.88 per unit, the variance is \$.88 per unit. The variance is unfavorable because the actual cost exceeded the standard cost.

The significance of variances depends not only on their amount but also on their direction, frequency, and trend. Persistent variances may indicate that standards need to be reevaluated.

Variance analysis enables **management by exception**, the practice of giving attention primarily to significant deviations from expectations (whether favorable or unfavorable).

- Concentrating on operations that are not performing within expected limits is likely to yield the best ratio of benefits to costs.

Assignment of Responsibility

A crucial part of variance analysis is the **assignment of responsibility**. The performance measures on which managers are judged should be directly related to the factors that drive the element being measured, e.g., cost drivers and revenue drivers.

The goal is to assign responsibility for variances to those most likely to have information that will enable management to find solutions. A manager who does not control an activity may nevertheless be the individual who is best informed about it.

- The constructive approach is to promote learning and continuous improvement in manufacturing operations, not to assign blame. However, variance analysis may be useful in evaluating managers' performance.

Overview of Variances



Author's Note

The variances beginning below are covered in greater detail throughout this study unit. CMA candidates should be prepared to calculate and understand these variances. Questions on variance analysis are among the most missed items on the CMA exam. It is also a heavily weighted subject. Thus, candidates should spend extra time on this topic area and work as many problems and questions as possible in preparation.

Static Budget Variance

The static budget variance measures the difference between the static (master) budget amount and the actual results. It is the total variance to be explained.

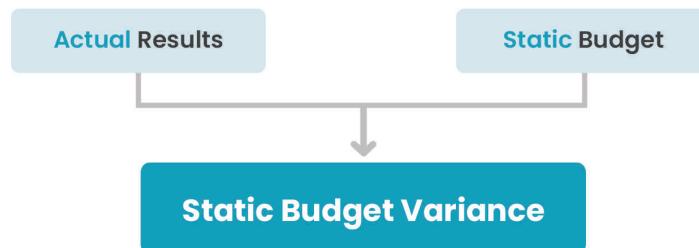


Figure 15-1

Flexible Budget Variance and Sales Volume Variance

The static budget variance consists of a flexible budget variance and a sales volume variance.

- The **flexible budget variance** is the difference between the actual results and the budgeted amount for the **actual activity level**. It may be analyzed in terms of variances related to selling prices, input costs, and input quantities.
 - A **flexible budget** must be based on per-unit variable costs (costs that vary with activity) and total fixed costs (costs incurred regardless of activity). Thus, it consists of the costs that should have been incurred given the actual level of production.
 - ▶ Actual production is actual output, but variable costs are measured using the standard level of inputs (e.g., direct labor hours, machine hours, etc.).
 - **Standard costs** alert management to cost problems, permit management by exception, and may increase the efficiency of employees who participate in setting standards. Standard costs also facilitate flexible budgeting, performance evaluation, and setting employee goals.
 - ▶ Standard costs should be established for direct materials, direct labor, and overhead. These standards can then be used to calculate variances.
 - ▶ Standard costs exclude inefficiencies and reflect expected changes. Their emphasis is on current performance and potential improvement.
- The **sales volume variance** is the difference between the flexible budget and static budget amounts if selling prices and costs are constant.

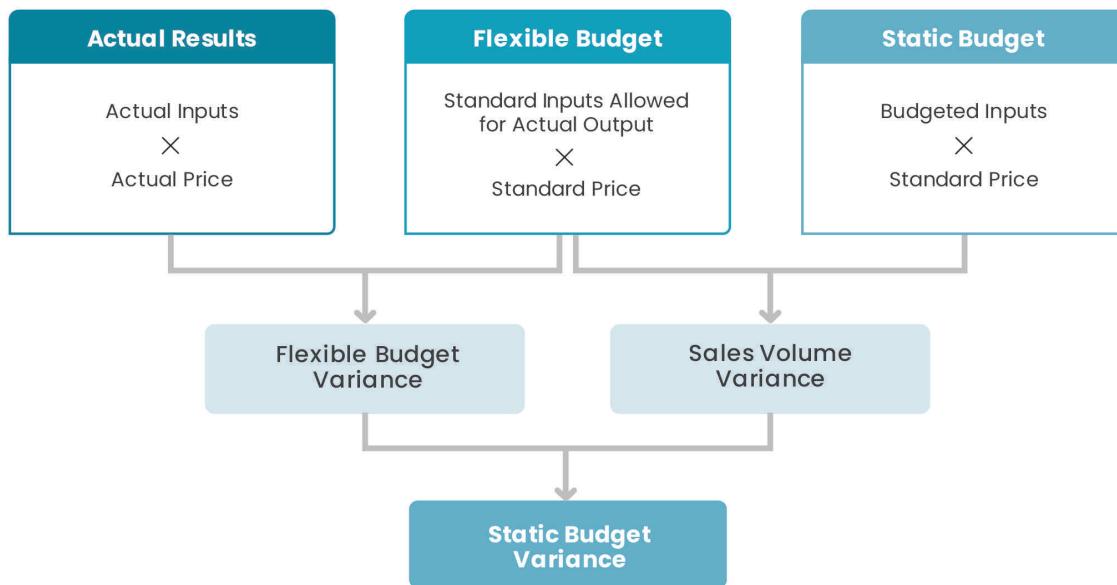


Figure 15-2

Components of the Flexible Budget Variance

The flexible budget variance consists of the following variances, which are depicted in Figure 15-3.

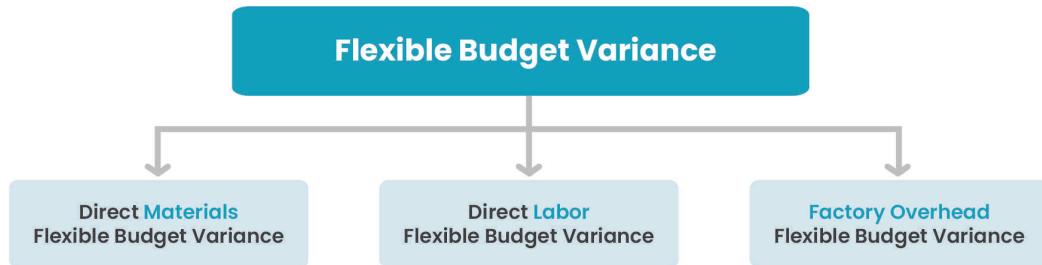


Figure 15-3

- A **direct materials variance** includes a
 - Price variance
 - Quantity or usage variance (an efficiency variance for direct materials)
 - ▶ When a product has more than one input, the materials mix variance and materials yield variance can be calculated.
- A **direct labor variance** includes a(n)
 - Rate variance (a price variance for direct labor)
 - Efficiency variance
 - ▶ When labor rates vary, the labor mix variance and labor yield variance can be calculated.
- **Factory overhead variances** have variable and fixed components. A four-way analysis includes two variable and two fixed components:
 - Variable overhead spending variance
 - Variable overhead efficiency variance
 - Fixed overhead spending variance (also known as a budget variance)
 - Fixed overhead production volume variance

Components of the Sales Volume Variance

When more than one product is made, the sales volume variance consists of the following variances:

- **Sales yield variance**
- **Sales mix variance**

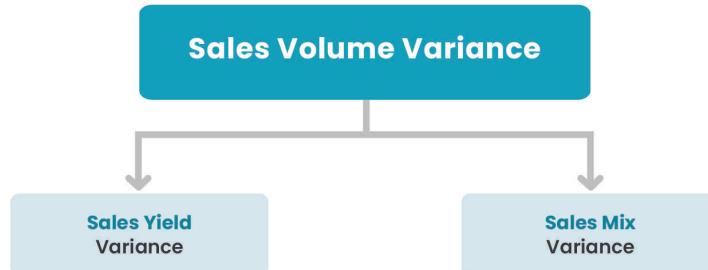


Figure 15-4

NOTE: Each of the variances introduced above and on the previous pages will be examined in detail in subsequent subunits.

Advantages and Disadvantages of Variance Analysis

Advantages of variance analysis include that it

- ✓ Identifies areas where actual results are different from budget and management can take appropriate action
- ✓ Provides a basis for investigation that promotes an understanding of operations
- ✓ Promotes accountability among personnel
- ✓ Evaluates performance of personnel
- ✓ Identifies budget estimates requiring revision

Disadvantages of variance analysis include that

- ✗ The length of time it takes to identify a problem may be too long for management to effectively take action
- ✗ There is a focus on the past without looking at the future

15.2 Static and Flexible Budget Variances

The Static Budget Variance

The static budget and actual results of the period are required to calculate the static budget variance. A **static budget** is prepared before the budget period begins and is not changed. It is based only on the output planned at the beginning of the budget period (i.e., for only one level of activity).

- The static budget reflects management's best estimates of, for example, sales, production, input prices, labor and overhead costs, and selling and administrative costs.

Standard prices (SP) are determined for the underlying cost drivers. They are budgeted unit costs established to improve productivity and efficiency.

- A standard price is not an average of past costs but an objectively determined estimate of what a cost should be. It may be based on accounting, engineering, or statistical quality control studies.
- Standard prices must be kept **current** to provide relevant information. If prices have changed considerably for a particular material, a variance is always reported if the standard price is not changed. Much of the usefulness of standard prices is lost if a large variance is always expected.

The **standard quantity (SQ)** is an objectively determined estimate of the quantity expected to be produced.

- **Ideal standards** are standard costs under optimal conditions. They are based on the work of the most skilled workers with no allowance for waste, spoilage, machine breakdowns, or other downtime. These **tight standards** are not in wide use because they are difficult to attain.
- **Practical standards** are defined as the performance that is reasonably expected to be achieved with an allowance for normal spoilage, waste, and downtime.
 - Practical standards are useful in determining standard quantity.



Success Tip

It is important to note that on the CMA exam, you may encounter slightly different names for the terms used in this outline. As a CMA candidate, it is important to be able to understand and apply variance analysis regardless of the terminology used.

Standard Price	Standard Quantity
Standard Cost	Standard Materials
Budgeted Price	Budgeted Quantity
Budgeted Cost	Budgeted Materials

Once all standard prices and standard quantities are determined, the static budget can be calculated.

$$\text{Static budget} = \text{Standard quantity} \times \text{Standard price} = \text{SQ} \times \text{SP}$$

The **actual results** are prepared after the budget period ends. The actual results reflect the revenues actually earned and the costs actually incurred.

$$\text{Actual results} = \text{Actual quantity} \times \text{Actual price} = \text{AQ} \times \text{AP}$$

The **static budget variance** is the difference between the static budget and the actual results for the period. The static budget variance provides useful information, but it does not explain the cause of the variance.

$$\text{Static budget variance} = \text{Actual results} - \text{Static budget} = (\text{AQ} \times \text{AP}) - (\text{SQ} \times \text{SP})$$

Example 15-2 Total Static Budget Variance

At the end of the current period, ChowDown, Inc., a pet food manufacturer, prepared the following analysis of the static budget variance:

	AQ × AP Actual Results	Static Budget Variances	SQ × SP Static Budget
Units sold	<u>16,500</u>	<u>(1,500) U</u>	<u>18,000</u>
Revenue	\$1,947,000	\$(213,000) U	\$2,160,000
Variable costs:			
Direct materials	750,750	160,500 F	911,250
Direct labor	321,750	(24,750) U	297,000
Variable manufacturing overhead	214,500	(41,700) U	172,800
Total variable costs	<u>\$1,287,000</u>	<u>\$ 94,050 F</u>	<u>\$1,381,050</u>
Contribution margin	\$ 660,000	\$(118,950) U	\$ 778,950
Fixed overhead	429,000	21,000 F	450,000
Operating income	<u>\$ 231,000</u>	<u>\$ (97,950) U</u>	<u>\$ 328,950</u>

Total Static Budget Variance
\$ (97,950) U

- Interpretation of the static budget variance can sometimes be misleading. For example, the \$160,500 variance on direct materials in Example 15-2 is labeled as favorable because actual cost was less than standard. However, if the variance was mostly the result of production being lower than planned, the favorable variance resulted regardless of the actions of the manager responsible. In fact, (s)he may have been the cause of production delays, which led to the use of fewer materials.
- A flexible budget using standard costs helps management determine how much of the static budget variance arose from inaccurate forecasts of output sold and variations in the effectiveness and efficiency of actual output.

Flexible Budget and Sales Volume Variances

Flexible budget variances and sales volume variances are based on flexible budgets.

A **flexible budget** adjusts for changes in the volume of activity. It can be adapted to any level of production. Budgeted revenues and costs are based on the actual quantities and standard costs.

$$\text{Flexible budget} = \text{Actual quantity} \times \text{Standard price} = \text{AQ} \times \text{SP}$$

Example 15-3 Flexible Budget

Amy's master budget for Year 4, when the company's planned volume is 20,000 units, is shown below.

Master Budget – 20,000 Units	
Sales revenue	\$4,000,000
Less: Variable expenses:	
Direct materials	(1,000,000)
Direct labor	(480,000)
Variable overhead	(140,000)
Variable selling & administrative	(60,000)
Contribution margin	\$2,320,000
Fixed overhead	800,000
Fixed selling & administrative	600,000
Operating income	\$ 920,000

The actual sales for Year 4 totaled 22,000 units. Prepare Amy's Year 4 flexible budget.

- For the items with a variable behavior (sales and variable expenses), find the budgeted cost per unit using the master budget.

$$\begin{aligned}\text{Sales revenue} &= \$4,000,000 \div 20,000 \text{ units} = \$200 \text{ per unit} \\ \text{Direct materials} &= \$1,000,000 \div 20,000 \text{ units} = \$50 \text{ per unit} \\ \text{Direct labor} &= \$480,000 \div 20,000 \text{ units} = \$24 \text{ per unit} \\ \text{Variable overhead} &= \$140,000 \div 20,000 \text{ units} = \$7 \text{ per unit} \\ \text{Variable selling & administrative} &= \$60,000 \div 20,000 \text{ units} = \$3 \text{ per unit}\end{aligned}$$

- To prepare the flexible budget based on 22,000 units, multiply the per unit amounts from the item above by 22,000 units.
- Fixed costs in total do not change as the activity level changes, assuming the 22,000 units is in the same relevant range as the master budget level of 20,000 units.

Flexible Budget – 20,000 Units	
Sales revenue	\$4,400,000
Less: Variable expenses:	
Direct materials	(1,100,000)
Direct labor	(528,000)
Variable overhead	(154,000)
Variable selling & administrative	(66,000)
Contribution margin	\$2,552,000
Fixed overhead	800,000
Fixed selling & administrative	600,000
Operating income	\$1,152,000

Flexible budget variances result from variations in the efficiency and effectiveness of producing actual output. They are the differences between actual results and flexible budget amounts.

$$\begin{aligned}\text{Flexible budget variance} &= \text{Actual results} - \text{Flexible budget} \\ &= (\text{AQ} \times \text{AP}) - (\text{AQ} \times \text{SP}) \\ &= \text{AQ} \times (\text{AP} - \text{SP})\end{aligned}$$

Sales volume variances result from inaccurate forecasts of output sold. They are the differences between flexible budget amounts and static budget amounts.

$$\begin{aligned}\text{Sales volume variance} &= \text{Flexible budget} - \text{Static budget} \\ &= (\text{AQ} \times \text{SP}) - (\text{SQ} \times \text{SP}) \\ &= \text{SP} \times (\text{AQ} - \text{SQ})\end{aligned}$$



Success Tip

The questions in this study unit use formulas written in different ways. For example, the flexible budget variance can be written in the following formats: $\text{AQ} \times (\text{AP} - \text{SP})$, $\text{AQ} \times (\text{SP} - \text{AP})$, $(\text{AP} - \text{SP}) \times \text{AQ}$, or $(\text{SP} - \text{AP}) \times \text{AQ}$. In each case, the absolute value is derived. The effect on income is then determined to decide whether the variance is favorable or unfavorable. Understanding the variances and understanding what each question is looking for will help you avoid becoming confused by the formulas being presented in different formats.

Example 15-4 Total Static Budget Variance -- Components

At the end of the current period, ChowDown, Inc., prepared the following analysis of the total static budget variance:

	AQ × AP Actual Results (AR)	AR – FB Flexible Budget Variances	AQ × SP Flexible Budget (FB)	FB – SB Sales Volume Variances	SQ × SP Static Budget (SB)
Units sold	<u>16,500</u>		<u>16,500</u>	<u>(1,500) U</u>	<u>18,000</u>
Revenue	\$1,947,000	\$(33,000) U	\$1,980,000	\$(180,000) U	\$2,160,000
Variable costs:					
Direct materials	750,750	84,563 F	835,313	75,937 F	911,250
Direct labor	321,750	(49,500) U	272,250	24,750 F	297,000
Variable non-mfg. overhead	214,500	(56,100) U	158,400	14,400 F	172,800
Total variable costs	<u>\$1,287,000</u>	<u>\$(21,037) U</u>	<u>\$1,265,963</u>	<u>\$ 115,087 F</u>	<u>\$1,381,050</u>
Contribution margin	660,000	(54,037) U	714,037	(64,913) U	778,950
Fixed overhead	429,000	21,000 F	450,000	0	450,000
Operating income	<u>\$ 231,000</u>	<u>\$(33,037) U</u>	<u>\$ 264,037</u>	<u>\$ (64,913) U</u>	<u>\$ 328,950</u>
Total Flexible Budget Variance \$(33,037) U			Total Sales Volume Variance \$(64,913) U		
Total Static Budget Variance \$(97,950) U					

15.3 Direct Materials Variances



Success Tip

CMA candidates must be able to calculate and analyze variances, which involves identifying causes and recommending corrective actions. Typically, a favorable variance is seen as desirable while an unfavorable one is undesirable, but this is not always the case. When taking the exam, it is easy to automatically see a favorable variance as desirable; however, you always need to analyze the variances, determine their causes, and evaluate whether they are desirable or not before recommending a course of action.

The **direct materials flexible budget variance** has price and quantity (efficiency) components. These two sources of the total variance can be isolated.

- Part of the total variance is attributed to using more or less materials than planned (the quantity component).
- Part is attributed to the price of materials being different than what was planned (the price component).

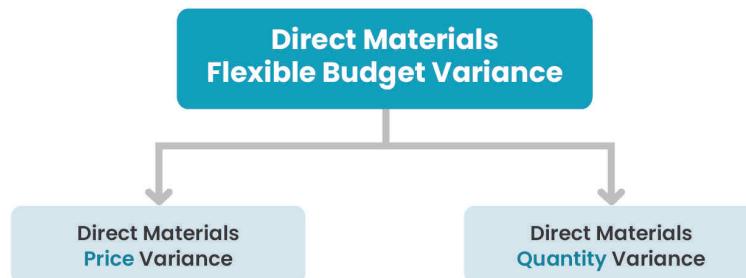


Figure 15-5

Direct Materials Price Variance

The direct materials price variance equals the actual quantity of total input times the difference between the standard price and the actual price.

$$(Actual \text{ units produced} \times Actual \text{ materials per unit}) \times (Actual \text{ price} - Standard \text{ price})$$

The price variance may be isolated at the time of purchase or when materials are transferred to work-in-process.

- A **purchase price variance** is a nonmanufacturing variance. It measures the difference between (1) the amount paid for **all** units of materials purchased during a specific period and (2) the amount expected to be paid. This formula can be used to calculate variances at the earliest time possible, which is at the time goods are purchased.
- An **unfavorable direct materials price variance** means that the actual price paid for materials is higher than the estimated standard price. This is usually undesirable.
 - The purchasing function may be responsible under the assumption that it bought materials that cost too much. Thus, an unfavorable variance is not the fault of the production departments.
 - However, the unfavorable variance may simply indicate that prices in the industry have risen, and standard prices should be updated.
- A **favorable direct materials price variance** may mean that the purchasing function performed well by finding a lower-cost source for the materials.
 - However, the favorable variance may simply indicate that prices in the industry have fallen, and standard prices should be updated.
 - Another possibility is that the lower price may be attributable to lower-quality materials. An analysis must be made to determine whether the lower-quality materials result in a lower-quality product or the use of excessive quantities in production. In these cases, the purchasing function is at fault.
- This variance is generally considered the responsibility of the purchasing manager and purchasing department.

Direct Materials Quantity Variance

The direct materials quantity variance (an efficiency or usage variance) equals the budgeted price times the difference between the actual quantity of total input and the budgeted quantity of total input.

$$Standard \text{ price} \times \left[\left(\frac{Actual \text{ units produced}}{} \times \frac{Actual \text{ materials per unit}}{} \right) - \left(\frac{Actual \text{ units produced}}{} \times \frac{Standard \text{ materials per unit}}{} \right) \right]$$

- When calculating the quantity variance, the standard quantity equals actual units produced times the standard materials per unit. This equals the materials that should have been used given the actual level of production.
- The actual cost of the materials is ignored because the variance isolates the effect that would have occurred given no price variance.
- An **unfavorable materials quantity variance** is usually the responsibility of the production department and may indicate an excessive use of materials. It also may indicate theft of materials or other waste or shrinkage.
 - However, the excessive use might be attributable to using lower-quality materials that were purchased at a lower price.
 - An alternative explanation is that excessive usage may have been caused by using unskilled (and lower cost) labor. Thus, a favorable labor rate variance may have contributed to an unfavorable materials quantity variance.
- A **favorable materials quantity variance** may indicate that workers have been unusually efficient, for example, by reducing normal spoilage.
 - However, the reduced usage may indicate that they are producing lower-quality products with less than the standard quantity of materials.
 - Accordingly, a favorable variance is not always desirable. It may be as bad as, or worse than, an unfavorable variance. It may suggest that costs have been reduced at the expense of product quality.
- This variance is generally considered the responsibility of the production manager and production department.

Example 15-5 Direct Materials -- Flexible Budget Variance

ChowDown, Inc., estimated output for the period of 18,000 units. However, actual output was 16,500 units. Standard direct materials per unit were estimated at 7.5, but the actual usage was 6.5 per unit. The standard price was budgeted at \$6.75, but the actual price was \$7.00. The direct materials variances are calculated as follows:

Direct Materials Variance	Units	×	Materials per Unit	=	Quantity of Total Input	×	Price	=	Total
Static budget direct materials	18,000		7.5		135,000		\$6.75		\$911,250
Flexible budget direct materials	16,500		7.5		123,750		\$6.75		\$835,313
Actual direct materials	16,500		6.5		107,250		\$7.00		\$750,750
Direct materials price variance			$107,250 \times (\$7.00 - \$6.75)$				\$ (26,813) U		
Direct materials quantity variance			$\$6.75 \times (107,250 - 123,750)$				111,375 F		
Direct materials flexible budget variance							\$ 84,562 F		(\$1 rounding difference)

Standard Material Cost Per Unit

The standard direct material cost for each unit of finished goods is calculated after consideration of spoilage (covered in Study Unit 8, Subunit 1).

Example 15-6 Standard Dollar Amount of Raw Materials in Finished Goods

A company consumes 11 ounces of materials per each unit of finished goods produced, of which 3% of the materials evaporates during production. The company pays its suppliers \$1 per ounce; the cost to ship the material to the company averages \$0.10 per ounce. The standard dollar amount of raw materials contained in one unit of finished goods is calculated as follows:

Step 1: Calculate the actual amount of materials used to produce each unit of finished goods.

$$\begin{aligned} X \text{ ounces} \times 97\% &= 11 \text{ ounces} \\ X &= 11 \text{ ounces} \div 97\% \\ X &= 11.34 \text{ ounces} \end{aligned}$$

NOTE: The evaporated material is considered normal spoilage and is absorbed into the cost of the finished good.

Step 2: Calculate total cost of raw materials per one unit of finished goods.

$$11.34 \text{ ounces} \times (\$1 \text{ per ounce} + \$0.10 \text{ shipping cost per ounce}) = \$12.47$$

Service Organizations

In a service organization, the direct materials variances are usually immaterial compared with the direct labor variances. The reason is that only a relatively small investment is made in direct materials because these organizations tend to be labor intensive.

15.4 Direct Labor Variances

The direct labor variance is similar to the direct materials variance. The total direct labor flexible budget variance consists of the rate (price) variance and the efficiency (quantity) variance.

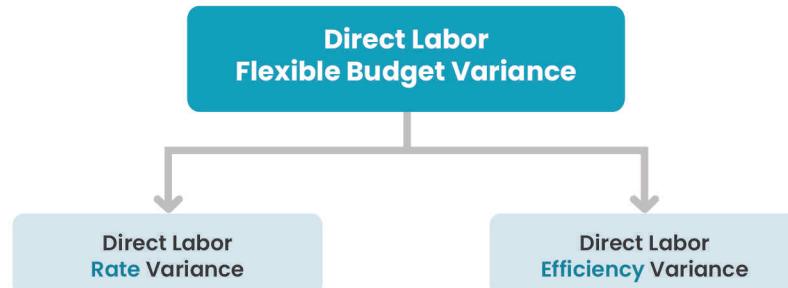


Figure 15-6

Direct Labor Rate Variance

This variance equals the actual quantity of total input times the difference between the actual price and the standard price.

$$(\text{Actual units produced} \times \text{Actual labor hours per unit}) \times (\text{Actual price} - \text{Standard price})$$

- An **unfavorable labor rate variance** is usually caused by assigning skilled workers to a production process when the standard price calculation assumed that unskilled (lower paid) workers could complete the job.
 - However, the greater efficiency of skilled workers might result in a favorable labor efficiency variance to offset the unfavorable labor rate variance.
 - Another explanation for an unfavorable labor rate variance is that a new union contract resulted in a higher wage to workers, in which case the standard prices should be updated.
- A **favorable labor rate variance** is usually caused by assigning workers with less skill to a job. This may be desirable when they are qualified for the job.
 - However, the favorable rate variance may be offset by an unfavorable efficiency variance or lower-quality products.

Direct Labor Efficiency Variance

This variance equals the standard price times the difference between the actual quantity of total input and the standard quantity of total input.

$$\text{Standard price} \times \left[\left(\frac{\text{Actual units produced}}{\text{Actual labor hours per unit}} \right) - \left(\frac{\text{Actual units produced}}{\text{Standard labor hours per unit}} \right) \right]$$

- An **unfavorable labor efficiency variance** means that workers are spending too much time on a production process, which is normally undesirable.
 - However, it may be caused by using workers with less skill than anticipated, in which case the labor rate variance may be favorable.
 - Another explanation is the use of low-quality materials that require extra time in the production process, in which case, the material price variance may be favorable.
- A **favorable labor efficiency variance** is almost always desirable. It means that employees are working efficiently and have been able to complete production in fewer hours than anticipated.
 - It is considered a production department efficiency.

Example 15-7 Direct Labor -- Flexible Budget Variance

ChowDown, Inc., estimated output for the period of 18,000 units. However, actual output was 16,500 units. Standard direct labor was estimated at 3 hours per unit, but the actual usage was 3.25 hours per unit. The standard price was \$5.50, but the actual price was \$6.00. The direct labor variances are calculated as follows:

Direct Labor Variance	Units	\times	Labor Hours per Unit	=	Total Input	\times	Price	=	Total
Static budget direct labor	18,000		3		54,000		\$5.50		\$297,000
Flexible budget direct labor	16,500		3		49,500		\$5.50		\$272,250
Actual direct labor	16,500		3.25		53,625		\$6.00		\$321,750
Direct labor rate variance			$53,625 \times (\$6.00 - \$5.50)$					\$26,813 U	
Direct labor efficiency variance			$\$5.50 \times (53,625 - 49,500)$					22,688 U	
Direct labor flexible budget variance								<u>\$49,501 U</u>	(\$1 rounding difference)

Service Organizations

In a service organization, the direct labor variances are usually more relevant than the direct materials variances. A relatively large investment is made in direct labor and only a minor investment in direct materials.

15.5 Mix and Yield Variances

In some production processes, inputs are **substitutable**; for example, a baker of pecan pies may use pecans from Florida instead of Georgia or higher-skilled labor instead of lower-skilled labor.

Given substitutable inputs, the direct materials quantity variance consists of the **materials mix variance** and the **materials yield variance**.

- A favorable (unfavorable) materials mix variance means that more (less) lower-priced materials were used than budgeted.
- A favorable (unfavorable) materials yield variance means that less (more) materials than budgeted were used to produce the output.

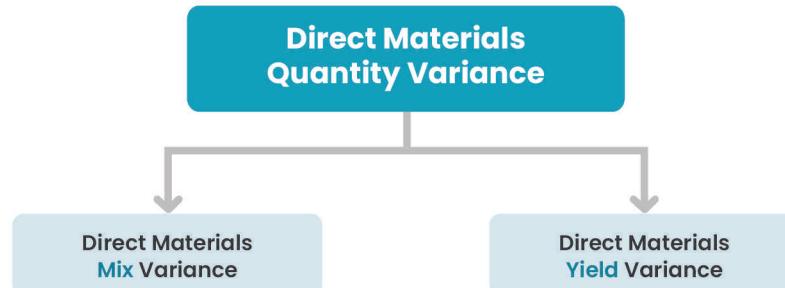


Figure 15-7

Given substitutable inputs, the direct labor efficiency variance consists of the **labor mix variance** and the **labor yield variance**.

- A favorable (unfavorable) labor mix variance means that low-paid employees worked more (less) hours and higher-paid employees worked less (more) hours than budgeted.
- A favorable (unfavorable) labor yield variance means less (more) hours than budgeted were used to produce the output.

The sum of the mix and yield variance is the efficiency variance.



Figure 15-8

To calculate these variances, the entity must determine the weighted-average standard price using

- The standard mix of inputs at standard prices (**SMSP**)
- The actual mix of inputs at standard prices (**AMSP**)

Example 15-8 SMSP vs. AMSP

A retail store budgets its employee hours for the upcoming month and calculates its weighted-average standard price of wages using the standard mix (SMSP) as follows:

	Budgeted Hours (SM)	Standard Wage (SP)	Subtotals
Managers	200	× \$22	= \$ 4,400
Sales associates	800	× 14	= 11,200
Warehouse	600	× 8	= 4,800
Totals	1,600		\$20,400

$$\text{SMSP} = \$20,400 \div 1,600 \text{ hours} = \$12.75 \text{ per hour}$$

After month end, the store employs the actual hours worked to calculate the weighted-average standard price using the actual mix (AMSP) as follows:

	Actual Hours (SM)	Standard Wage (SP)	Subtotals
Managers	220	× \$22	= \$ 4,840
Sales associates	800	× 14	= 11,200
Warehouse	480	× 8	= 3,840
Totals	1,500		\$19,880

$$\text{AMSP} = \$19,880 \div 1,500 \text{ hours} = \$13.2533 \text{ per hour}$$

The **mix variance** measures the relative use of higher-priced and lower-priced inputs in the production process based on standard input prices and **actual total quantity (ATQ)** of inputs. It isolates the effect of using the actual mix instead of the standard mix.

$$\text{Mix variance} = \text{ATQ} \times (\text{SMSP} - \text{AMSP})$$

Example 15-9 Labor Mix Variance

The store calculates its labor mix variance as follows:

$$\begin{aligned}\text{Labor mix variance} &= \text{ATQ} \times (\text{SMSP} - \text{AMSP}) \\ &= 1,500 \text{ hours} \times (\$12.75 - \$13.2533) \\ &= 1,500 \text{ hours} \times -\$0.5033 \\ &= \$755 \text{ unfavorable}\end{aligned}$$

This variance was unfavorable because higher-paid managers worked more hours and lower-paid warehouse employees worked fewer hours than budgeted.

The **yield variance** isolates the effect of the difference between the ATQ of inputs and the **STQ (standard total quantity)**. The calculation is based on standard input prices and the standard mix.

$$\text{Yield variance} = (\text{STQ} - \text{ATQ}) \times \text{SMSP}$$

Example 15-10 Labor Yield Variance

The store calculates its labor yield variance as follows:

$$\begin{aligned}\text{Labor yield variance} &= (\text{STQ} - \text{ATQ}) \times \text{SMSP} \\ &= (1,600 \text{ hours} - 1,500 \text{ hours}) \times \$12.75 \\ &= 100 \text{ hours} \times \$12.75 \\ &= \$1,275 \text{ favorable}\end{aligned}$$

The variance was favorable because fewer hours than budgeted were used to produce the output. The sum of the mix and yield variances is the efficiency variance ($\$755 \text{ U} + \$1,275 \text{ F} = \$520 \text{ F}$).

The same formulas can be applied to the mix and yield variances for direct materials.

15.6 Overhead Variances

The total overhead variance consists of four variances. Two are calculated for variable overhead and two for fixed overhead.

Variable Overhead

The total **variable overhead variance** is the flexible-budget variance. It is the difference between actual variable overhead and the amount applied based on the budgeted application rate and the standard input allowed for the actual quantity.

$$\text{Actual variable overhead} - \left[\frac{\text{Budgeted application rate}}{\text{Standard cost driver per unit}} \times (\text{Actual units}) \right]$$

Variable overhead includes the following:

- The **spending variance** is the difference between (1) actual variable overhead and (2) the product of the budgeted application rate and the actual amount of the allocation base.

$$\left(\frac{\text{Actual allocation base}}{\text{Actual application rate}} \times \text{Actual allocation base} \right) - \left(\frac{\text{Actual allocation base}}{\text{Budgeted application rate}} \times \text{Budgeted application rate} \right)$$

$$\text{Actual allocation base} \times \left(\frac{\text{Actual application rate}}{\text{Budgeted application rate}} - 1 \right)$$

- The variable overhead spending variance is favorable or unfavorable if production spending is less or more, respectively, than the standard.
- The **efficiency variance** is the budgeted application rate times the difference between (1) the actual allocation base and (2) the standard input allowed for the actual quantity.

$$\text{Budgeted application rate} \times \left[\frac{\text{Actual allocation base}}{\text{Standard cost driver per unit}} - (\text{Actual units}) \right]$$

- Variable overhead applied equals the flexible-budget amount for the actual output level. The reason is that unit variable costs are assumed to be constant within the relevant range.

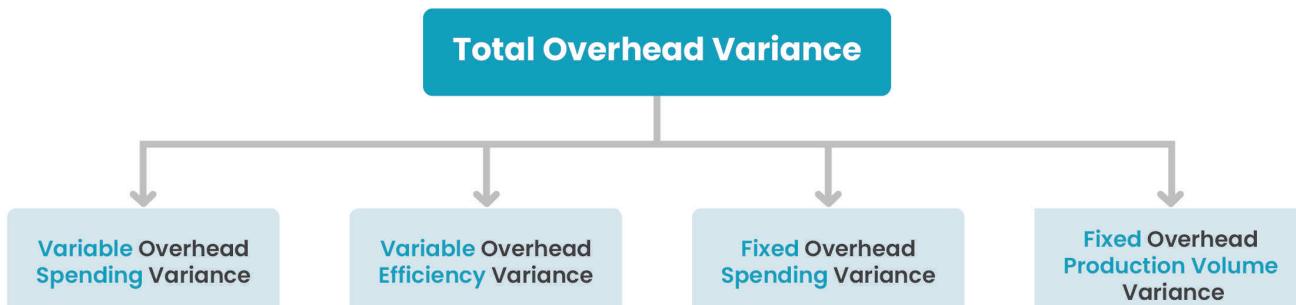


Figure 15-9

- If variable overhead is applied on the basis of output, not inputs, no efficiency variance arises.
- The variable overhead efficiency variance is related to the labor efficiency variance if overhead is applied to production on the basis of direct labor hours.
 - ▶ For example, if the labor efficiency variance is unfavorable, the overhead efficiency variance also is unfavorable because it is based on the same number of input hours.

Variable Overhead Variances

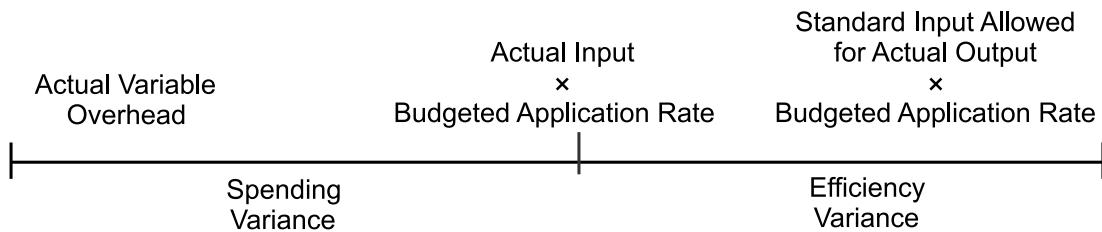


Figure 15-10

Example 15-11 Variable Overhead Variances

ChowDown, Inc., estimated output for the period of 18,000 units. However, actual output was 16,500 units. Standard processing time is 1.2 machine hours per unit. But actual usage was 1.3 machine hours per unit. The standard application rate was \$8.00 per machine hour, but the actual rate was \$10.00 per machine hour. The variable overhead variances are calculated as follows:

Variable Overhead Variances	Units	×	Cost Driver per Unit	=	Allocation Base	×	Application Rate	=	Total
Static budget variable overhead	18,000		1.2		21,600		\$ 8.00		\$172,800
Flexible budget variance overhead	16,500		1.2		19,800		\$ 8.00		\$158,400
Actual variable overhead	16,500		1.3		21,450		\$10.00		\$214,500
Variable overhead spending variance				$21,450 \times (\$10.00 - \$8.00)$			\$42,900 U		
Variable overhead efficiency variance				$\$8.00 \times (21,450 - 19,800)$			13,200 U		
Total variable overhead variances							<u>\$56,100 U</u>		

Fixed Overhead

The **total fixed overhead variance** is the difference between (1) actual fixed overhead and (2) the product of the budgeted application rate and the standard input allowed for the actual output.

$$\text{Actual fixed overhead} - \left[\frac{\text{Budgeted application rate}}{\text{Standard cost driver per unit}} \times (\text{Actual units}) \right]$$

Fixed overhead includes the following:

- The fixed overhead **spending variance** (also known as budget variance) is the easiest to calculate because it is the difference between (1) actual fixed overhead and (2) the amount budgeted, regardless of actual and budgeted production levels.

$$\text{Actual fixed overhead} - \text{Budgeted fixed overhead}$$

- This variance is the same as the fixed overhead flexible-budget variance. The reason is that the static budget lump-sum of fixed overhead is also the flexible budget amount over the relevant range of output. Moreover, the efficiency of production does not affect the fixed overhead variances.
- An efficiency variance is calculated for variable, but not fixed, overhead.
- The fixed overhead variance is simply attributable to more or less spending by the production function. Whether the difference is justified should be investigated.

Example 15-12 Fixed Overhead Spending Variance

If the budgeted fixed overhead is \$450,000 for 18,000 units, with a standard cost of \$25 per unit, and the actual cost is \$429,000 for 16,500 units, the fixed overhead spending variance is \$21,000 favorable. This was calculated by deducting the \$429,000 actual cost from the \$450,000 budgeted. The difference in units produced is not considered. The firm spent \$21,000 less on fixed costs than was anticipated.

- The **production volume variance** (idle capacity variance or denominator-level variance) is the difference between (1) budgeted fixed overhead and (2) the product of the budgeted application rate and the standard input allowed for the actual output.

$$\text{Budgeted fixed overhead} - \left[\frac{\text{Budgeted application rate}}{\text{Standard cost driver per unit}} \times (\text{Actual units}) \right]$$

- This variance results when production capacity differs from capacity usage. A favorable (unfavorable) variance occurs when overhead applied is more (less) than budgeted fixed costs. For example, the variance is favorable when actual production exceeds planned production.

- The production volume variance is typically not the fault of the production function. The sales staff often is blamed, or rewarded, for a volume variance.
 - ▶ If sales are greater than expected, production increases, and the variance may be favorable.
 - ▶ An unfavorable volume variance may be caused by low sales (the fault of the sales staff) or by a production shutdown, perhaps due to a labor strike, power failure, or natural disaster. In these cases, the variance is attributable to actions of the general administration of the entity or to uncontrollable external factors.

Fixed Overhead Variances

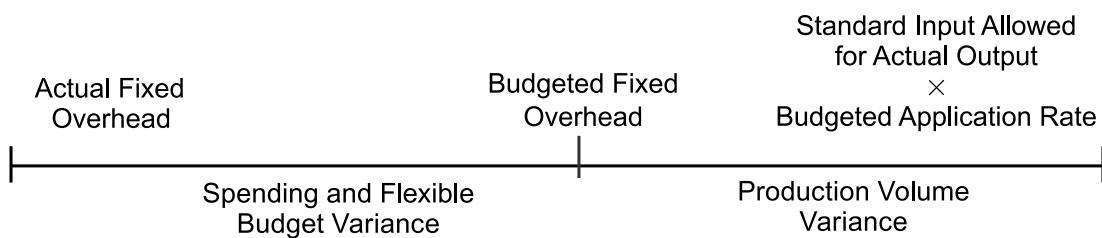


Figure 15-11

Example 15-13 Fixed Overhead Variances

ChowDown, Inc., estimates output for the period of 18,000 units. However, actual output was 16,500 units. Fixed overhead is applied at \$25 per unit sold. But actual cost per unit was \$26. The fixed overhead variances are calculated below:

Fixed Overhead Variances	Units	\times	Cost Driver per Unit	\times	Application Rate	=	Total
Static and flexible budget fixed overhead	18,000		1		\$25.00		\$450,000
Applied fixed overhead	16,500		1		\$25.00		\$412,500
Actual fixed overhead	16,500		1		\$26.00		\$429,000
Fixed overhead spending variance					$\$429,000 - \$450,000$		$\$21,000 \text{ F}$
Fixed overhead production volume variance					$\$450,000 - [\$25 \times (1 \times 16,500)]$		$(37,500) \text{ U}$

NOTE: The production volume variance is unfavorable because it indicates that fixed overhead was underallocated to actual output. The variance is the amount of fixed overhead incurred for unused production capacity.

Analysis of Overhead Variances

Example 15-14 Overhead Variances Comprehensive Example

Overhead is applied on the basis of machine hours. The standard machine hours is 4 hours per unit.

Budgeted production for this year is 10,000 units. The annual budget for the year includes budgeted variable overhead of \$230,000 and budgeted fixed overhead of \$180,000.

Actual results for the year:

Actual production	10,600 units
Actual machine hours used	41,000
Actual variable overhead cost	\$234,000
Actual fixed overhead cost	\$185,000

- Find the predetermined variable overhead rate (budgeted application rate).

$$\frac{\text{Budgeted variable overhead cost}}{\text{Budgeted machine hours}} = \text{Predetermined variable overhead rate}$$

$$\begin{aligned} \text{Budgeted machine hours} &= 10,000 \text{ units} \times 4 \text{ hours per unit} = 40,000 \text{ machine hours} \\ \$230,000 \div 40,000 \text{ hours} &= \$5.75 \end{aligned}$$

- Find the predetermined fixed overhead rate (budgeted application rate).

$$\frac{\text{Budgeted fixed overhead cost}}{\text{Budgeted machine hours}} = \text{Predetermined fixed overhead rate}$$

$$\$180,000 \div 40,000 \text{ hours} = \$4.50$$

- Calculate the VOH variances.

Actual Variable Overhead	AQ × SP	SQ × SP
\$234,000	41,000 × \$5.75 \$235,750	42,400 × \$5.75 \$243,800
\$1,750 F	\$8,050 F	
VOH Spending Variance		VOH Efficiency Variance

$$\begin{aligned} \text{SQ} &= \text{Standard input allowed for actual output} \\ \text{Actual production of } 10,600 \text{ units} \times 4 \text{ hours per unit} &= 42,400 \text{ hours} \end{aligned}$$

-- Continued on next page --

Example 15-14 -- Continued

- Calculate the FOH variances.

Actual Fixed Overhead	Budgeted Fixed Overhead	SQ × SP
\$185,000	\$180,000	42,400 × \$4.50 \$190,800
FOH Spending Variance		Production Volume Variance

SQ = Standard input allowed for actual output
Actual production of 10,600 units × 4 hours per unit = 42,400 hours

- What is the total overhead spending variance?

VOH spending variance + FOH spending variance = Total overhead spending variance

$$\$1,750 \text{ F} + \$5,000 \text{ U} = \$3,250 \text{ U}$$



Success Tip

CMA exam questions may ask if the amount of overhead is over- or under-applied.

Favorable variances = overhead is overapplied

Unfavorable variances = overhead is underapplied

15.7 Comprehensive Example



Success Tip

As a CMA candidate, you are expected to know and understand the different variance formulas. You may need to solve more than one formula to get the values you need to input into the formula that will give you your final answer. Take the time to memorize them but also to understand them. You may be given different elements of the variance formulas and be expected to solve for the unknown variable. Remember to account for the way a favorable/unfavorable variance affects your answer. The example on the following pages may be used to create notecards for these formulas to aid in retention. If asked to find total overhead variance, it may be useful to convert the fixed and variable overhead to a per unit basis, add together, and then multiply by the actual rate base.

You will be presented with a tutorial before your time for the CMA exam begins. However, by using the Gleim CMA Review Course and CMA Test Prep, you will already be familiar with the information provided in the tutorial. Take these few minutes to write any formulas or variances you can recall on your scrap paper. (Don't forget to pay attention to the time, as once the time for the tutorial is up, your exam will begin.) This way, when you are presented with questions requiring you to calculate variances, you will be able to look at your scrap paper rather than trying to recall from memory during a time when you are stressed. This will help you keep the formulas straight and manage your time on the exam.

At the end of the current period, the following analysis of the flexible budget variance was prepared:

	Actual Amounts		Standard Amounts		
	AQ × AP Actual Results (AR)	AR – FB Flexible Budget Variances	AQ × SP Flexible Budget (FB)	FB – SB Sales Volume Variances	SQ × SP Static Budget (SB)
Units sold	<u>7,000</u>		<u>7,000</u>	<u>1,000 F</u>	<u>6,000</u>
Revenue	\$455,000	\$ 14,000 F	\$441,000	\$ 63,000 F	\$378,000
Variable costs:					
Direct materials	73,500	10,500 F	84,000	(12,000) U	72,000
Direct labor	134,750	(29,750) U	105,000	(15,000) U	90,000
Variable non-mfg. overhead	56,000	(24,500) U	31,500	(4,500) U	27,000
Total variable costs	<u>\$264,250</u>	<u>\$(43,750) U</u>	<u>\$220,500</u>	<u>\$(31,500) U</u>	<u>\$189,000</u>
Contribution margin	190,750	(29,750) U	220,500	31,500 F	189,000
Fixed overhead	112,000	(33,250) U	78,750	(11,250) U	67,500
Operating income	\$ 78,750	<u>\$(63,000) U</u>	<u>\$141,750</u>	<u>\$ 20,250 F</u>	<u>\$121,500</u>
	Total Flexible Budget Variance		Total Sales Volume Variance		
	\$63,000 U		\$20,250 F		
			Total Static Budget Variance		
			\$42,750 U		

Variances

MATERIALS VARIANCES

Price Variance

$$\begin{aligned}
 &= (\text{Actual Units} \times \text{Actual Materials/Unit}) \times (\text{Actual Price} - \text{Std Price}) \\
 &= (7,000 \times 1.50) \times (\$7.00 - \$6.00) \\
 &= 10,500 \times \$1.00 \\
 &= \$(-10,500) \text{ U}
 \end{aligned}$$

Quantity Variance

$$\begin{aligned}
 &= \text{Std Price} \times [(\text{Actual Units} \times \text{Actual Materials/Unit}) - (\text{Actual Units} \times \text{Std Materials/Unit})] \\
 &= \$6.00 \times [(7,000 \times 1.50) - (7,000 \times 2.00)] \\
 &= \$6.00 \times (10,500 - 14,000) \\
 &= \$21,000 \text{ F}
 \end{aligned}$$

Direct Materials Price Variance \$(-10,500) U

Direct Materials Quantity Variance \$ 21,000 F

Direct Materials Flexible Budget Variance \$ 10,500 F

LABOR VARIANCES

Rate Variance

$$\begin{aligned}
 &= (\text{Actual Units} \times \text{Actual Labor Hrs/Unit}) \times (\text{Actual Price} - \text{Std Price}) \\
 &= (7,000 \times 3.50) \times (\$5.50 - \$5.00) \\
 &= 24,500 \times \$0.50 \\
 &= \$(-12,250) \text{ U}
 \end{aligned}$$

Efficiency Variance

$$\begin{aligned}
 &= \text{Std Price} \times [(\text{Actual Units} \times \text{Actual Labor Hrs/Unit}) - (\text{Actual Units} \times \text{Std Labor Hrs/Unit})] \\
 &= \$5.00 \times [(7,000 \times 3.50) - (7,000 \times 3.00)] \\
 &= \$5.00 \times (24,500 - 21,000) \\
 &= \$(-17,500) \text{ U}
 \end{aligned}$$

Direct Labor Rate Variance \$(-12,250) U

Direct Labor Efficiency Variance \$(-17,500) U

Direct Labor Flexible Budget Variance \$(-29,750) U

VARIABLE OVERHEAD VARIANCES

Spending Variance

$$\begin{aligned}
 &= \text{Actual Allocation Base} \times (\text{Actual Application Rate} - \text{Budgeted Application Rate}) \\
 &= 14,000 \times (\$4.00 - \$3.00) \\
 &= \$(-14,000) \text{ U}
 \end{aligned}$$

Efficiency Variance

$$\begin{aligned}
 &= \text{Budgeted Application Rate} \times [\text{Actual Allocation Base} - (\text{Std Cost Driver/Unit} \times \text{Actual Units})] \\
 &= \$3.00 \times [14,000 - (1.50^* \times 7,000)] \\
 &= \$3.00 \times (14,000 - 10,500) \\
 &= \$(-10,500) \text{ U}
 \end{aligned}$$

*The standard cost driver/unit is the standard input allowed for actual output. In this example, it is the \$3 per machine hour (standard input) \div 2 machine hours per unit (actual output).

$1.5 = \$3 \text{ per machine hour} \div 2 \text{ machine hours per unit}$

Variable Overhead Spending Variance	<u>$\\$(-14,000)$ U</u>
Variable Overhead Efficiency Variance	<u>$\\$(-10,500)$ U</u>
Variable Overhead Flexible Budget Variance	<u>$\\$(-24,500)$ U</u>

FIXED OVERHEAD VARIANCES

Spending Variance

$$\begin{aligned}
 &= \text{Actual Fixed Overhead} - \text{Budgeted Fixed Overhead} \\
 &= \$112,000 - 67,500 \\
 &= \$ (44,500) \text{ U}
 \end{aligned}$$

Production Volume Variance

$$\begin{aligned}
 &= \text{Budgeted Fixed Overhead} - [\text{Budgeted Application Rate} \times (\text{Std Cost Driver/Unit} \times \text{Actual Units})] \\
 &= \$67,500 - [\$7.50 \times (1.50 \times 7,000)] \\
 &= \$67,500 - (\$7.50 \times 10,500) \\
 &= \$11,250 \text{ F}
 \end{aligned}$$

Fixed Overhead Spending Variance	<u>$\\$(-44,500)$ U</u>
Fixed Overhead Production Volume Variance	<u>$\\$ 11,250$ F</u>
Total Fixed Overhead Variance	<u>$\\$(-33,250)$ U</u>

	Actual Output at Actual Input and Cost	AQ \times SP Actual Output at Standard Input and Cost	Variance
Materials	\$ 73,500	\$ 84,000	<u>$\\$ 10,500$ F</u>
Labor	134,750	105,000	<u>$(29,750)$ U</u>
Variable overhead	56,000	31,500	<u>$(24,500)$ U</u>
Fixed overhead	112,000	78,750	<u>$(33,250)$ U</u>
	<u>376,250</u>	<u>299,250</u>	
Net unfavorable variance	<u>$\\$376,250$</u>	<u>$77,000$</u>	<u>$(77,000)$ U</u>
		<u>$\\$376,250$</u>	

15.8 Sales Variances

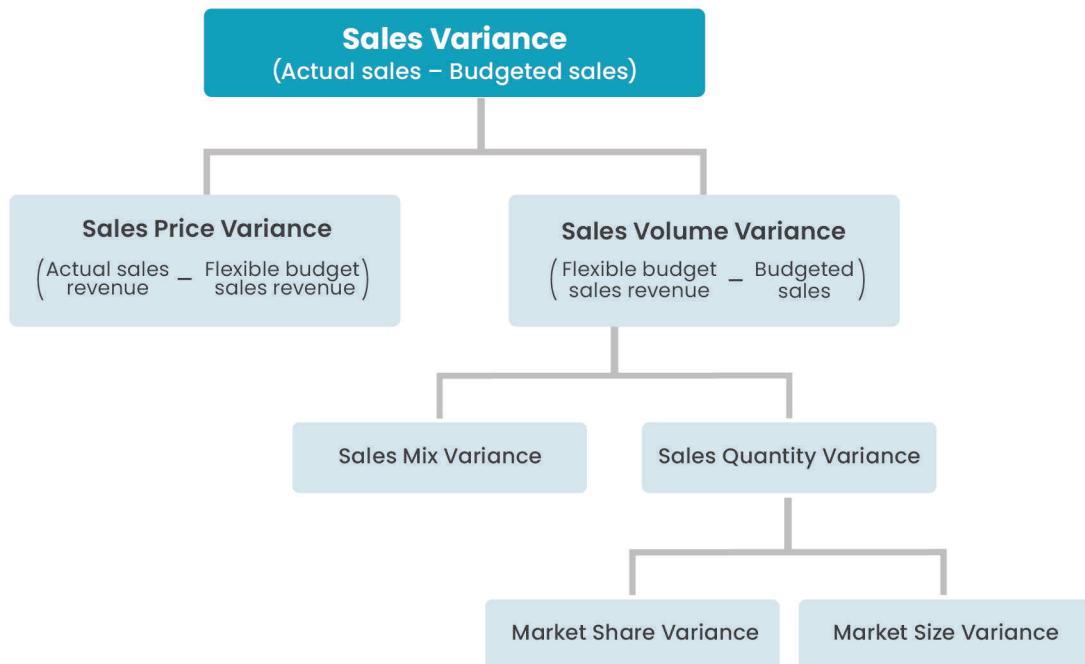


Figure 15-12

Single Product Sales Variances

Variance analysis is useful for evaluating not only the production function but also the selling function.

- If sales differ from the amount budgeted, the difference could be attributable to either the **sales price variance** or the **sales volume variance** (sum of the sales quantity and mix variances).
- The analysis of these variances concentrates on **contribution margins** because fixed costs are assumed to be constant.

For a single product, the **sales price variance** is the change in the contribution margin attributable solely to the change in selling price (holding quantity constant).

$$\text{Sales price variance} = (AP - SP) \times AQ$$

For a single product, the **sales volume variance** is the change in the contribution margin attributable solely to the difference between the actual and standard unit sales.

$$\text{Sales volume variance} = (AQ - SQ) \times SCM$$

- For a single product, the sales mix variance is zero.

Example 15-15 Budgeted vs. Actual Results

A firm has budgeted sales of 10,000 units of its sole product at \$17 per unit. Variable costs are expected to be \$10 per unit, and fixed costs are budgeted at \$50,000. The following compares budgeted and actual results:

	Budget Computation	Budget Amount	Actual Computation	Actual Amount
Sales	10,000 units × \$17 per unit	\$170,000	11,000 units × \$16 per unit	\$176,000
Variable costs	10,000 units × \$10 per unit	(100,000)	11,000 units × \$10 per unit	(110,000)
Contribution margin		\$ 70,000		\$ 66,000
Fixed costs		(50,000)		(50,000)
Operating income		\$ 20,000		\$ 16,000
Unit contribution margin (UCM)	\$70,000 ÷ 10,000 units	\$7	\$66,000 ÷ 11,000 units	\$6

Although sales were greater than budgeted, the actual contribution margin (ACM) is less than the standard contribution margin (SCM). The discrepancy can be analyzed in terms of the sales price variance and the sales volume variance.

$$\begin{aligned}\text{Sales price variance} &= (\text{AP} - \text{SP}) \times \text{AQ} \\ &= (\$16 - \$17) \times 11,000 \\ &= (\$11,000) \text{ U}\end{aligned}$$

$$\begin{aligned}\text{Sales volume variance} &= (\text{AQ} - \text{SQ}) \times \text{SCM} \\ &= (11,000 - 10,000) \times \$7 \\ &= \$7,000 \text{ F}\end{aligned}$$

The sales price variance (\$11,000 U) plus the sales volume variance (\$7,000 F) equals the total change in the contribution margin (\$4,000 U).

A similar analysis may be done for **cost of goods sold**.

- The average production cost per unit is used instead of the average unit selling price, but the quantities for unit production are the same.
- Accordingly, the overall variation in gross profit is the sum of the variation in revenue plus the variation in cost of goods sold.

Multiproduct Sales Variances

For two or more products, the multiproduct sales variances reflect not only the change in total unit sales but also the change in the sales mix.

- The **multiproduct sales price variance** may be calculated as in the single-product case for each product. The results are then added.
 - An alternative is to multiply the actual total units sold times the difference between the following:
 - ▶ The weighted-average price based on actual units sold at actual unit prices
 - ▶ The weighted-average price based on actual units sold at standard prices
- The **multiproduct sales volume variance** may be calculated as in the single-product case for each product. The results are then added.
 - An alternative is to determine the difference between the following:
 - ▶ Actual total unit sales times the standard weighted-average UCM for the actual mix
 - ▶ Standard total unit sales times the standard weighted-average UCM for the standard mix
- The multiproduct sales volume variance consists of the sales quantity and sales mix variances.
 - The **sales quantity variance** is the difference between (1) the standard contribution margin based on actual unit sales and (2) the standard contribution margin based on standard unit sales.
 - ▶ One way to calculate this variance is to multiply the standard UCM (SUCM) for each product times the difference between (1) its standard percentage of actual total unit sales and (2) the standard unit sales of the product. The results for each product are then added together. The equation to calculate this variance for each product is

$$\text{Sales quantity variance} = \text{SUCM} \times [(\text{Total AQ} \times \text{Standard mix \%}) - \text{Standard unit sales}]$$

- ▶ An alternative is to multiply the standard weighted-average UCM based on the standard mix times the difference between (1) total actual unit sales and (2) the total standard unit sales.
- ▶ The components of the sales quantity variance are the market size variance and the market share variance.

The **market size variance** is the change in contribution margin caused by a change in the market size.

$$\text{Market size variance} = \frac{\text{Budgeted market share percentage}}{\text{Actual market size in units}} \times \left(\frac{\text{Actual market size in units} - \text{Budgeted market size in units}}{\text{Budgeted market size in units}} \right) \times \text{Budgeted weighted-average UCM}$$

The **market share variance** is the amount of contribution margin gained (forgone) because of a change in the market share.

$$\text{Market share variance} = \left(\frac{\text{Actual market share percentage} - \text{Budgeted market share percentage}}{\text{Actual market size in units}} \right) \times \text{Budgeted weighted-average UCM}$$

- The **sales mix variance** is the difference between (1) the standard contribution margin for the actual mix and actual total unit sales and (2) the standard contribution margin for the standard mix and actual total unit sales.
- One way to calculate this variance is to multiply the SUCM for each product times the difference between (1) actual unit sales of the product and (2) its standard percentage of actual total unit sales. The results for each product are then added together. The equation to calculate this variance for each product is

$$\text{Sales mix variance} = \text{SUCM} \times [\text{AQ} - (\text{Total AQ} \times \text{Standard mix \%})]$$

- An alternative is to multiply total actual unit sales times the difference between (1) the standard weighted-average UCM for the standard mix and (2) the standard weighted-average UCM for the actual mix.

Example 15-16 Contribution Margin and Sales Volumes Variances

	Plastic	Metal	Total
Standard selling price per unit	\$6.00	\$10.00	
Standard variable cost per unit	3.00	7.50	
Standard contribution margin per unit	<u><u>\$3.00</u></u>	<u><u>\$ 2.50</u></u>	
Standard unit sales	300	200	500
Standard mix percentage	60%	40%	100%
Actual units sold	260	260	520
Actual selling price per unit	\$6.00	\$9.50	

As shown below (000 omitted), the **total contribution margin variance** was \$100 unfavorable (\$130 unfavorable sales price variance – \$30 favorable sales volume variance).

Sales price variance:		
Plastic 260 × (\$6.00 – \$6.00)	\$ 0	
Metal 260 × (\$10 – \$9.50)	<u>(130)</u>	\$130 unfavorable
Sales volume variance:		
Plastic (260 – 300) × \$3.00	<u>\$(120)</u>	
Metal (260 – 200) × \$2.50	<u>150</u>	\$ 30 favorable
Total contribution margin variance	<u><u>\$100</u></u>	unfavorable

The sales volume variance consists of the following:

Sales quantity variance:		
Plastic [(520 × .6) – 300] × \$3.00	\$ 36	
Metal [(520 × .4) – 200] × \$2.50	<u>20</u>	\$ 56 favorable
Sales mix variance:		
Plastic [260 – (520 × .6)] × \$3.00	<u>\$(156)</u>	
Metal [260 – (520 × .4)] × \$2.50	<u>130</u>	\$ 26 unfavorable
Sales volume variance	<u><u>\$ 30</u></u>	favorable

Study Unit Sixteen

Responsibility Accounting and Performance Measures

16.1	<i>Responsibility Centers</i>	2
16.2	<i>Performance Measures -- Cost, Revenue, and Profit Centers</i>	5
16.3	<i>Performance Measures -- Investment Centers</i>	8
16.4	<i>The Balanced Scorecard</i>	12
16.5	<i>Transfer Pricing</i>	19

This study unit is the **second of two on performance management**. The relative weight assigned to this major topic in Part 1 of the exam is **20%**. The two study units are

- Study Unit 15: Cost and Variance Measures
- **Study Unit 16: Responsibility Accounting and Performance Measures**

This study unit discusses responsibility centers and performance measures. Detailed references for the ICMA's Learning Outcome Statements (LOSSs) are included in Appendix D. Topics covered in this study unit include

- Types of responsibility centers
- Methods for determining transfer prices
- Return on investment (ROI)
- Residual income (RI)
- Benefits and limitations of ROI and RI as performance measures
- Key performance indicators (KPIs)

16.1 Responsibility Centers

The primary distinction between centralized and decentralized organizations is in the degree of freedom of decision making by managers at many levels.

- In a **centralized** organization, decision making is consolidated so that activities throughout the organization may be more effectively coordinated from the top.
- In a **decentralized** organization, decision making is at as low a level as possible. The premise is that a local manager can make more informed decisions than a manager farther from the decision.

Responsibility Centers

A decentralized organization is divided into **responsibility centers** (also called **strategic business units**, or SBUs) to facilitate local decision making and to provide a basis for measuring the performance of subunits. The main characteristic of a responsibility center is the authority to make decisions affecting the major determinants of the type of center.

Four types of responsibility centers are generally recognized: cost, revenue, profit, and investment.

Responsibility Center	Manager is responsible for . . .	Example
Cost center	Costs only	Janitorial department
Revenue center	Revenues only	Sales department
Profit center	Revenues and expenses	Appliance department in a retail store
Investment center	Revenues, expenses, and invested capital	Branch office

Performance Measures and Manager Motivation

Controllability

The performance measures on which the manager's incentive package is based must be, as far as practicable, under the manager's direct responsibility and authority. Controllable factors are those factors that a manager can influence in a given time period. Noncontrollable factors are those that a particular manager does not have the authority to change.

- Some costs, especially **common costs** such as the costs of central administrative functions, cannot be traced to particular activities or responsibility centers.

Goal Congruence

Performance measures must be designed such that the manager's pursuit of them ties directly to accomplishment of the organization's overall goals. Suboptimization results when segments of the organization pursue goals that are in that segment's own best interests rather than those of the organization as a whole.

Allocating Common Costs

Common costs are the costs of products, activities, facilities, services, or operations shared by two or more cost objects. The difficulty with common costs is that they are **indirect costs** whose allocation may be arbitrary.

- A direct **cause-and-effect** relationship between a common cost and the actions of the cost object to which it is allocated is desirable. Such a relationship promotes acceptance of the allocation by managers who perceive the fairness of the procedure, but identification of cause and effect may not be feasible.
 - A common method of allocation is to use budgeted rates and standard hours allowed for actual output for variable costs and budgeted rates and capacity available for fixed costs.
 - An alternative allocation criterion is the **benefit received**.
 - For example, advertising costs that do not relate to particular products may increase sales of all products. Allocation based on the increase in sales by organizational subunits is likely to be accepted as equitable despite the absence of clear cause-and-effect relationships.
 - Allocating costs to foster competition may also be appropriate. Care must be taken to ensure this competition is healthy for organizational dynamics.
-

Headquarters Costs

A persistent problem in large organizations is the treatment of the costs of headquarters and other central support costs. Such costs are frequently allocated. Research has shown that central support costs are allocated to departments or divisions for the following reasons:

- The allocation reminds managers that support costs exist and that the managers would incur these costs if their operations were independent.
- The allocation reminds managers that profit center earnings must cover some amount of support costs.
- Departments or divisions should be motivated to use central support services appropriately.
- Managers who must bear the costs of central support services that they do not control may be encouraged to exert pressure on those who do. Thus, they may be able to restrain such costs indirectly.

Effects of Arbitrary Allocations

Managers' morale may suffer when allocations depress operating results.

Dysfunctional conflict may arise among managers when costs controlled by one are allocated to others.

Resentment may result if cost allocation is perceived to be arbitrary or unfair.

- For example, an allocation on an ability-to-bear basis, such as operating income, penalizes successful managers and rewards underachievers and may therefore have a demotivating effect.

Common Cost Allocation

Two specific approaches to common cost allocation are in general use.

- Under the **stand-alone method**, the common cost is allocated to each cost object on a proportionate basis.
- Under the **incremental method**, the cost objects are sorted in descending order by total traceable cost, and the common cost is allocated up to the amount of each.

Example 16-1 Common Cost Allocation

The proportionate costs of servicing three customers are presented in the table below. The common cost of providing service to these customers is \$8,000.

	Cost of Servicing	%
Luciano	\$ 7,000	70%
Ratzinger	2,000	20%
Wojtyla	1,000	10%
Total	<u>\$10,000</u>	<u>100%</u>

Stand-Alone Method

	Total Cost to Be Allocated	Allocation %	Allocated Cost
Luciano	\$8,000	x 70%	= \$5,600
Ratzinger	8,000	x 20%	= 1,600
Wojtyla	8,000	x 10%	= 800
Total		<u>100%</u>	<u>\$8,000</u>

Incremental Method

To be allocated	Traceable Cost	Allocated Cost	Remaining Unallocated
			\$8,000
Luciano	\$ 7,000	\$7,000	1,000
Ratzinger	2,000	1,000	0
Wojtyla	1,000	0	
Total	<u>\$10,000</u>	<u>\$8,000</u>	

16.2 Performance Measures -- Cost, Revenue, and Profit Centers

Cost Centers and Revenue Centers

Since managers of cost and revenue centers can influence only one type of factor, variance analysis (discussed in Study Unit 15) is the most appropriate performance measurement technique for these responsibility centers.

To be effective, a performance measure should be based on a **cause-and-effect** relationship between the outcome (effect) being measured and a driver (cause) that is under the manager's control.

- An appropriate performance measure for a cost or revenue center might not even be financial. Examples might include number of invoices processed per hour or percentage of customer shipments correctly filled.

Profit Centers

The **segment margin approach** to reporting is extremely useful in performance measurement for profit centers. This method uses the basic contribution margin approach but further breaks out fixed costs as controllable costs and traceable fixed costs for segment analysis. Allocated common costs are ignored in the calculation of a segment's margin.

- The segment margin approach isolates the effects of variable and fixed costs and thus highlights the effects of a manager's choices regarding improving the contribution margin and segment margin.
- Segment margin can also be referred to as **controllable margin**.

In addition to contribution margin and segment margin income, this approach can also be used to calculate multiple intermediate measures, as shown below:

Segment Margin Income Statement		
Sales	\$150,000	
Variable production costs	(40,000)	
Manufacturing contribution margin	\$110,000	
Variable S&A expenses	(20,000)	
Contribution margin	\$ 90,000	
Controllable fixed costs:		
Fixed production costs	\$30,000	
Fixed S&A expenses	25,000	(55,000)
Short-run performance margin	\$ 35,000	
Traceable fixed costs:		
Depreciation	\$10,000	
Insurance	5,000	(15,000)
Segment margin	\$ 20,000	

Segment Reporting

A segment is a product line, geographical area, or other meaningful subunit of the organization. As the following example illustrates, contribution margin reporting is very useful for managerial decision making.

Area office profitability analysis allows management to determine whether a segment is providing any coverage of fixed costs.

Example 16-2 Area Office Profitability Analysis

A geographic profitability analysis for a company that provides research services allows management to see which branch offices are the most profitable.

	Cartagena	Riyadh	Mumbai	Osaka	Total
Sales	\$1,200,000	\$800,000	\$2,000,000	\$4,600,000	\$8,600,000
Variable costs of sales	800,000	460,000	1,400,000	3,200,000	5,860,000
Other variable costs	256,000	176,000	320,000	544,000	1,296,000
Contribution margin	\$ 144,000	\$164,000	\$ 280,000	\$ 856,000	\$1,444,000
Traceable fixed costs	150,000	100,000	160,000	220,000	630,000
Area office margin	\$ (6,000)	\$ 64,000	\$ 120,000	\$ 636,000	\$ 814,000
Nontraceable fixed costs					200,000
Operating income					\$ 614,000

Customer profitability analysis enables management to determine the level of profitability for specific customers. This insight could affect decisions about customers.

- **Customer margin (controllable margin)** considers the relevant costs of the customer and is the key to estimating customer profitability.

Issues involved in determining product profitability, business unit profitability, and customer profitability include the following:

- **Cost measurement** involves calculating correct costs and not undercosting (i.e., product consumes a high amount of resources but is reported as having low costs per unit) or overcosting (i.e., business unit consumes a low amount of resources but is reported as having high costs).
- **Cost allocation** is the assignment of costs to the appropriate product, business unit, and customer. Incorrect costs assignment will lead to overcosting and undercosting. Thus, providing erroneous feedback on the profitability of the applicable product, business unit, and/or customer will lead management to base decisions on inaccurate financial results.
- **Investment measurement** involves calculating the cost to expand production, develop new products, or enter new business markets through acquisition or internal development. This process involves identifying investments, determining the resources required, and projecting the expected amounts and timing of returns. Hence, sound decisions regarding projected favorable returns on investments (i.e., ranking the identified investments) are contingent on accurate valuations of potential investment.
- **Other measures** include but are not limited to
 - Nonvalue-added costs and inefficient production activities
 - Selection and placement of value-added and efficient production activities
 - Response to customer requirements
 - High-quality products produced with less resources

Successful monitoring and management of these processes are ways to improve profitability and/or identify production activities, products, or customers requiring disposal. Nonfinancial measures are discussed in more detail in Study Unit 11, Subunit 2.

16.3 Performance Measures -- Investment Centers

Performance measures for investment centers reveal how efficiently the manager is deploying capital to produce income for the organization. Thus, most performance measures relate the center's resources (balance sheet) to its income (income statement).

Two widely used performance measures for an investment center are return on investment and residual income. These measures allow an investor to assess how effectively and efficiently management is using assets to obtain a return.

Return on Investment (ROI)

ROI is the relationship between income and the investment in assets to generate such income. Income means operating income unless otherwise noted. Operating income is known as earnings before interest and taxes (EBIT).

$$\text{ROI} = \frac{\text{Income of business unit}}{\text{Assets of business unit}}$$

Example 16-3 ROI Calculations

The ROI calculations for the branch offices displayed in Example 16-2 in Subunit 16.2 are shown below:

	Cartagena	Riyadh	Mumbai	Osaka
Income of business unit	\$ (6,000)	\$ 64,000	\$ 120,000	\$ 636,000
Total assets	121,000	825,000	1,015,000	9,900,000
Return on investment	(5.0%)	7.8%	11.8%	6.4%

Even though the managers of the Osaka branch generated by far the largest contribution, they were not as efficient in the deployment of the resources at their disposal as were the managers of the Riyadh or Mumbai branches.

This example illustrates the principle that the appraisal of individual performance must consider more factors than simple dollars.

Benefits with the application of ROI include, but are not limited to, the following:

- ✓ **Improve projects** by analyzing data collected to determine how the projects should change in order to achieve favorable returns.
- ✓ **Secure funding** through the use of positive ROI forecasts.
- ✓ **Comparative analysis** assists in making comparisons between different business units in terms of profitability and asset utilization.
- ✓ **Discontinue ineffective products or operations** by using ROI data to support that the product or operation does not add value.

A limitation with the application of ROI is that an investment center with a high ROI may not accept a profitable investment even though the investment's return is higher than the center's target ROI.

- EXAMPLE: An investment center has an 8% ROI, and its investors expect 2%. If the decision makers look only at current ROI, they will reject a project earning 6% because it would reduce the overall average ROI, even though that return exceeds the target.

Residual Income

Residual income is a variation of ROI that measures performance in dollar terms rather than as a percentage return. Income means operating income unless otherwise noted. Operating income is known as EBIT (earnings before interest and taxes).

Residual income = Income of business unit – (Assets of business unit × Required rate of return)

Residual income is a significant refinement of the ROI concept because it forces business unit managers to consider the **opportunity cost** of capital. Opportunity cost represents the return on the best alternative investment of similar risk that would have been generated if management had invested.

Example 16-4 Residual Income Calculations

The residual income calculations for the branch offices displayed in Example 16-3 on the previous page are shown below:

	Cartagena	Riyadh
Income of business unit	\$ (6,000)	\$ 64,000
Total assets	<u>\$121,000</u>	<u>\$825,000</u>
Times: Target rate of return	<u>× 6.0%</u>	<u>× 6.0%</u>
Opportunity cost of capital	<u>(7,260)</u>	<u>(49,500)</u>
Residual income	<u><u>\$ (13,260)</u></u>	<u><u>\$ 14,500</u></u>
	Mumbai	Osaka
Income of business unit	\$120,000	\$636,000
Total assets	<u>\$1,015,000</u>	<u>\$9,900,000</u>
Times: Target rate of return	<u>× 6.0%</u>	<u>× 6.0%</u>
Opportunity cost of capital	<u>(60,900)</u>	<u>(594,000)</u>
Residual income	<u><u>\$ 59,100</u></u>	<u><u>\$ 42,000</u></u>

This calculation reveals that, by employing the most resources, the Osaka branch has by far the highest threshold to clear for profitability.

ROI vs. Residual Income

Residual income is often considered preferable to ROI because it deals in absolute dollars rather than percentages. Following is a simple example:

- A manager with a 10% ROI would be reluctant to invest in a project with only an 8% return because his or her average overall return would decline. This reluctance would be detrimental to the company as a whole if the cost of capital were only 5%.
 - However, under the residual income method, the manager would invest in any project with a return greater than the cost of capital or the hurdle rate that (s)he has been assigned.
 - Thus, overall, the company would be better off even though the individual manager's ROI declined.
-

Comparability Issues with Investment Center Performance Measures

Alternative income measurements include income of business unit, income of business unit adjusted for price level changes, cash flow, and EBIT.

Invested capital may be defined in various ways, for example, as

- Total assets available
- Total assets employed, which excludes assets that are idle, such as vacant land
- Working capital (current assets less current liabilities) plus other assets (i.e., capital provided by short-term creditors)
 - This investment base assumes that the manager controls short-term credit.

Different attributes of financial information will also affect the elements of the investment base such as historical cost, replacement cost, market value, and present value.

The comparability of performance measures may be affected by differences in the **accounting policies** used by different business units.

- For example, policies regarding depreciation, decisions to capitalize or expense, inventory flow assumptions, and revenue recognition can lead to comparability issues for performance measures.

Performance evaluation in multinational companies is impacted by the following:

- **Expropriation** is a foreign government's seizure (nationalization) of the assets of a business for a public purpose and for just compensation.
- **Repatriation** is conversion of funds held in a foreign country into another currency and remittance of these funds to another nation. A firm often must obtain permission from the currency exchange authorities to repatriate earnings and investments. Regulations in many nations encourage a reinvestment of earnings in the country.

- **Tariffs** are taxes imposed on imported goods. Tariffs can discourage consumption of foreign goods, raise revenue, or both.
- **Import quotas** set limits on the quantity of different products that can be imported.
- **Inflation risk** is the risk that purchasing power of the currency will decline.
- **Exchange rate risk** is the risk of loss because of fluctuation in the relative value of a foreign currency in which the investment is payable.
- **Political risk** is the probability of loss from actions of governments, such as changes in tax laws or environmental regulations or expropriation of assets.

Revenue and Expense Recognition Policies

A company's revenue and expense recognition policies may affect the measurement of income and thus reduce comparability among business units.

- For example, a company that uses last-in, first-out (LIFO) for inventory valuation will often show lower inventories and higher costs than a company that uses the first-in, first-out (FIFO) methodology. As a result, the LIFO company could appear to have a lower rate of return than if it had used the FIFO method.

When comparing companies or units on the basis of either ROI or residual income, the analyst must be sure that both companies or units are using the same accounting policies in the determination of income.

- The sharing of assets by subunits within an organization may also affect measures of return.
 - For instance, assets normally appear on the books of only one division, even though another division might have access to those assets. Therefore, the division that shares its assets with another division may find that it has a lower rate of return than the division that has access to the use of the assets.
- Similarly, a company or division that uses straight-line depreciation on its plant assets will have lower expenses in the early years of an asset's life than if an accelerated method were being used. Thus, the straight-line division would appear to be more profitable than the division using the accelerated method.
 - Of course, the accelerated method may be preferred by top management because it results in a tax savings, but the implication of the ROI measure might be that the straight-line division is more profitable.

16.4 The Balanced Scorecard

The trend in performance evaluation is the balanced scorecard approach to managing the implementation of the firm's strategy. The balanced scorecard is a tool for communicating the company's strategy throughout the organization, and connects the firm's critical success factors to measurements of its performance.

Key Performance Indicators (KPIs)

KPIs are specific, measurable financial and nonfinancial elements of a firm's performance that are vital to its competitive advantage. Multiple measures of performance permit a determination as to whether a manager is achieving certain objectives at the expense of others that may be equally or more important.

- For example, an improvement in operating results at the expense of new product development would be apparent using a balanced scorecard approach.

The balanced scorecard is a goal congruence tool that informs managers about the financial and nonfinancial factors that are essential to have a competitive advantage. Those factors are defined as the **critical success factors (CSFs)**.

- CSFs are the methods a firm uses to achieve goals.
- KPIs are the metrics that measure the firm's success.
- Measures on the balanced scorecard may be internal or external, and short term or long term.
- The balanced scorecard facilitates **best practice analysis**. Best practice analysis determines a method of carrying on a business function or process that is considered to be superior to all other known methods. A lesson learned from one area of a business can be passed on to another area of the business or between businesses.

SWOT Analysis

A firm identifies its KPIs by means of a SWOT analysis. The firm's greatest strengths are its core competencies, which are the basis for its competitive advantages and strategy.

Strengths and weaknesses are internal resources or a lack thereof, for example, technologically advanced products, a broad product mix, capable management, leadership in R&D, modern production facilities, and a strong marketing organization.

Opportunities and threats arise from such externalities as government regulation, advances in technology, and demographic changes. They may be reflected in such competitive conditions as

- Raising or lowering of barriers to entry into the firm's industry by competitors
- Changes in the intensity of rivalry within the industry, for example, because of overcapacity or high exit barriers
- The relative availability of substitutes for the firm's products or services

- Bargaining power of customers, which tends to be greater when switching costs are low and products are not highly differentiated
- Bargaining power of suppliers, which tends to be higher when suppliers are few

The SWOT analysis tends to highlight the basic factors of cost, quality, and the speed of product development and delivery.

PEST Analysis

A PEST analysis is an analysis of certain factors in the external environment of an organization, which can affect its activities and performances. It is used to identify KPIs.

PEST analysis includes

- Political factors,
- Economic factors,
- Social factors, and
- Technological factors.

PEST analysis may also include environmental, legal, and ethical considerations, among others.

Measures

Once the firm has identified its KPIs, it must establish specific measures for each KPI that are both relevant to the success of the firm and can be reliably stated. This means that the balanced scorecard varies with the strategy adopted by the firm.

- For example, product differentiation or cost leadership either in a broad market or a narrowly focused market (a focus strategy). These measures provide a basis for implementing the firm's competitive strategy.

The scorecard should include lagging indicators (such as output and financial measures) and leading indicators (such as many types of nonfinancial measures). Nonfinancial measures should be used only if they are predictors of ultimate financial performance.

The scorecard should permit a determination of whether certain objectives are being achieved at the expense of others.

- For example, reduced spending on customer service may improve short-term financial results at a significant cost that is revealed by a long-term decline in customer satisfaction measures.

By providing measures that are **nonfinancial as well as financial**, long term as well as short term, and internal as well as external, the balanced scorecard de-emphasizes short-term financial results and focuses attention on KPIs.

An effective balanced scorecard requires a vast amount of data of many different types. For this reason, an enterprise resource planning (ERP) system is almost a necessity. An ERP system integrates information systems across the organization by creating one database linking all of the firm's applications.

Possible KPIs and Measures

A typical balanced scorecard classifies objectives into one of four perspectives on the business:



Following are examples of key performance indicators and measures that can be used for each perspective:

Financial Perspective	
KPI	Measure
Sales	New product sales
Fair value of firm's stock	Price/Earnings ratio
Profits	Return on investment
Liquidity	Quick ratio

Other financial measures may include sales, projected sales, accuracy of sales projections, stock prices, operating earnings, earnings trend, revenue growth, gross margin percentage, cost reductions, residual income, cash flow coverage and trends, turnover (assets, receivables, and inventory), and interest coverage.

Customer Satisfaction Perspective		
KPI	Financial Measure	Nonfinancial Measure
Customer satisfaction	Trends in dollar amounts of returns	Market share
Dealer and distributor relationships	Trends in dollar amounts of discounts taken	Lead time
Marketing and selling performance	Trends in dollar amounts of sales	Market research results
Prompt delivery	Trend in delivery expenses	On-time delivery rate
Quality	Dollar amount of defects	Rate of defects

Other financial measures for the customer satisfaction perspective may include dollar amount of sales, dollar amount of returns, and warranty expense.

Other nonfinancial measures for the customer satisfaction perspective may include unit sales, trends in unit sales, trend in market share, number of returns, rate of returns, customer retention rate, number of defects, number of warranty claims, rate of warranty claims, survey results, coverage and strength of distribution channels, training of marketing people, service response time, and service effectiveness.

Internal Business Processes Perspective		
KPI	Financial Measure	Nonfinancial Measure
Quality	Scrap costs	Rate of scrap and rework
Productivity	Change in company revenue/ change in company costs	Units produced per machine hour
Flexibility of response to changing conditions	Cost to repurpose machine for new use	Time to repurpose machine for new use
Operating readiness	Set-up costs	Downtime
Safety	Dollar amount of injury claims	Number of injury claims

Other financial measures for the internal business processes perspective may include such things as quality costs and level of inventory carrying costs.

Other nonfinancial measures for the internal business processes perspective may include new products marketed, technological capabilities, survey results, field service reports, vendor defect rate, cycle time, labor and machine efficiency, setup time, scheduling effectiveness, capacity usage, maintenance, and accidents and their results.

Learning and Growth Perspective		
KPI	Financial Measure	Nonfinancial Measure
Development of new products	R&D costs	Number of new patents applied for
Promptness of new product introduction	Lost revenue (from slow introduction of new product to market)	Length of time to bring a product to market
Human resource development	Recruiting costs	Personnel turnover
Morale	Orientation/team-building costs	Personnel complaints
Competence of work force	Training/retraining costs	Hours of training

Other financial measures for the learning and growth perspective may include financial and operating results.

Other nonfinancial measures for the learning and growth perspective may include number of design changes and copyrights registered, R&D personnel qualifications, actual versus planned shipping dates, skill set levels attained, personnel survey results, organizational learning, and industry leadership.

Example Balanced Scorecard

Objectives	Performance Measures	Targets	Outcomes	Corrective Initiatives
Perspective: Financial Performance				
Increase sales	Gross revenues	Increase 15%	Increase 3%	<ul style="list-style-type: none"> • Expand into new markets • Improve same-store sales
Perspective: Customer Service				
Reduce returns	Number of returns	Decrease 10%	Decrease 2%	<ul style="list-style-type: none"> • Reduce number of defects • Determine customer needs prior to sale
Perspective: Internal Business Processes				
Reduce scrap	Costs of scrap	Decrease 5%	Increase 4%	<ul style="list-style-type: none"> • Improve employee training • Seek higher quality materials
Perspective: Learning and Growth				
Reduce personnel turnover	Length of time employed	Increase 50%	Increase 10%	<ul style="list-style-type: none"> • Improve hiring practices • Reevaluate compensation plan

Development

The active support and participation of senior management are essential. This involvement will in turn ensure the cooperation of lower-level managers in the identification of objectives, appropriate measures, targeted results, and methods of achieving the results.

The scorecard should contain measures at the detail level that permit everyone to understand how his or her efforts affect the firm's results. The scorecard and the strategy it represents must be communicated to all managers and used as a basis for compensation decisions.

Functionality

Each objective is associated with one or more measures that permit the organization to gauge progress toward the objective. In order for the balanced scorecard to be useful, the organization must be able to identify a cause-and-effect relationship between an action that could be taken (or avoided) and an effect on a KPI.

- For example, if the organization increases its R&D budget, then the organization can increase the number of new patents applied for.

A **strategy map** is a visual representation of the organization's balanced scorecard perspectives, strategic objectives, and cause and effect relationships.

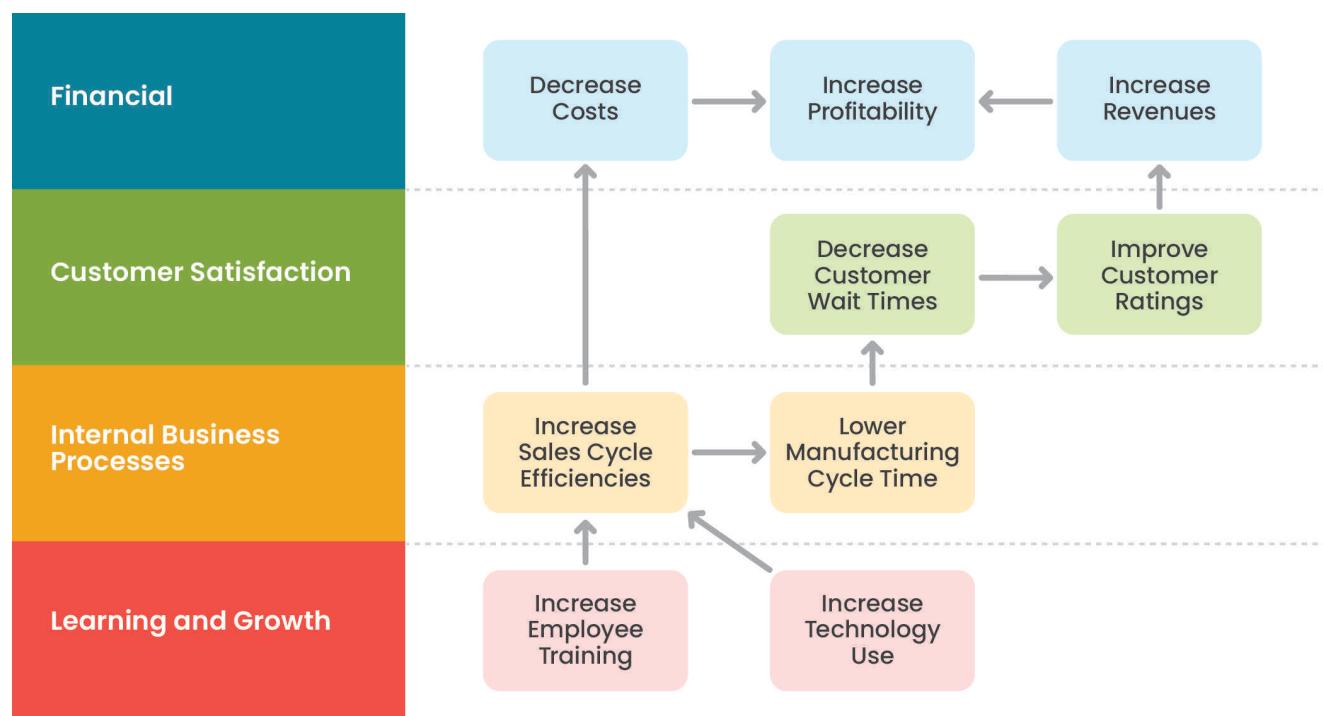


Figure 16-1

When measuring results and planning actions to take, the organization must stay focused on the cost-effectiveness of any action taken (or not taken). Achieving goals should not become ends unto themselves. Achievement of goals should be linked to the bottom line.

The following are **problems in implementation** of the balanced scorecard approach:

- ⊖ Using too many measures, with a consequent loss of focus on KPIs
- ⊖ Failing to evaluate personnel on nonfinancial as well as financial measures
- ⊖ Including measures that will not have long-term financial benefits
- ⊖ Not understanding that subjective measures (such as customer satisfaction) are imprecise
- ⊖ Trying to achieve improvements in all areas at all times
- ⊖ Not being aware that the hypothesized connection between nonfinancial measures and ultimate financial success may not continue to be true

16.5 Transfer Pricing

Transfer prices are the amounts charged by one segment of an organization for goods and services it provides to another segment of the same organization. The principal challenge is determining a price that motivates both the selling and the buying manager to pursue organizational **goal congruence**.

In a decentralized system, each responsibility center theoretically may be completely separate. Thus, Division A should charge the same price to Division B as would be charged to an outside buyer. The reason for decentralization is to motivate managers, and the best interests of Division A may not be served by giving a special discount to Division B if the goods can be sold at the regular price to outside buyers. However, having A sell at a special price to B may be to the company's advantage.

Transfer Pricing Methods

Four basic methods of transfer price setting are in common use: variable cost, full cost, market price, and negotiated price.

Variable Cost

By allowing the buyer to purchase at the selling division's variable cost, unused production capacity will be utilized (this method should only be used when the selling division has **excess capacity**). However, there is no incentive for the selling division, since it will be producing the products at a loss (even though the company as a whole will benefit from the arrangement).

- In practice, companies who follow this philosophy actually adopt a negotiation policy wherein the transfer price will be something greater than variable costs but less than full costs. At least the seller would have a positive contribution margin if the price is set slightly above variable costs.
- The advantage of using variable costs is that the buyer is motivated to solve the company's excess capacity problem, even though that excess capacity is not in the buyer's division.

Full (Absorption) Cost

Full (absorption) cost includes materials, labor, and full allocation of manufacturing overhead.

- The use of full (absorption) cost ensures that the selling division will not incur a loss and provides more incentive to the buying division to buy internally than does use of market price.
- However, there is no motivation for the seller to control production costs since all costs can be passed along to the buying division.

Market Price

A market price is the best transfer price to use in many situations. For example, if the selling division is operating at **full capacity** and can sell all of its output at the market price, then there is no justification to use a lower price as the transfer price for intracompany transfers.

Alternatively, if the selling division is not producing at full capacity, the use of market prices for internal transfers is not justified. A lower price might be more motivational to either the buyer or the seller.

Negotiation

A negotiated price may result when organizational subunits are free to determine the prices at which they buy and sell internally. Hence, a transfer price may simply reflect the **best bargain** that the parties can strike between themselves.

- The transfer price need not be based directly on particular market or cost information.
- A negotiated price may be especially appropriate when market prices are subject to rapid fluctuation.

Example 16-5 Transfer Pricing

Fordice's Division X costs were as follows for Product A:

Direct materials per unit	\$7.00
Direct labor per unit	3.00
Variable overhead cost per unit	1.50
Variable selling cost per unit	1.00

Fixed overhead cost for the year totaled \$400,000. Fixed selling and administrative costs for the year totaled \$175,000. During this year of operations, Fordice produced 200,000 units and sold 180,000 units at \$40 each. Fordice's Division Y can purchase Product A from outside buyers or from Division X.

Transfer pricing schemes:

1. Variable cost

Assuming that variable selling costs would not be incurred for intercompany transfers, what would the transfer price be if Fordice uses variable cost to set transfer prices between segments?

$$\text{Variable cost transfer price} = \$7 + \$3 + \$1.50 = \$11.50$$

2. Full (absorption) cost

What would the transfer price be if Fordice uses full (absorption) cost to set transfer prices between segments?

$$\text{Unit product cost} = \$7 \text{ DM} + \$3 \text{ DL} + \$1.50 \text{ VOH} + \$2 \text{ FOH}^* = \$13.50 \text{ per unit}$$

$$^*\text{FOH per unit} = \$400,000 \div 200,000 \text{ units produced} = \$2$$

3. Market price

What would the transfer price be if Fordice uses market price to set transfer prices between segments?

The transfer price would equal the market price of \$40 per unit.

4. Negotiation

Using the solutions from 1.-3. above, the negotiation between Division X and Division Y would use a range of \$11.50-\$40 for the transfer price of Product A.

Choice of Transfer Pricing Policy

The choice of a transfer pricing policy (which type of transfer price to use) is normally decided by top management at the corporate level. The decision typically includes consideration of multiple factors.

Goal congruence: The transfer price should promote the goals of the company as a whole.

Segmental performance: The segment making the transfer should be allowed to recover its incremental cost plus its opportunity cost of the transfer. The opportunity cost is the benefit forgone by not selling to an outsider.

- For this purpose, the transfer should be at market price.
- The selling manager should not lose income by selling within the company.
- Properly allocating revenues and expenses through appropriate transfer pricing also facilitates evaluation of the performance of the various segments.

Negotiation: If the purchasing segment could purchase the product or service outside the company, it should be permitted to negotiate the transfer price. The purchasing manager should not have to incur greater costs by purchasing within the company.

Capacity: If Division A has excess capacity, it should be used for producing products for Division B. If Division A is operating at full capacity and selling its products at the full market price, profitable work should not be abandoned to produce for Division B.

Cost structure: If Division A has excess capacity and an opportunity arises to sell to Division B at a price in excess of the variable cost, the work should be performed for Division B because a contribution to cover the fixed costs will result.

Tax issues: A wide range of tax issues on the interstate and international levels may arise, e.g., income taxes, sales taxes, value-added taxes, inventory and payroll taxes, and other governmental charges.

- In the international context, exchange rate fluctuations, threats of expropriation, and limits on transfers of profits outside the host country are additional concerns.
 - Because the best transfer price may be a low one because of the existence of tariffs or a high one because of the existence of foreign exchange controls, the effect may be to skew the performance statistics of management.
 - The high transfer price may result in foreign management appearing to show a lower return on investment than domestic management, but the ratio differences may be negated by the fact that a different transfer pricing formula is used.

TRANSFER PRICE

Decision Tree

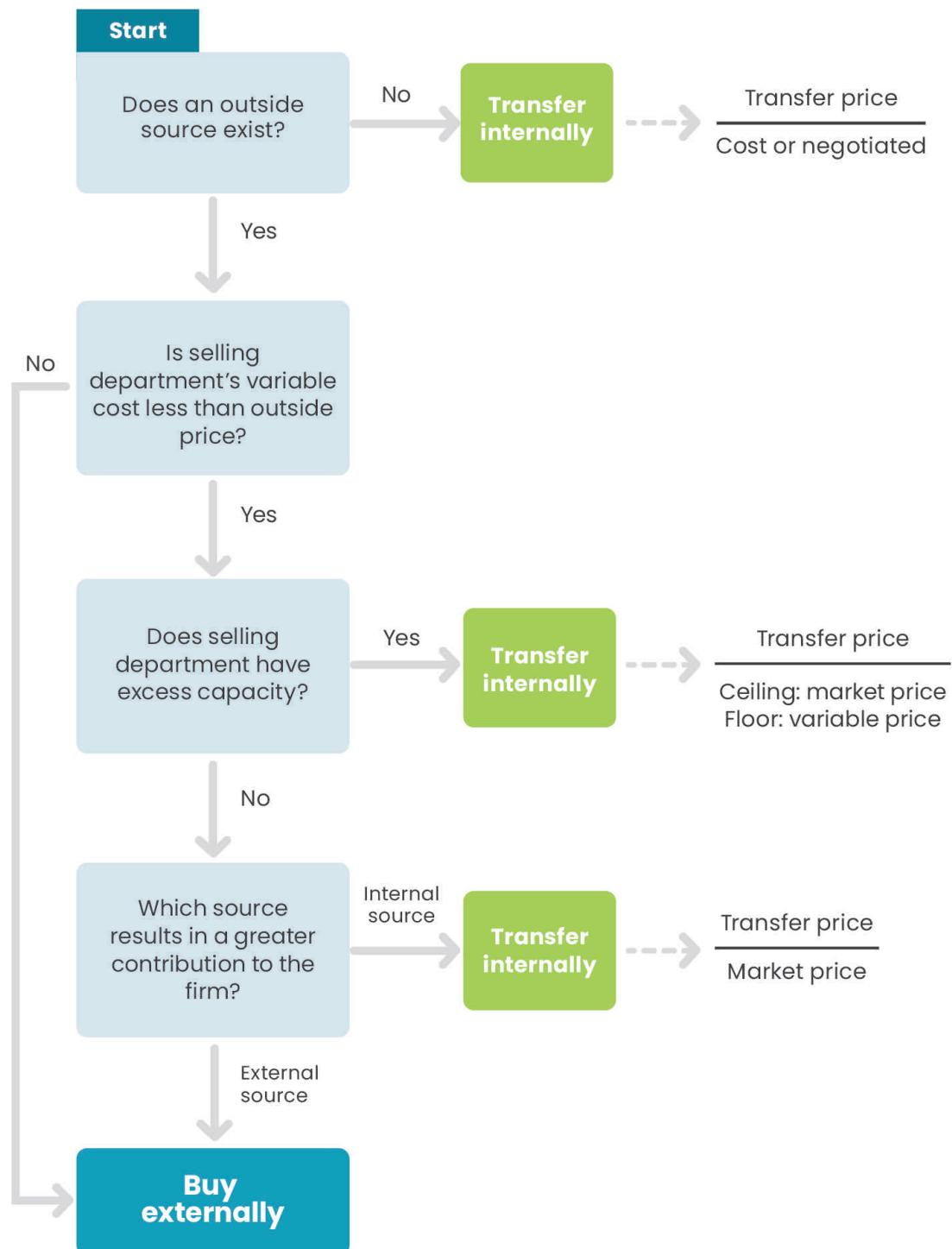


Figure 16-2

Example 16-6 Transfer Pricing Decision Scenarios

Division A produces a small part at a cost of \$6 per unit. The regular selling price is \$10 per unit. If Division B can use the part in its production, the cost to the company (as a whole) will be \$6.

Division B has another supplier who will sell the item to B at \$9.50 per part. Division B wants to buy the \$9.50 part from the outside supplier instead of the \$10 part from Division A, but making the part for \$6 is in the company's best interest.

What amount should Division A charge Division B?

The answer is complicated by many factors. For example, if Division A has excess capacity, B should be charged a lower price. If it is operating at full capacity, B should be charged \$10.

Also consider what portion of Division A's costs is fixed. For example, if a competitor offered to sell the part to B at \$5 each, can Division A advantageously sell to B at a price lower than \$5? If Division A's \$6 total cost is composed of \$4 of variable costs and \$2 of fixed costs, it is beneficial for all concerned for A to sell to B at a price less than \$5. Even at a price of \$4.01, the parts would be providing a contribution margin to cover some of A's fixed costs.

Dual Pricing

Under dual pricing, the selling and buying units record the transfer at different prices.

- For example, the seller could record the transfer to another segment as a sale at the usual market price that would be paid by an outsider. The buyer, however, would record a purchase at the variable cost of production. Each segment's reported performance is improved by the use of a dual-pricing scheme.
- The firm as a whole would benefit because variable costs would be used for decision-making purposes. In a sense, variable costs would be the relevant price for decision-making purposes, but the regular market price would be used for evaluation of production divisions.

However, under a dual-pricing system, the profit for the company will be less than the sum of the profits of the individual segments. In effect, the seller is given a corporate subsidy.

- The dual-pricing system is rarely used because the incentive to control costs is reduced.
- The seller is assured of a high price, and the buyer is assured of an artificially low price. Thus, neither manager must exert much effort to show a profit on segmental performance reports.

Study Unit Seventeen

Internal Controls -- Corporate Governance

17.1	<i>Corporate Governance and Regulations Relating to Internal Control</i>	2
17.2	<i>Risk and Internal Control</i>	11

This study unit is the **first of two on internal controls**. The relative weight assigned to this major topic in Part 1 of the exam is **15%**. The two study units are

- **Study Unit 17: Internal Controls -- Corporate Governance**
- Study Unit 18: Internal Controls -- Controls and Security Measures

This study unit discusses internal controls and related topics. Topics covered in this study unit include

- Internal control objectives
- Major components of internal control
- Corporate governance
- How internal controls are designed
- Personnel policies and procedures
- Major internal control provisions of the Sarbanes-Oxley Act
- Inherent risk, control risk, and detection risk
- The top-down approach versus bottom-up approach to auditing internal controls
- Major internal control provisions of the Foreign Corrupt Practices Act
- External auditor responsibilities
- Types of audit opinions



Author's Note

Management accountants are expected to have a thorough understanding of the risks inherent to, and the internal controls within, a business. Internal controls have always been a good idea in a well-run business, but with the passage of the Foreign Corrupt Practices Act in 1977, an effective internal control system became a legal requirement. The Sarbanes-Oxley Act of 2002 further enhanced the legal requirements for internal controls.

17.1 Corporate Governance and Regulations Relating to Internal Control

Definition of Corporate Governance

Governance is the combination of people, policies, procedures, and processes (including internal control) that help ensure that an entity effectively and efficiently directs its activities toward meeting the objectives of its stakeholders.

Stakeholders are persons or entities who are affected by the activities of the entity. Among others, these include shareholders, employees, suppliers, customers, neighbors of the entity's facilities, and government regulators.

Corporate governance can be either internal or external.

- Corporate charters and bylaws, boards of directors, and internal audit functions are internal.
- Laws, regulations, and the government regulators who enforce them are external.

Governance Practices

Governance practices reflect the organization's unique culture and largely depend on it for effectiveness. The organizational culture

- Sets values, objectives, and strategies
- Defines roles and behaviors
- Measures performance
- Specifies accountability

Governance practices may use various legal forms, structures, strategies, and procedures. They ensure that the organization

- Complies with society's legal and regulatory rules
- Satisfies the generally accepted business norms, ethical principles, and social expectations of society
- Provides overall benefit to society and enhances the interests of the specific stakeholders in both the long and short term
- Reports fully and truthfully to its stakeholders, including the public, to ensure accountability for its decisions, actions, and performances

Governance applies to all organizational activities. Its processes provide overall direction for risk management activities. Internal control activities are, in turn, a key element of risk management. They implement the organization's risk management strategies.

Governance does not exist independently of risk management and control. Rather, governance, risk management, and control (collectively referred to as GRC) are interrelated.

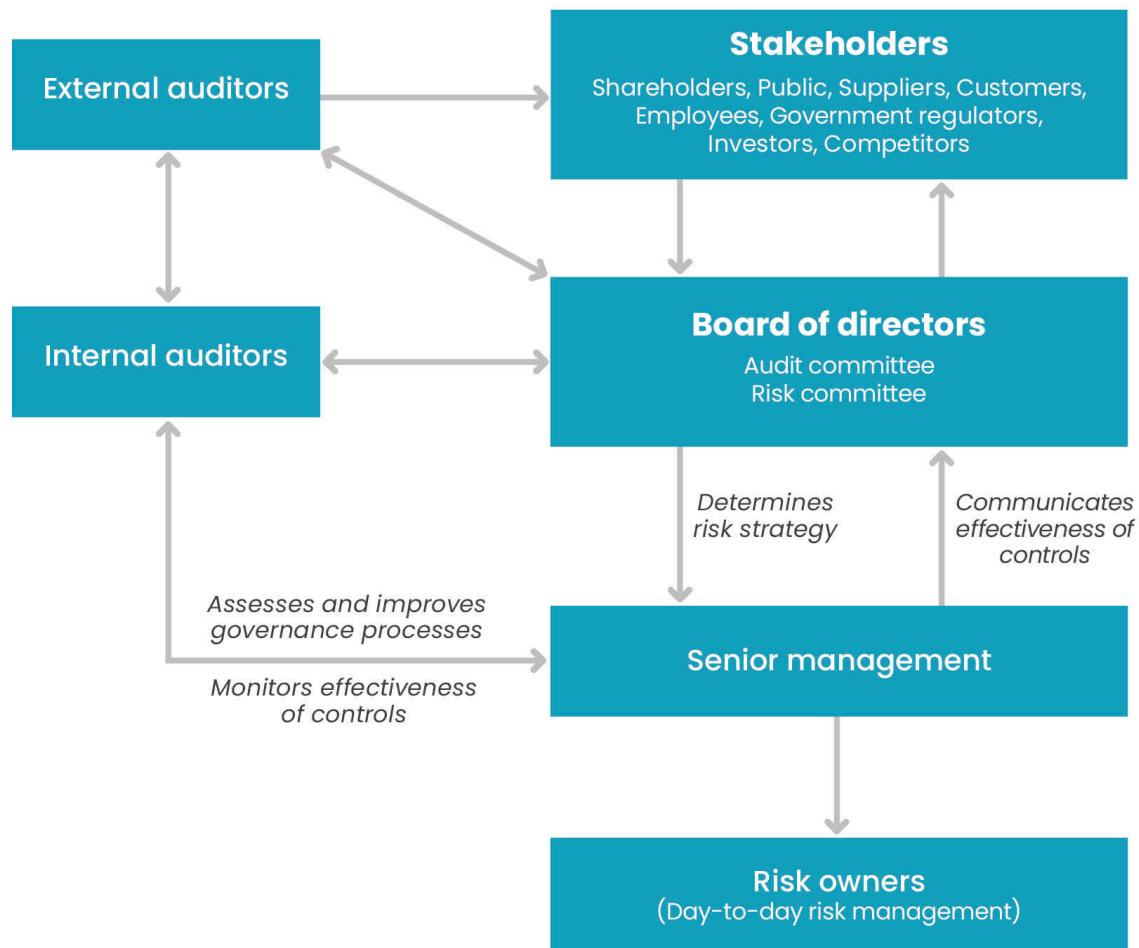


Figure 17-1

Governance in Corporations

Unlike a sole proprietorship or a general partnership, a corporation is a legal entity created under authority of a **state statute** to carry out the purposes permitted by that statute and the articles of incorporation. The corporation ordinarily is treated as a **legal person** with rights and obligations separate from its owners and managers.

Corporations are governed by **shareholders** (owners) who elect a board of directors and approve fundamental changes in the corporate structure. **Directors** establish corporate policies, adapt bylaws, and elect or appoint corporate **officers** who carry out the policies in the day-to-day management of the organization.

Incorporation may be in any state. **Articles of incorporation** must be filed with the secretary of state or another designated official. The articles must include the following:

- Corporation's name (must differ from the name of any corporation authorized to do business in the state)
- Number of authorized shares of stock
- Street address of the corporation's initial registered office
- Name of the registered agent at that office
- Name and address of each incorporator

Bylaws govern the internal structure and operation of the corporation. Initial bylaws are adopted by the incorporators or the board. They may contain any provision for managing the business and regulating the entity's affairs that does not conflict with the law or the articles.

Personnel policies and procedures are integral to an efficient control environment. They influence the control consciousness of personnel.

Corporate Governance Process

Governance has two major components: strategic direction and oversight.

- Strategic direction determines
 - The business model
 - Overall objectives
 - The approach to risk taking (including the risk appetite)
 - The limits of organizational conduct
- Oversight is the governance component with which internal auditing is most concerned. It is also the component to which risk management and control activities are most likely to be applied. The elements of oversight are
 - Risk management activities performed by senior management and risk owners
 - Internal and external assurance activities

The **board** is the source of overall direction to, and the authority of, management. It also has the ultimate responsibility for oversight. Directors have a **fiduciary** duty to the corporation.

- Another responsibility is to identify stakeholders, whether directly involved with the business (employees, customers, and suppliers), indirectly involved (investors), or having influence over the business (regulators and competitors).
- The board must determine the expectations of stakeholders and the outcomes that are unacceptable.

The most important function of the board's **audit committee** is to promote the independence of the external and internal auditors from undue influence by management. A related function is support for the recommendations made by auditors.

Management performs day-to-day governance functions and determines

- What specific risks are to be managed
- Who will be **risk owners** (managers responsible for specific day-to-day risks)
- How specific risks will be managed

The functions of risk owners include

- Evaluating the adequacy of the design of risk management activities and the organization's ability to carry them out as designed
- Determining whether risk management activities are operating as designed
- Establishing monitoring activities
- Ensuring that information to be reported to senior management and the board is accurate, timely, and available

A **risk committee** may be created that

- Identifies key risks
- Connects them to risk management processes
- Delegates them to risk owners
- Considers whether tolerance levels delegated to risk owners are consistent with the organization's risk appetite

Governance expectations, including tolerance levels, must be periodically reevaluated by the board and senior management. The result may be changes in risk management activities.

Internal Control

An organization establishes a system of internal control to help it manage many of the risks it faces.

The COSO model (described in detail in Subunit 17.2) defines internal control as follows:

*Internal control is a process, effected by an entity's board of directors, management, and other personnel, designed to provide **reasonable assurance** (not absolute assurance) regarding the achievement of objectives relating to operations, reporting, and compliance.*

One such risk is the risk of fraud. **Fraud** differs from error because it is intentional. It typically involves pressures or incentives to engage in wrongdoing and a perceived opportunity to do so. Examples are fraudulent financial reporting and misappropriation of assets.

- Internal controls are designed to prevent and detect fraud. However, because of the concealment aspects of fraudulent activity (e.g., collusion or falsification of documents), controls cannot give absolute assurance that material fraud will be prevented or detected.

Controls must be cost beneficial. They should not have an adverse effect on efficiency or profitability. For example, the audit committee might review the internal auditor's work schedule.

Foreign Corrupt Practices Act

The Foreign Corrupt Practices Act (FCPA) is designed to prevent secret payments of corporate funds for purposes that Congress has determined to be contrary to public policy, such as bribery of foreign officials.

The act amends the Securities Exchange Act of 1934 to prohibit a **domestic** concern engaged in interstate commerce (including any person acting on its behalf), whether or not doing business overseas and whether or not registered with the SEC, from offering or authorizing corrupt payments to any

- Foreign official
- Foreign political party or official thereof
- Candidate for political office in a foreign country
 - Only political payments to **foreign government officials** are prohibited. Payments to foreign business owners or corporate officers are not addressed by the FCPA.

Corrupt payments are payments for the purpose of inducing the recipient to act or refrain from acting so that the domestic concern might obtain or retain business. The FCPA prohibits a mere offer or promise of a bribe, even if it is not consummated. The FCPA prohibits payment of anything of value, except for de minimis gifts (e.g., tokens of hospitality). Payments are prohibited if the person making them knew or should have known that some or all of them would be used to influence a governmental official. Foreign officials do not include clerical or ministerial employees.

- EXAMPLE: Payments made to a clerk to expedite the processing of goods through customs may not be prohibited by the act. Such payments are not prohibited as long as the recipient has no discretion in carrying out a governmental function.
- Payments that are allowed under the written law of the foreign country are also not prohibited.

Regardless of whether they have foreign operations, all **public companies** must make and keep books, records, and accounts in reasonable detail that accurately and fairly reflect transactions and dispositions of assets.

All public companies registered under the 1934 act must devise and maintain a system of internal accounting control sufficient to provide **reasonable assurance** (not absolute assurance) that

- Transactions are executed in accordance with management's general or specific authorization.
- Transactions are recorded as necessary to
 - Permit preparation of financial statements in conformity with generally accepted accounting principles (GAAP) or any other criteria applicable to such statements and
 - Maintain accountability for assets.
- Access to assets is permitted only in accordance with management's general or specific authorization.
- The recorded accountability for assets is compared with the existing assets at reasonable intervals, and appropriate action is taken with respect to any differences.

The penalties for an individual for each criminal violation of the corrupt practices provisions are a fine of up to \$100,000 or imprisonment for up to 5 years, or both. A corporation may be assessed a fine of up to \$2,000,000 for violation of the same section. Fines imposed upon individuals may not be paid directly or indirectly by an employer.

The implications of the FCPA extend well beyond its anti-bribery provisions.

- All U.S. businesses and business people are involved. Management is particularly affected. The responsibility for internal control is not new, but the potential for civil and criminal liabilities represents an added burden.
- The impact of the law and the threat its ambiguities pose may alter business operations. Management might decide to abandon direct selling operations in foreign countries in favor of the use of foreign agents in hopes that this might lessen their "reason to know."

A written code of ethics and conduct is a necessity. This code should be communicated and monitored by internal auditors for compliance.

- The code might include an explanation of the FCPA and its penalties. A firm may require written representations from employees that they have read and understood the provisions of the code.
- Written representations regarding compliance might also be requested at future times. Foreign agents should be made aware of the prohibitions of indirect payments.

Sarbanes-Oxley Act

The Sarbanes-Oxley Act of 2002 was a response to numerous financial reporting scandals involving large public companies. The act contains provisions that impose new responsibilities on issuers (public companies) and their auditors. The act created the **Public Company Accounting Oversight Board (PCAOB)**, which establishes auditing standards for registered public accounting firms to apply in their audits of issuers.

The act requires that each member of the issuer's **audit committee** be an **independent member** of the board of directors. To be independent, a director must not be affiliated with, or receive any compensation (other than for service on the board) from, the issuer. Additional requirements are as follows:

- The audit committee must consist of **at least three** fully independent members.
- At least **one** member of the audit committee must be a **financial expert**.
- The audit committee must be directly responsible for appointing, compensating, and overseeing the work of the independent auditor. The independent auditor must report directly to the audit committee, not to management.
- The audit committee also must establish procedures for
 - The receipt, retention, and treatment of complaints received regarding accounting, internal control, or auditing matters and
 - The confidential, anonymous submission of employees' concerns regarding questionable accounting or auditing matters.

Tested Sections

The following major internal control provisions of the Sarbanes-Oxley Act are tested on the CMA exam:

Prohibited nonaudit services: **Section 201** of the act lists several activities that cannot be performed on behalf of audit clients.

- An accounting firm may perform nonaudit services (e.g., tax services) for an audit client only if the activity is approved in advance by the audit committee of the client.

Audit partner rotation: **Section 203** of the act requires the lead auditor and the reviewing partner to be rotated off the audit so that the same individual is not supervising a client's audit for an extended period of time.

- The lead audit partner cannot perform audit services for more than 5 consecutive fiscal years of the audit client.

Auditor reports to audit committees: Section 204 of the act requires that the following be reported:

- All critical accounting policies and practices
- Alternative treatments of financial information
- Other written communications between the auditor and management

Corporate responsibility: Section 302 of the act requires periodic statutory financial reports to include certain certifications.

Internal control report: Section 404 of the act requires management to establish and document internal control procedures and to include in the annual report a report on the company's internal control over financial reporting. This report is to include

- A statement of management's responsibility for internal control.
- Management's assessment of the effectiveness of internal control as of the end of the most recent fiscal year.
- Identification of the framework used to evaluate the effectiveness of internal control (such as the report of the Committee of Sponsoring Organizations).
- A statement about whether significant changes in controls were made after their evaluation, including any corrective actions.
- A statement that the external auditor has issued an attestation report on management's assessment. Because of this requirement, two audit opinions are expressed: one on internal control and one on the financial statements. The external auditor must attest to and report on management's assessment and must evaluate whether the structure and procedures (1) include records that accurately and fairly reflect the firm's transactions and (2) provide reasonable assurance that transactions are recorded so as to permit statements to be prepared in accordance with GAAP.
 - The auditor's report must describe any material weaknesses in internal controls.
 - The evaluation is not to be the subject of a separate engagement but must be performed in conjunction with the audit of the financial statements.

Audit committee financial experts: Section 407 of the act outlines required disclosure of the audit committee financial expert.

Audit Approaches

The **substantive procedures (bottom-up) approach** applies audit resources to large volumes of transactions and account balances without any particular focus on specified areas of the financial statements. Vouching and direct verification are examples.

- A bottom-up approach is not risk-based and views all controls equally, therefore, testing a high number of controls instead of focusing on high-risk controls, processes, and transactions.

The **risk-based (top-down) approach** directs audit resources to appropriate financial statement assertions based on the auditor's assessment of the risk of material misstatements (whether by fraud or error).

- Auditors are required to make risk assessments at the financial statement and relevant assertion levels based on an appropriate understanding of the entity and its environment, including internal controls.
 - Risks of material misstatement at the **financial statement level** relate pervasively to the financial statements as a whole and potentially affect many assertions.
 - **Assertions** are representations by management, made either explicitly or implicitly, about the recognition, measurement, presentation, and disclosure of information in the financial statements.
 - This approach requires auditors to identify the key day-to-day risks faced by a business, consider the effect these risks could have on the financial statements, and plan their audit procedures accordingly.
-

Audit Opinions

An external auditor may express four types of audit opinions in audit reports on financial statements.

An **unmodified opinion** is the conclusion that the financial statements are presented fairly, in all material respects, in accordance with the framework.

A **qualified opinion** is the conclusion that, except for the matter(s) described in the basis for qualified opinion paragraph, the financial statements are presented fairly, in all material respects, in accordance with the framework.

- If the auditor has obtained sufficient appropriate audit evidence, misstatements are material but not pervasive.
- If the auditor has not obtained sufficient appropriate audit evidence, the possible effects of undetected misstatements are material but not pervasive.

An **adverse opinion** is the conclusion that, because of the significance of the matter(s) described in the basis for adverse opinion paragraph, the financial statements are not presented fairly.

- The auditor has obtained sufficient appropriate audit evidence, but the misstatements are material and pervasive.

A **disclaimer of opinion** is the conclusion that, because of the significance of the matter(s) described in the basis for disclaimer of opinion paragraph, the auditor has not been able to obtain sufficient appropriate audit evidence. Accordingly, the auditor does not express an opinion on the financial statements.

- The possible effects of undetected misstatements are material and pervasive.

17.2 Risk and Internal Control

The Assessment and Management of Risk

Every organization faces risks, that is, unforeseen obstacles to the pursuit of its objectives. Risks take many forms and can originate from inside or outside the organization. Examples include the following:

- A hacker may break into a university's information systems, changing grades and awarding unearned degrees.
- The CEO may bribe a member of Congress to introduce legislation favorable to the firm's business.
- A foreign government may be overthrown in a coup d'etat, followed by the expropriation of the firm's assets in that country.
- An accounts payable clerk may establish fictitious vendors in the company's information systems and receive checks in payment for nonexistent goods or services.
- A spike in interest rates may make the firm's long-term capital projects unprofitable.
- The introduction of a new technology may make one of the firm's premier products obsolete.

Risk assessment is the process whereby management identifies the organization's vulnerabilities. All systems of internal control involve tradeoffs between cost and benefit. For this reason, no system of internal control can be said to be "100% effective." Organizations accept the fact that risk can only be mitigated, not eliminated.

Risk management is the ongoing process of designing and operating internal controls that mitigate the risks identified in the organization's risk assessment.

Risk can be quantified as a combination of two factors: the severity of consequences and the likelihood of occurrence. The expected value of a loss due to a risk exposure can thus be stated numerically as the product of the two factors. Risk can also be assessed in qualitative terms.

Example 17-1 Risk Assessment Factors

A company is assessing the risks of its systems being penetrated by hackers.

Event	Consequences	Likelihood
Minor penetration	Annoyance	90%
Unauthorized viewing of internal databases	Public embarrassment, Loss of customer confidence	8%
Unauthorized alteration of internal databases	PR crisis, Customer defection	2%

Although the occurrence of an annoyance-level incident is viewed as almost inevitable, the company will not find it worthwhile to institute the level of control necessary to prevent it.

By contrast, the occurrence of a disastrous-level incident is seen as remote, but the consequences are so severe that the company is willing to institute costly internal controls to ensure its prevention.

In the AICPA's **audit risk** model, audit risk is defined as the risk that an auditor may express an inappropriate opinion on materially misstated financial statements. The model may be adapted to the system of internal control as follows:

- **Inherent risk (IR)** is the susceptibility of one of the company's objectives to obstacles arising from the nature of the objective, assuming no related internal controls. For example, a uranium mine is inherently riskier than a shopping mall.
- **Control risk (CR)** is the risk that the controls put in place will fail to prevent an obstacle from interfering with the achievement of the objective. For example, a policy requiring two approvals for expenditures over a certain dollar amount could be bypassed by collusion.
- **Detection risk (DR)** is the risk that an obstacle to an objective will not be detected before a loss has occurred. For example, an embezzlement that continues for a year before detection is much costlier than one that is discovered after 1 month.

Total audit risk (TR) may thus be stated as follows:

$$TR = IR \times CR \times DR$$

Objectives of Internal Control

The three classes of objectives direct organizations to the different (but overlapping) elements of control.

The following is a useful memory aid for the COSO classes of objectives:

O	Operations
R	Reporting
C	Compliance

Operations

Operations objectives relate to **achieving the entity's mission**. Appropriate objectives include improving financial performance, productivity, quality, innovation, and customer satisfaction.

Operations objectives also include **safeguarding of assets**.

- Objectives related to protecting and preserving assets assist in risk assessment and development of mitigating controls.
- Avoidance of waste, inefficiency, and bad business decisions relates to broader objectives than safeguarding of assets.

Reporting

To make sound decisions, stakeholders must have reliable, timely, and transparent financial information. Reports may be prepared for use by the organization and stakeholders. Objectives may relate to

- Financial and nonfinancial reporting
- Internal or external reporting

Compliance

Entities are subject to laws, rules, and regulations that set minimum standards of conduct.

- Examples include taxation, environmental protection, and employee relations.
- Compliance with **internal policies and procedures** is an operational matter.

The entity's overall objectives must connect its particular capabilities and prospects with the objectives of its business units. As conditions change, the objectives (and related internal controls) of subunits must be altered to adapt to changes in the objectives of the entity as a whole.

Achievement of Objectives

An internal control system is more likely to provide reasonable assurance of achieving the reporting and compliance objectives than the operational objectives.

- Reporting and compliance objectives are responses to standards established by external parties, such as regulators. Thus, achieving these objectives depends on actions almost entirely within the entity's control.
 - However, operational effectiveness may not be within the entity's control because it is affected by human judgment and many external factors.
-

Roles and Responsibilities Regarding Internal Control

Board of Directors and Its Committees

The entity's commitment to integrity and ethical values is reflected in the board's selections for the chief executive officer (CEO) and senior vice president positions.

- To be effective, board members should be objective, have a role regarding internal controls in an oversight only capacity, have knowledge of the organization's industry, and be willing to ask the relevant questions about management's decisions.

Senior Management

Senior management is responsible for establishing and maintaining the organization's system of internal control. The CEO also establishes the tone at the top. Organizations inevitably reflect the ethical values and control consciousness of the CEO.

The chief financial officer (CFO) is responsible for the organization's financial operations, which includes the system of internal control.

Internal Auditors

Although management is ultimately responsible for the design and operation of the system of internal controls, an organization's internal audit function has a consulting and advisory role.

Internal audit also evaluates the adequacy and effectiveness of internal control in response to risks in the entity's oversight, operations, and information systems. For example, internal audit evaluates controls over the following:

- Achievement of the organization's strategic objectives
- Reliability and integrity of financial and operational information
- Effectiveness and efficiency of operations and programs
- Safeguarding of assets
- Compliance with laws, regulations, standards, policies, procedures, and contracts

To remain independent in the conduct of these reviews, the internal audit function cannot be responsible for selecting and executing controls. This is solely the responsibility of management.

Other Entity Personnel

Everyone in the organization must be aware that (s)he has a role to play in internal control, and every employee is expected to perform his or her appropriate control activities. In addition, all employees should understand that they are expected to inform those higher in the organization of instances of poor control.

External Auditors

Traditionally, independent accountants have been required by their professional standards to consider the auditee's system of internal control as part of their audit of the entity's financial statements.

This is no longer simply a good practice self-imposed by the accounting profession. The PCAOB has made it a legal requirement for auditors of public companies to examine and report on internal control.

Legislators and Regulators

Congress passed the Foreign Corrupt Practices Act and the Sarbanes-Oxley Act, both of which set legal requirements with regard to internal control.

Outsourced Service Providers

Some of an entity's business functions, e.g., IT, human resources, or internal audit, may be performed by external service providers. Accordingly, management must manage the risks of outsourcing. Thus, it must implement a means of evaluating the effectiveness of control over outsourced activities.

Flowcharting

Flowcharting is the representation of a process using pictorial symbols and is useful in understanding, evaluating, and documenting internal control and systems development. Flowcharts provide a visual of the various steps of a process from beginning to end. Flowcharts assist with identifying strengths and weaknesses in internal controls. A document flowchart effectively displays the document flows through various departments.

PCAOB Approach

One of the requirements of the Sarbanes-Oxley Act is that the annual financial statement audit also address the firm's system of internal control over financial reporting.

The PCAOB issued its Auditing Standard (AS) No. 2201, "An Audit of Internal Control Over Financial Reporting That Is Integrated with An Audit of Financial Statements," to provide guidance when these two audits are integrated.

AS 2201 requires the external auditor to express an opinion on both the system of internal control over financial reporting and the fair presentation of financial statements.

- The auditor's primary consideration when assessing a firm's internal controls over financial reporting is whether they affect the financial statement assertions.
- Per AS 2201, the auditor should use a top-down (risk-based) approach to audit internal controls over financial reporting. Under the top-down approach, the auditor begins at the financial statement level, focusing on entity-level controls, and then works down to significant accounts and disclosures and their relevant assertions.

AS 2201 focuses on the **existence of material weaknesses** in internal control:

Because a company's internal control cannot be considered effective if one or more material weaknesses exist, to form a basis for expressing an opinion, the auditor must plan and perform the audit to obtain competent evidence that is sufficient to obtain reasonable assurance about whether material weaknesses exist as of the date specified in management's assessment. A material weakness in internal control over financial reporting may exist even when financial statements are not materially misstated.

The AICPA's auditing standards define material weakness as follows:

A material weakness is a deficiency, or combination of deficiencies, in internal control that results in a reasonable possibility that a material misstatement of the financial statements will not be prevented or timely detected and corrected.

- This financial reporting-oriented focus for internal controls stands in contrast with the broader view that internal controls are processes to aid the organization in achieving its goals.

COSO Framework

Internal Control – Integrated Framework is widely accepted as the standard for the design and operation of internal control systems.

The COSO model defines internal control as follows:

*Internal control is a process, effected by an entity's board of directors, management, and other personnel, designed to provide **reasonable** assurance (not absolute assurance) regarding the achievement of objectives relating to operations, reporting, and compliance.*

Internal control is

- Intended to **achieve** three classes of **objectives**
 - An **ongoing process**
 - Effected by **people** at **all** organizational **levels**, e.g., the board, management, and all other employees
 - Able to provide **reasonable**, but not absolute, **assurance**
 - **Adaptable** to an entity's structure
-

Components of Internal Control

Supporting the organization in its efforts to achieve objectives are the following five components of internal control:

1. Control environment
2. Risk assessment
3. Control activities
4. Information and communication
5. Monitoring

A useful memory aid for the COSO components of internal control is, “Controls stop **CRIME**.”

C	Control activities
R	Risk assessment
I	Information and communication
M	Monitoring
E	Control environment

Control Environment

The control environment is a set of standards, processes, and structures that pervasively affects the system of internal control. Five principles relate to the control environment:

1. The organization demonstrates a commitment to **integrity and ethical values** by

- Setting the **tone at the top**. Through words and actions, the board of directors and management communicate their attitude toward integrity and ethical values.
- Establishing standards of conduct. The board and management create expectations that should be understood at all organizational levels and by outside service providers and business partners.
- Evaluating the performance of individuals and teams based on the established standards of conduct.
- Correcting deviations in a timely and consistent manner.

2. The board demonstrates independence from management and exercises **oversight** of internal control. The board

- Establishes oversight responsibility. The board identifies and accepts its oversight responsibilities.
- Applies relevant experience by defining, maintaining, and periodically evaluating the skills and expertise needed among its members to ask difficult questions of management and take appropriate actions.
- Operates independently. The board includes enough members who are independent and objective in evaluations and decision making.
 - ▶ For example, in some jurisdictions, all members of the audit committee must be outside directors.
- Provides oversight. The board is responsible for oversight of management's design, implementation, and conduct of internal control.

3. Management establishes, with board oversight, **structures, reporting lines, and appropriate authorities and responsibilities**. Management

- Considers all structures of the entity. Variables considered in establishing organizational structures include the following:
 - ▶ Nature of the business
 - ▶ Size and geographic scope of the entity
 - ▶ Risks, some of them outsourced, and connections with outside service providers and partners
 - ▶ Assignment of authority to different management levels
 - ▶ Definition of reporting lines
 - ▶ Reporting requirements
- Establishes and evaluates reporting lines. The trend in corporate governance has been to allow employees closer to day-to-day operations to make decisions.
- Designs, assigns, and limits authorities and responsibilities.

4. The organization demonstrates a **commitment to attract, develop, and retain competent individuals** in alignment with objectives.

- Policies and practices reflect expectations of competence. Internal control is strengthened when management specifies what competencies are needed for particular jobs.
- The board and management evaluate competence and address shortcomings. Employees and outside service providers have the appropriate skills and knowledge to perform their jobs.
- The organization attracts, develops, and retains individuals. The organization is committed to hiring individuals who are competent and have integrity. Ongoing training and mentoring are necessary to adapt employees to the control requirements of a changing environment.
- Senior management and the board plan and prepare for succession.

5. The **organization holds individuals accountable** for their internal control responsibilities in pursuit of objectives. Management and the board

- Enforce accountability through structures, authorities, and responsibilities
- Establish performance measures, incentives, and rewards
- Evaluate performance measures, incentives, and rewards for ongoing relevance
- Consider excessive pressures
- Evaluate performance and reward or discipline individuals

The control environment reflects the attitude and actions of the board and management regarding the significance of control within the organization.

Internal control policies and procedures help ensure that management directives to mitigate risks are carried out. They are intended to ensure that necessary actions are taken to address risks to achieve management's objectives.

Risk Assessment

The risk assessment process encompasses an assessment of the risks themselves and the need to manage organizational change. This process is a basis for determining how the risks should be managed. Four principles relate to risk assessment:

1. The organization **specifies objectives** with sufficient clarity to enable the identification and assessment of risks relating to five types of objectives.
 - a. Operations
 - b. External financial reporting
 - c. External nonfinancial reporting
 - d. Internal reporting
 - e. Compliance
2. The organization **identifies** risks to the achievement of its objectives across the entity and **analyzes** risks to determine the appropriate risk **response**. Management must focus carefully on risks at all levels of the entity and take the necessary actions to manage them.
 - **Risk response** considers how each risk should be managed; whether to accept, avoid, reduce, or share the risk; and the design of controls. Strategies for risk response include the following:
 - ▶ Risk **avoidance** ends the activity from which the risk arises. For example, the risk of having a pipeline sabotaged in an unstable region can be avoided by simply selling the pipeline.
 - ▶ Risk **retention** accepts the risk of an activity. This term is a synonym for self-insurance.
 - ▶ Risk **reduction** (mitigation) lowers the level of risk associated with an activity. For example, the risk of systems penetration can be reduced by maintaining a robust information security function within the organization.
 - ▶ Risk **sharing** transfers some loss potential to another party. Examples are purchasing insurance, hedging, and entering into joint ventures.
 - ▶ Risk **exploitation** seeks risk to obtain a high return on investment.
3. The organization considers the potential for fraud in **assessing fraud risks** to the achievement of objectives. The organization must
 - Consider various types of fraud,
 - Assess incentives and pressures,
 - Assess opportunities, and
 - Assess attitudes and rationalizations.
4. The organization **identifies and assesses changes** that could significantly affect the system of internal control.
 - Significant changes could occur in an organization's external environment, business model, and leadership. Thus, internal controls must be adapted to the entity's changing circumstances.

Control Activities

These policies and procedures help ensure that management directives and risk responses are carried out. Whether automated or manual, they are applied at various levels of the entity and stages of processes.

- They may be preventive or detective, and segregation of duties is usually present (discussed in more detail in Study Unit 18, Subunit 1).

Three principles relate to control activities:

1. The organization **selects and develops control activities** that contribute to the mitigation of risks to the achievement of objectives to acceptable levels.
 2. The organization selects and develops **general control activities** over technology to support the achievement of objectives.
 3. The organization **deploys control activities** through **policies** that establish what is expected and **procedures** that put policies into action.
-

Information and Communication

Information systems enable the organization to obtain, generate, use, and communicate information to

- Maintain accountability
- Measure and review performance

Three principles relate to information and communication:

1. The organization obtains or generates and uses **relevant, quality information** to support the functioning of internal control.
2. The organization **internally communicates** information, including objectives and responsibilities for internal control, necessary to support the function of internal control.
3. The organization **communicates with external parties** regarding matters affecting the functioning of internal control.

Monitoring Activities

Control systems and the way controls are applied change over time. Monitoring is a process that assesses the quality of internal control performance over time to ensure that controls continue to meet the needs of the organization. The following are two principles related to monitoring activities:

1. The organization selects, develops, and performs **ongoing or separate evaluations (or both)** to determine whether the components of internal control are present and functioning.
2. The organization **evaluates and communicates control deficiencies** in a timely manner.

Relationship of Objectives, Components, and Organizational Structure

The COSO model may be displayed as a cube with rows, slices, and columns. The rows are the five components, the slices are the three objectives, and the columns represent an entity's organizational structure.

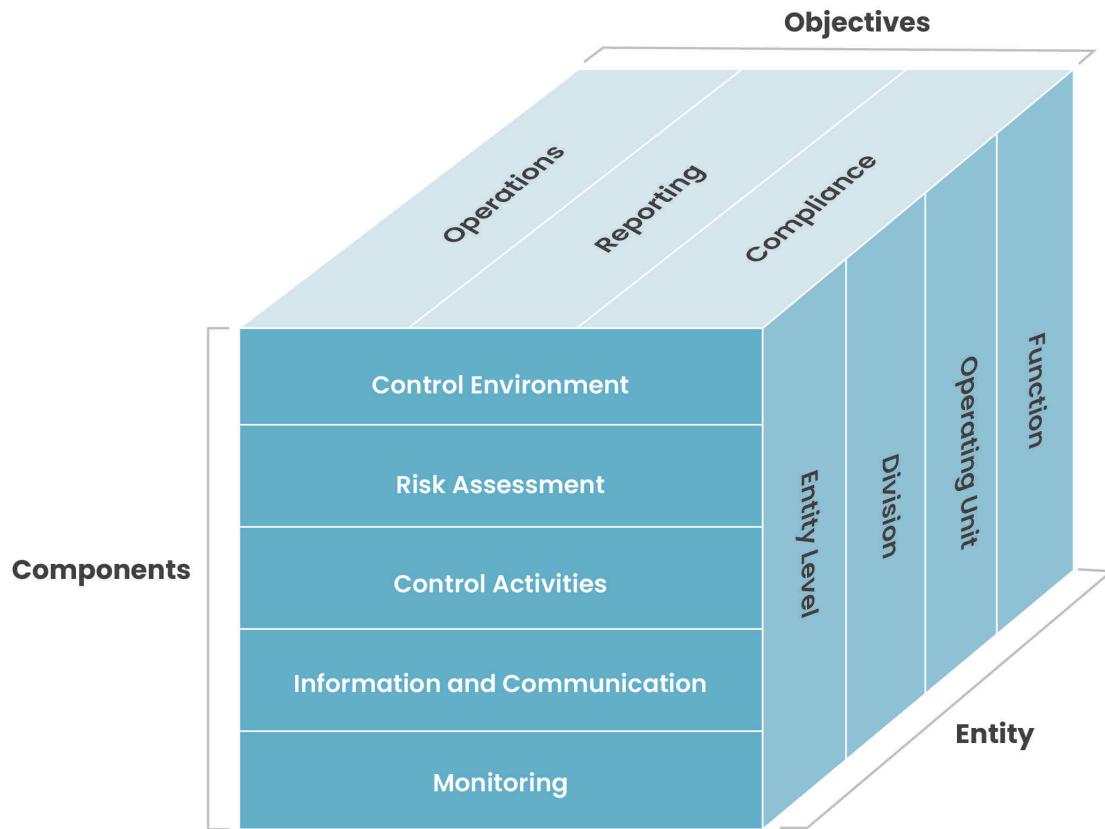


Figure 17-2

Study Unit Eighteen

Internal Controls -- Controls and Security Measures

18.1	<i>Control Procedures</i>	2
18.2	<i>Systems Controls and Information Security</i>	12
18.3	<i>Security Measures and Business Continuity Planning</i>	22

This study unit is the **second of two** on internal controls. The relative weight assigned to this major topic in Part 1 of the exam is **15%**. The two study units are

- Study Unit 17: Internal Controls -- Corporate Governance
- **Study Unit 18: Internal Controls -- Controls and Security Measures**

This study unit discusses controls. Topics covered in this study unit include

- Segregation of duties
- Safeguarding controls
- Preventive and detective controls
- Threats to information systems
- Input controls
- Processing controls
- Output controls
- Storage controls
- Data encryption
- Business continuity planning

18.1 Control Procedures

The Control Process

Control requires feedback on the results of organizational activities for the purposes of measurement and correction. The control process is a key element of management. Management is responsible for establishing goals and objectives, developing and implementing control procedures, and accomplishing desired results.

The control process includes

- Establishing standards for the operation to be controlled
- Measuring performance against the standards
- Examining and analyzing deviations
- Taking corrective action
- Reappraising the standards based on experience

Items to consider include the following:

- An evaluation-reward system should be implemented to encourage compliance with the control system.
- The costs of internal control must not be greater than its benefits.
- No control system can eliminate all fraud. Experienced employees can often evade controls, and collusion between employees also can override many controls.

Types of Controls

Primary Controls

Preventive controls deter the occurrence of unwanted events. Thus, effective control stops problems before they occur.

- Storing petty cash in a locked safe and segregation of duties are examples of this type of control.
- IT examples include
 - Designing a database so that users cannot enter a letter in the field that stores a Social Security number
 - Requiring the number of invoices in a batch to be entered before processing begins
 - Establishing a formal security policy

- Using only clean and certified copies of software
- Not using shareware software
- Checking new software with antivirus software
- Restricting access
- Educating users
- Using edit (field) checks to prevent certain types of incorrect data from entering a system
- Preformatting a data entry screen so that certain fields must be filled before proceeding

Detective controls alert the proper people after an unwanted event. They are effective when detection occurs before material harm occurs. Examples of detective controls include

- Automatic reporting to the accounts payable department of all rejected batches of invoices
- Using hash totals (defined in Subunit 18.2) to detect data entry errors and/or test for completeness
- Installing burglar alarms
- Examining system logs of actions that require scrutiny, such as repeated failed login attempts and the use of powerful utility programs

Corrective controls correct the negative effects of unwanted events. Examples of corrective controls include

- Requiring that all cost variances over a certain amount are justified
- Correcting errors reported on error listings
- Isolating and removing viruses
- Restarting from system crashes

Directive controls cause or encourage the occurrence of a desirable event. Policy and procedure manuals are common examples.

Secondary Controls

Compensatory (mitigative) controls may reduce risk when the primary controls are ineffective. However, they do not, by themselves, reduce risk to an acceptable level.

- An example is supervisory review when segregation of duties is not feasible.

Complementary controls work with other controls to reduce risk to an acceptable level.

- For example, separating the functions of accounting for and custody of cash receipts is complemented by obtaining deposit slips validated by the bank.

Time-Based Classification

Feedback controls report information about completed activities. They permit improvement in future performance by learning from past mistakes. Thus, corrective action occurs after the fact. Inspection of completed goods is an example.

Concurrent controls adjust ongoing processes. These real-time controls monitor activities in the present to prevent them from deviating too far from standards. An example is close supervision of production-line workers.

Financial vs. Operating Controls

Financial controls should be based on relevant established accounting principles. Objectives of financial controls may include proper authorization; appropriate recordkeeping; safeguarding of assets; and compliance with laws, regulations, and contracts. These are sometimes called “**accounting controls**.”

Operating controls apply to production and support activities. They are sometimes called “**administrative controls**.”

- Because they may lack established criteria or standards, they should be based on management principles and methods. They also should be designed with regard to the management functions of planning, organizing, directing, and controlling.
- **Documentary controls** apply to documents, such as vendor invoices, purchase orders, and receiving reports, that evidence the performance of operating controls. A purchase order stating the quantity goes to the vendor and to accounts payable. The receiving department should be sent a blind copy (no price or quantity) so that a count is needed to prepare the receiving report. Payment for a purchase is authorized by accounts payable only after examination of the vendor's invoice, purchase order, and receiving report.

People-Based vs. System-Based Controls

People-based controls are dependent on the intervention of humans for their proper operation, for example, regular performance of bank reconciliations.

- Checklists, such as lists of required procedures for month-end closing, can be valuable to ensure that people-based controls are executed when needed.

System-based controls are executed whenever needed with no human intervention.

- An example is code in a computerized purchasing system that prevents any purchase order over a certain monetary threshold from being submitted to the vendor without managerial approval.
- Other examples include control totals, reasonableness checks, and sequence tests.

General Controls and Application Controls

The two broad groupings of information systems control activities are **general controls** and **application controls**.

General controls is the umbrella under which the IT function operates. They affect the organization's entire processing environment and commonly include controls over

- Data center and network operations
- Systems software acquisition, change, and maintenance
- Access security
- Application system acquisition, development, and maintenance

Controls over software acquisition, change, and maintenance include

- **Controls over systems software**, which ensure that operating systems, utilities, and database management systems are acquired and changed only under close supervision and that vendor updates are routinely installed.
- **Controls over application software**, which ensure that programs used for transaction processing (e.g., payroll and accounts receivable) are cost-effective and stable.

Hardware controls are built into the equipment by the manufacturer. They ensure the proper internal handling of data as they are moved and stored.

- They include parity checks, echo checks, read-after-write checks, and any other procedure built into the equipment to ensure data integrity.

Application controls relate to specific computer applications. They are designed to ensure that only correct, authorized data enter the system and that the data are processed and reported properly.

- Input, processing, and output controls are examples of application controls covered in Subunit 18.2.
-

Control Activities

Control activities are designed and placed in operation to ensure that management's directives are executed. Thus, they should include the requisite steps to respond to the risks that threaten the attainment of organizational objectives.

- For this purpose, controls should be suitably designed to prevent or detect unfavorable conditions arising from particular risk exposures. They also should be placed in operation and operate effectively. If controls are not always enforced, they cannot operate effectively, no matter how effective their design.
- Control procedures are implemented to manage or limit risk in accordance with the entity's risk assessments whenever risk exposures exist that threaten loss of assets or misstatements of accounting or management information.

- Controls can be identified in the following areas:
 - Segregation of duties, including four basic functional responsibilities
 - Independent checks and verification
 - Safeguarding controls
 - Prenumbered forms
 - Specific document flow

Segregation of Duties



Success Tip

This subunit describes the types and provides examples of segregation of duties. As a CMA candidate, you must be able to identify and explain proper segregation of duties procedures. However, you should also be able to apply this concept to many different functions within the internal control process.

The **segregation of accounting duties** is vital because a separation of functions (authorization, recording, and access to assets) may not be feasible in an IT environment. For example, a computer may print checks, record disbursements, and generate information for reconciling the account balance. These activities customarily are segregated in a manual system.

Four types of functional responsibilities should be segregated:

1. Authority to execute transactions
2. Recordkeeping of the transactions
3. Custody of the assets affected by the transactions
4. Periodic reconciliation of the existing assets to recorded amounts

The following memory aid is for the functions that should be kept separate for proper segregation of duties:

A	Authorization
R	Recordkeeping
C	Custody
R	Reconciliation

Despite best efforts to segregate certain duties, this control can be compromised through collusion among employees.

Examples of Segregation of Duties within Each Basic Accounting Cycle

EXAMPLE: In the purchases-payables cycle,

- Inventory control initiates purchase requisitions. The authority to execute and follow up on transactions with vendors is then vested in the purchasing department.
 - Specifications should be established for quality, nature, and amounts purchased.
- Recordkeeping is done by accounts payable, not purchasing.
- Custody of the assets involved is vested in the warehouse, not inventory control.
- Goods received are approved by a separate receiving department.
- Periodic reconciliation of the existing assets to recorded amounts is performed by inventory control, not the warehouse.
- Purchasing is a high risk activity despite the stated controls. A purchasing department employee may transact with parties related to the employee.

EXAMPLE: In the sales-receivables cycle (also known as the revenue cycle),

- The authority to execute transactions is vested in the sales department, not the treasurer.
- Recordkeeping is done by accounts receivable, not sales.
- Custody of the assets involved is vested in the warehouse (in the case of the merchandise) and the treasurer (in the case of the cash).
- Periodic reconciliation of the existing assets to recorded amounts is performed by the general ledger accounting group, not the treasurer.
- Appropriate control over obsolete or spoiled materials requires that they be determined by an approved authority, separate from the regular user, to lack salability or regular usability.
- Credit sales should be authorized prior to executing the sales.

EXAMPLE: In the payroll cycle,

- The authority to execute transactions is vested in the human resources department, which authorizes the hiring and termination of employees and their rates of pay and deductions.
- Recordkeeping is done by the payroll department.
- Custody of the assets involved is vested in the treasurer.
- Periodic reconciliation of the existing assets to recorded amounts is performed by the general ledger accounting group.
- Supervisors in a department should approve employee time cards because they know whether hours were actually worked, but they should not distribute paychecks to that department's employees.

EXAMPLE: In the financing-treasury cycle,

- Transactions in debt and equity instruments should be properly authorized. The board of directors should review and approve all major funding and repayment proposals.

Independent Checks and Verification

The reconciliation of recorded accountability with the assets must be performed by a part of the organization either

- Unconnected with the original transaction or
- Without custody of the assets involved.

A comparison revealing that the assets do not agree with the recorded accountability provides evidence of unrecorded or improperly recorded transactions. The converse, however, does not necessarily follow. For example, agreement of a cash count with the recorded balance does not provide evidence that all cash received has been properly recorded.

The frequency of such comparisons for the purpose of safeguarding assets depends on the nature and amount of the assets involved and the cost of making the comparison. For example, cash may be counted daily but materials inventory only annually.

Safeguarding Controls

Safeguarding controls limit access to an organization's assets to authorized personnel. Access includes both direct physical access and indirect access through the preparation or processing of documents that authorize the use or disposition of assets. Examples of safeguarding controls include:

- A lockbox system for collecting cash receipts from customers
- Daily, intact deposit of cash receipts after preparation and verification by two treasury employees
- Approval of credit memos by the credit department, not sales
- Writeoffs of uncollectible accounts by the supervisor of the credit department manager
- Unescorted access to computer operations center prohibited to (1) all non-information systems personnel and (2) all non-operations information system personnel, such as developers
- Online access to production application libraries prohibited to developers; online access to production databases prohibited to all users except the organizational “owners” of the data elements
- Direct deposit of pay in lieu of distribution of physical paychecks; unclaimed paychecks held by the treasurer, not payroll; and maintenance of control over unused checks
- Holding of securities in a safe deposit box; two employees always present when box is accessed
- Physical measures taken to protect assets from natural disasters, e.g., floods, wind damage, earthquakes
- Authorization of a payment voucher by accounts payable only after examining the supporting documents

Prenumbered Forms

Sequentially prenumbered forms are the basis for a strong set of internal controls. Receiving reports in the warehouse and purchase orders in the sales department are common examples.

- When every hardcopy form is prenumbered, all can be accounted for; e.g., the date of their use and the person who filled them out can be ascertained. Any document in the sequence that is missing can be flagged for special scrutiny when it is processed.
 - During the periodic reconciliation, the verifying party can detect unrecorded and unauthorized transactions.
- This functionality can be achieved even in a paperless environment. Applications can be coded to sequentially number initiated transactions, and proper review and approval can be verified online.
- In addition to prenumbered forms, procedures ensuring that personnel do not receive documents inappropriate to their duties enhance internal control.
 - For example, documents authorizing the write-off of uncollectible receivables should not be routed to cashiers. These cashiers could later pocket the money if a written-off account was subsequently paid.

Specific Document Flow

As an organization conducts business, documents and other evidence of business transactions should be created. Sequentially prenumbered forms increase the usability of this evidence.

Tracing and Vouching

Tracing follows a transaction forward from the triggering event to a resulting event, ensuring that the transaction was accounted for properly.

- Tracing is used to gain assurance that a liability was properly accrued for all goods received.

Vouching tracks a result backward to the originating event, ensuring that a recorded amount is properly supported.

- Vouching is used to gain assurance that a receivable claimed is supported by a sale to a customer.



Figure 18-1

By searching for missing records in the document flow, auditors can detect errors or fraud.

The table below describes some possible procedures and the information they provide.

Procedures	Information Provided
<ul style="list-style-type: none"> ● Trace shipping documents with sales invoices and journal entries. ● Account for the numerical sequence of sales orders, shipping documents, invoices, etc. 	<ul style="list-style-type: none"> ● Sales and receivables were all accounted for.
<ul style="list-style-type: none"> ● Vouch sample of recorded sales to customer orders and shipping documents. 	<ul style="list-style-type: none"> ● Sales occurred.
<ul style="list-style-type: none"> ● Trace cash receipts to specific accounts. 	<ul style="list-style-type: none"> ● Accounts receivable are measured appropriately.
<ul style="list-style-type: none"> ● Vouch a sample of recorded cash receipts to accounts receivable and customer orders. ● Vouch a sample of recorded cash disbursements to approved vouchers. 	<ul style="list-style-type: none"> ● Cash transactions occurred.
<ul style="list-style-type: none"> ● Vouch a sample of recorded purchases to documentation. ● Vouch a sample of recorded cost of sales to documentation. 	<ul style="list-style-type: none"> ● Inventory transactions occurred.
<ul style="list-style-type: none"> ● Vouch a sample of recorded payables to documentation, e.g., requisitions, purchase orders, receiving reports, and approved invoices. 	<ul style="list-style-type: none"> ● Purchases occurred.
<ul style="list-style-type: none"> ● Trace subsequent payments to recorded payables. ● Collect supporting documentation and search for unmatched documents to determine whether relevant documents have been lost, misplaced, or misfiled. 	<ul style="list-style-type: none"> ● Accounts payable are all accounted for.

Compensating Controls

Compensating controls replace the normal controls, such as segregation of duties, when the normal controls cannot feasibly be implemented.

- For example, in the finance and investment cycle, senior management may authorize and execute investments and have access to records, stock certificates, etc. The compensating control is for at least two people to perform each function.
 - Oversight is an alternative to the performance of each function by at least two people. Thus, the board may authorize an investment with other functions (custody of stock certificates, management of the portfolio, and oversight of recordkeeping) performed by a senior manager.
- Other compensating controls in the finance and investment cycle include
 - Periodic communications with the board.
 - Oversight by a committee of the board.
 - Internal auditing's reconciliation of the securities portfolio with the recorded information.

Testing the Adequacy of Internal Controls

A system of internal controls is only effective if the controls are properly designed and followed on a consistent basis. The adequacy of internal controls should be tested regularly. Four common methods of testing are inquiry, observation, inspection, and reperformance.

- **Inquiry:** asking questions of those who designed or are implementing the controls to understand the system and evaluate whether the procedures are being followed consistently.
 - **Observation:** observing internal control activities and identifying weaknesses, if any. One possible weakness could be a simple failure to follow a properly designed control.
 - **Inspection:** examining written procedures and company records to determine their overall effectiveness.
 - **Reperformance:** performing the internal control procedure again to assess its accuracy and effectiveness. Software tools can assist the tester in identifying control deficiencies.
-

Remediation of Internal Control Deficiencies

When internal control deficiencies are identified, it is important to take steps to remediate those deficiencies.

- The first step is to identify and understand the root cause of the deficiency. Was it a design error or an execution problem?
- It is also necessary to assess the severity of the deficiency to determine its possible impact. The level of severity and the magnitude of the possible impact will affect the urgency of the next steps.

When the root cause is identified and the severity is determined, a plan of action should be developed. This could involve redesigning the control, providing additional staff training, hiring new staff, redeploying resources, and/or investing in new technology.

18.2 Systems Controls and Information Security

Information security encompasses not only computer hardware and software but all of an organization's information, regardless of what medium it resides on. Information security involves far more than just user IDs and passwords.

The importance of a broad definition of information security becomes clear in light of recent incidents of firms accidentally disposing of documents containing confidential customer information with their regular trash.

Three Goals of Information Security

1. **Availability** is the ability of the intended and authorized users to access computer resources to meet organizational goals.
2. **Confidentiality** is assurance of the secrecy of information that could adversely affect the organization if revealed to unauthorized persons.
3. **Integrity** is ensuring that data accurately reflect the business events underlying them and preventing the unauthorized or accidental modification of programs or data.

Five Steps in Creating an Information Security Plan

1. Threats to the organization's information, i.e., events that can potentially compromise an organization's information infrastructure, must be identified.
 - Threats to confidentiality include the improper disposal of customer records. Threats to availability include viruses and denial-of-service attacks. Threats to integrity include employee errors and sabotage.
2. The risks that the identified threats entail must be determined. Risk analysis encompasses determining the likelihood of the identified threats and the level of damage that could potentially be done should the threats materialize.
 - For example, an organization may conclude that, while the potential damage from sabotage is very high, its likelihood is quite low.
3. Controls that will compensate for the identified risks should be designed. Controls should be designed based on the combination of likelihood and potential damage determined in the risk analysis.

4. The new controls should be incorporated into a coherent, enterprise-wide information security plan. A plan should list the controls that will be put in place and how they will be enforced.
 5. Policies for expectations of all persons, both employees and external users, with access to the organization's systems must be established.
 - The most important policy is that which governs the information resources to which individuals have access and how the level of access will be tied to their job duties.
 - ▶ Carrying out such a policy requires the organization's systems to be able to tie data and program access to individual system IDs.
 - ▶ One provision of the policy should be for the immediate removal of access to the system for terminated employees.
-

Threats to Information Systems

Input manipulation is an intrusion into a system by exploiting a vulnerability in a legitimate electronic portal, such as the input fields on a web page. An input field may call, for instance, for the user's address, but a knowledgeable hacker can implant HTML code in the input field that runs a system command giving him or her access to the organization's data.

Program alteration is the deliberate changing of the processing routines of an application program. A famous, if fictitious, example is a piece of code that directs all amounts less than one cent to be directed to the malicious programmer's bank account.

Direct file alteration is the deliberate changing of data in a database to the intruder's advantage. A common example is a hacker who uses unauthorized access to change his or her course grades while bypassing the normal audit trail.

Data theft is the surreptitious copying of critical data elements from an organization's databases. Social Security and credit card numbers are common targets of this type of attack.

Sabotage is the disruption of an organization's systems, not for personal gain, but simply for revenge or in the spirit of vandalism. Changing a company's website to include unflattering information that is not immediately noticeable is an example. Another example is a disgruntled programmer who injects a logic bomb into an application that will disrupt processing long after the programmer's departure from the company.

Malware is short for malicious software. Basically, the term “malware” encompasses all harmful software, including all of those listed below.

Viruses are computer programs that propagate (replicate) themselves from one computer to another without the user’s knowledge. Some are written only for the programmer’s amusement and are relatively harmless. This type of virus may cause a clever or annoying message to appear on the user’s screen. Others are malicious and can cause great inconvenience and even loss of data.

- One symptom is that programs load or execute more slowly.
- A common way of spreading a virus is by email attachments and downloads of public domain software.
- Countermeasures include access restriction, frequent change of passwords, and tests using virus detection software, although antivirus software may not detect new viruses or variants of known viruses.

Logic bombs also destroy data but, unlike viruses, they remain on a single computer and do not replicate. Often they lie dormant until triggered by some occurrence, such as the arrival of a certain date.

Worms are pieces of code that do not threaten the data on a computer (unlike viruses and logic bombs) but are destructive because of the rapidity with which they replicate themselves.

- A worm released onto the Internet will propagate from network to network, eventually overwhelming one or more servers with traffic.

Trojan horses are voluntarily installed on a computer by the user because they are masquerading as programs the user wants.

- While the program may present the user with, for instance, an entertaining video game, it contains code that a hacker can activate to control the computer, retrieving sensitive data from it or using it to launch proxy attacks on other computers.

Back doors are a means of obtaining access to a system while bypassing the usual password controls. IT personnel often deliberately design back doors into systems to allow system management during unusual circumstances. Hackers search for vulnerabilities in systems to exploit back doors for their own purposes.

Spyware spies on a user without his or her knowledge and collects data, such as a history of keystrokes. Programs that capture keystrokes are called **keylogger** software.

Ransomware holds a computer or files hostage and demands a ransom payment. Ransomware distributors do not really want to cause major trouble. They just want to take something hostage and get a quick payment from the computer user.

Theft becomes increasingly problematic with the higher portability of laptop and palmtop computers. All organizations must establish policies for the proper physical protection of computing infrastructure assets.

Phishing is the attempt to acquire sensitive information by pretending to be a trustworthy entity.

Systems Development Controls

All information systems, automated or manual, perform four basic functions on information: input, processing, output, and storage. Proper management of the systems development process can enhance the accuracy, validity, safety, security, and adaptability of the controls over these functions.

Effective systems development requires the setting of priorities. This can be achieved through a steering committee composed of managers from both the IT function and the end-user functions. The committee approves development projects, assigns resources, and reviews their progress.

- The steering committee also ensures that requests for new systems are aligned with the overall strategic plan of the organization.
- All newly developed systems should conform to established organizational standards for coding and documentation.

The most critical separation of duties in an information system is between computer operators, files, equipment, and production programs and programmers and systems analysts.

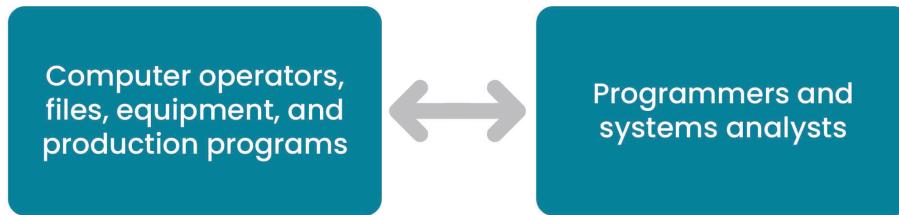


Figure 18-2

- Neither a computer operator nor a systems analyst should be allowed to perform programming duties.
- An operator should not have custody of files.

Changes to existing systems should be subject to the same strict controls. Requests for changes should be initiated by an end user and authorized by management or the steering committee.

- All changes should be made to a working copy of the program. Production code should never be directly alterable by a programmer.
- All changes should be adequately tested before being placed in production. The test results should be demonstrated for and accepted by the user who requested the change.
 - Adequate testing must involve the use of incorrect data. The program must be able to appropriately handle data that do not conform to the ideal.
- The changed program code should be stored in a secure library during testing and while awaiting migration into production.

Unauthorized program changes can be detected by code comparison. The version in use is compared electronically with an archived version known to be correct.

Physical Controls

Physical controls limit physical access and environmental damage to computer equipment and important documents.

Access Controls

Access controls prevent improper use or manipulation of data files and programs. They ensure that only those persons with a bona fide purpose and authorization have access.

- No persons except operators should be allowed unmonitored access to the processing facility.
This can be accomplished through the use of a guard desk, a keypad, or a magnetic card reader.

Passwords and identification numbers (for example, a PIN used for an ATM) prevent unauthorized access to files in an online system. Lists of authorized persons are maintained online. To avoid unauthorized access, the entity may combine

- The entry of passwords or identification numbers;
- A prearranged set of personal questions; and
- The use of badges, magnetic cards, optically scanned cards, or biometric attributes.

Device authorization tables grant access only to those physical devices that should logically need access. For example, because it is illogical for anyone to access the accounts receivable file from a manufacturing terminal, the device authorization table will deny access even when a valid password is used.

System access logs record all uses and attempted uses of the system. The date and time, codes used, mode of access, data involved, and interventions by operators are recorded.

Encryption encodes data before transmission over communication lines in order to make it more difficult for someone with access to the transmission to understand or modify its contents. Encryption technology converts data into a code.

- Unauthorized users may still be able to access the data but, without the encryption key, will be unable to decode the information.

A **callback** feature requires the remote user to call, give identification, hang up, and wait for a call to an authorized number. This control ensures acceptance of data only from authorized modems. However, a call-forwarding device may thwart this control by transferring access from an authorized to an unauthorized number.

Controlled disposal of documents enforces access restrictions by destroying data that are no longer in use. Paper documents may be shredded and magnetic media may be erased.

Biometric technologies are automated methods of establishing an individual's identity using physiological or behavioral traits. These characteristics include fingerprints, retina patterns, hand geometry, signature dynamics, speech, and keystroke dynamics.

Automatic log-off is the disconnection of inactive data terminals, which may prevent the viewing of sensitive data on an unattended work station.

An entity may hire security specialists. For example, the information security officer may be responsible for

- Developing an information security policy for the entity
- Commenting on security controls in new applications
- Monitoring and investigating unsuccessful access attempts

Environmental Controls

The processing facility should be equipped with both a cooling and heating system (to maintain a year-round constant level of temperature and humidity) and a fire suppression system.

Logical Controls

Logical controls grant system access only to authorized persons and only to the extent necessary to perform their job duties. For example, database access lists should be reconciled with current payroll lists.

Authentication is the act of ensuring that the person attempting to access the system is in fact who (s)he says (s)he is. The most widespread means of achieving this is through the use of IDs and passwords.

- Anyone attempting to access one of the organization's systems must supply a unique identifier (e.g., the person's name or other series of characters) and a password that is known only to that person and is not stored anywhere in the system in unencrypted format.
 - Not even information security personnel should be able to view unencrypted passwords. Security personnel can change passwords, but the policy should require that the user immediately change it to something secret.
- Password optimization includes the following:
 - Passwords should be difficult to guess. Ideally, passwords are at least eight characters long and contain both uppercase and lowercase letters as well as numerals.
 - A dialog can be designed to query the user for common names in his or her life (e.g., children, pets, sports teams) so that these words can be stored and never permitted by the system to be used as that person's password.
 - The system should force passwords to be changed periodically, e.g., every 90 days.
- Password fatigue results when users must log on to several systems in the course of a day. Users are likely to write down their IDs and passwords in such cases, defeating the purpose of automated authentication.
 - Single sign-on can be the solution in well-managed systems environments. A single ID and password combination is required to allow a user access to all IT resources (s)he needs. A high level of maintenance and security awareness is required to make single sign-on successful.
 - The policy should prohibit employees from leaving their IDs and passwords written down in plain view.

Authorization is the practice of ensuring that, once in the system, the user can only access those programs and data elements necessary to his or her job duties. In many cases, users should be able to view the contents of some data fields but not be able to change them.

- An example is an accounts receivable clerk who can view customers' credit limits but cannot change them. This same clerk can, however, change a customer's outstanding balance by entering or adjusting an invoice.
- To extend the example, only the head of the accounts receivable department should be able to execute the program that updates the accounts receivable master balance file. An individual clerk should have no such power.

Input, Processing, and Output Controls

Operations is the part of an information system involved in daily processing of data and distribution of results. Key controls apply to input, processing, and output. **Input controls** provide reasonable assurance that data submitted for processing are authorized, complete, and accurate. These controls vary depending on whether input is entered in online or batch mode.

Online input controls can be used when data are keyed into an input screen. The following are examples:

- **Edit (field) checks:** The data entry screen prevents certain types of incorrect data from entering the system. For example, the system rejects any attempt to enter numerals in the Name field or letters in the Amount field. Dropdown menus can restrict the user's choices to only valid selections.
- **Limit (reasonableness) checks:** Certain amounts can be restricted to appropriate ranges, such as hours worked < 20 per day, or invoices over \$100,000 requiring supervisor approval.
- **Check digits:** An algorithm is applied to any kind of serial identifier to derive a check digit. During data entry, the check digit is recomputed by the system to ensure proper entry. Requiring the full number including the check digit to be keyed in all future data entry operations eliminates the possibility of dropped or transposed digits, etc.
 - However, if the check digit is a sum-of-digits, transposition errors will not be detected because the sum of transposed digits will not change. For example, the sum of serial identifier "1, 3, 6" is the same as the sum of "3, 6, 1."

Batch input controls can be used when data are grouped for processing in "batches." The following are examples:

- **Management release:** A batch is not released for processing until a manager reviews and approves it.
- **Record count:** A batch is not released for processing unless the number of records in the batch, as reported by the system, matches the number calculated by the user.
- **Control total validation routines:** A batch is not released for processing unless the sum of the dollar amounts of the individual items as reported by the system matches the amount calculated by the user.
- **Hash total:** The arithmetic sum of a numeric field, which has no meaning by itself, can serve as a check that the same records that should have been processed were processed. An example is the sum of all Social Security numbers.
 - This number is much too unwieldy to be calculated by the user, but once it is calculated by the system, it can follow the batch through subsequent stages of processing.

Processing controls provide reasonable assurance that all data submitted for processing are processed and only approved data are processed. These controls are built into the application code by programmers during the systems development process. Some processing controls repeat the steps performed by the input controls, such as limit checks and control totals. Other examples include:

- **Validation:** Identifiers are matched against master files to determine existence. For example, any accounts payable transaction in which the vendor number does not match a number on the vendor master file is rejected. Limit checks and field checks are other examples of input validation routines.
- **Completeness:** Any record with missing data is rejected.
- **Arithmetic controls:** Cross-footing compares an amount to the sum of its components. Zero-balance checking adds the debits and credits in a transaction or batch to ensure they sum to zero.
- **Sequence check:** Computer effort is expended most efficiently when data are processed in a logical order, such as by customer number. This check ensures the batch is sorted in this order before processing begins. Thus, it is not appropriate in a real-time environment.
- **Run-to-run control totals:** The controls associated with a given batch are checked after each stage of processing to ensure all transactions have been processed.
- **Key integrity:** A record's "key" is the group of values in designated fields that uniquely identify the record. No application process should be able to alter the data in these key fields.
- **Transaction log:** The log keeps track of all transactions that occur and can be used to make sure all transactions are properly processed.

Output controls provide assurance that processing was complete and accurate. A complete audit trail should be generated by each process: batch number, time of submission, time of completion, number of records in batch, total dollars in batch, number of records rejected, total dollars rejected, etc.

- The audit trail is immediately submitted to a reasonableness check by the user, who is most qualified to judge the adequacy of processing and the proper treatment of erroneous transactions.
- Error listings report all transactions rejected by the system. These should be corrected and resubmitted by the user.

Storage Controls

Complete, up-to-date **program documentation** of all programs and associated operating procedures is necessary for efficient operation of an information system. Maintenance of programs is important to provide for continuity and consistency of data processing services to users.

By using dual write routines, data can be stored on two separate physical devices (usually magnetic hard drives) so that a mishap to one does not destroy the organization's data set.

- Especially important in this regard is the technology known as RAID (redundant array of independent discs), a data storage virtualization technology that combines multiple physical disk drive components into a single logical unit for the purposes of data redundancy, performance, or both.
- **Spooling** refers to sending data to an intermediate storage that is accessible by the peripheral device when needed. For example, print files are spooled to an intermediary storage for the printer to access when it is ready to print. This differs from a dual write routine in that data are spooled to a separate physical device to shorten processing time rather than for the purpose of data protection.

Other examples of storage controls are:

Validity checks: Hardware that transmits or receives data compares the bits in each byte to the permissible combinations to determine whether they constitute a valid structure.

Physical controls: Mounting hard drives in physically secure rooms and storing portable media in locked storage areas are vital to preventing the compromise of confidential data.

When utilizing **cloud computing**, organizations are relieved of the need to manage the storage of both applications and data because all the software and data they need are located on the Internet.

- Cloud computing is defined as a standardized IT capability (services, software, infrastructure) delivered via the Internet in a pay-per-use, self-service way.
- Advantages of cloud computing include lower infrastructure investments and maintenance costs, increased mobility, and lower personnel and utility costs.
- Disadvantages of cloud computing include less control than over an internal IT department, more difficulty ensuring data security and privacy, and less compatibility with existing tools and software.

18.3 Security Measures and Business Continuity Planning

Using the Internet carries inherent risk that the entity's systems, devices, and documents will be subjected to various types of attacks.

A **brute-force** attack uses password cracking software to try large numbers of letter and number combinations to access a network. A simple variation is the use of password cracking software that tries all the words in a dictionary.

Passwords also may be compromised by Trojan horses, IP spoofing, and packet sniffers.

- **Spoofing** is identity misrepresentation in cyberspace (e.g., using a false website to obtain visitor information).
- **Sniffing** is the use of software to eavesdrop on information sent by a user to the host computer or a website.

A **man-in-the-middle attack** takes advantage of network packet sniffing and routing and transport protocols. These attacks may be used to steal data, obtain access to the network during a rightful user's active session, analyze the traffic on the network to learn about its operations and users, insert new data or modify the data being transmitted, and deny service.

- Encryption is the effective response to man-in-the-middle attacks. The encrypted data will be useless to the attacker unless it can be decrypted.

A **denial-of-service** (DoS) attack is an attempt to overload an organization's network with so many messages that it cannot function (i.e., induce a system crash).

- A **distributed denial-of-service (DDoS)** attack comes from multiple sources, for example, the machines of several innocent parties infected by Trojan horses. When activated, these programs send messages to the target and leave the connection open.
- A DoS attack may establish as many network connections as possible to exclude other users, thus overloading primary memory or corrupting file systems.

Use of Data Encryption

Encryption technology converts data into a code. Unauthorized users may still be able to access the data, but without the encryption key, they cannot decode it. Encryption technology may be either hardware- or software-based. Two major types of encryption software exist: public-key and private-key.

Public-key, or asymmetric, encryption is the more secure of the two because it requires two keys: The public key for coding messages is widely known, but the private key for decoding messages is kept secret by the recipient.

- The parties who wish to transmit coded messages must use algorithmically-related pairs of public and private keys.
- The sender uses the recipient's public key, obtained from a directory, to encode the message, and transmits the message to the recipient. The recipient then uses the public key and the related private (secret) key to decode the message.
- Neither party knows the other's private key. The related public key and private key pair is issued by a certificate authority (a third-party fiduciary, e.g., VeriSign or Thawte). However, the private key is issued only to one party.

Private-key, or symmetric, encryption is less secure because it requires only a single key for each pair of parties that want to send each other coded messages.

Firewalls

A firewall is a combination of hardware and software that separates an internal network from an external network, such as the Internet, and prevents passage of traffic deemed suspicious. Two principal types of firewalls are network firewalls and application firewalls.

- Firewall systems ordinarily produce reports on organization-wide Internet use, exception reports for unusual usage patterns, and system penetration-attempt reports. These reports are very helpful as a method of continuous monitoring, or logging, of the system.

Network firewalls regulate traffic to an entire network, such as an organization's LAN.

- The firewall examines each query and, depending on the rules set up by the network security administrator, denies entry to the network based on the source, destination, or other data in the header.
- Queries from a particular source address that repeatedly fail to gain access to the network might indicate a penetration attempt. The firewall can notify network security personnel who can then investigate.

Application firewalls regulate traffic to a specified application, such as an email or file transfer application. An application firewall is based on proxy server technology. The firewall becomes a proxy, or intermediary, between the computer actually sending the packet and the application in question. This arrangement allows for a high level of security over the application but at the cost of slowing down communications.

- Since an application firewall only provides security for a single application, it is not a substitute for a network firewall.
- A firewall alone is not an adequate defense against computer viruses. Specialized antivirus software is also necessary.

Identifying Weaknesses

Vulnerability and penetration testing work in unison to identify computer system security weaknesses that require fixes. Vulnerability testing takes place first, then penetration testing occurs.

- **Vulnerability testing** (commonly referred to as vulnerability scanning) identifies weaknesses in the IT infrastructure (e.g., operating systems, outdated applications, missing patches, obsolete protocols and certificates, physical access, or open ports). Vulnerability testing provides information on
 - Targets for penetration testing
 - How to mitigate identified vulnerabilities
- **Penetration testing** involves using tools and techniques commonly used by hackers to gain access to an application, system, or network by circumventing its security features.
 - Generally, penetration tests focus on multiple vulnerabilities on one or more systems that can be used to gain more extensive access rather than focusing on only a single vulnerability.
 - Penetration testing determines
 - ▶ How well the system tolerates real-world-style attack patterns,
 - ▶ The experience level an attacker needs to successfully access the system,
 - ▶ The countermeasures required to protect against attacks, and
 - ▶ The ability to detect attacks and respond appropriately.

Routine Backup and Offsite Rotation

An organization's data is more valuable than its hardware. Hardware can be replaced for a price, but each organization's data bundle is unique and is indispensable to carrying on business. If it is ever destroyed, it cannot be replaced. For this reason, periodic backup and rotation are essential.

The offsite location must be temperature and humidity controlled and guarded against physical intrusion. Just as important, it must be geographically remote enough from the site of the organization's main operations that it would not be affected by the same natural disaster. It does the organization no good to have sound backup procedures if the files are not accessible or have been destroyed. An alternative is not to keep all files in one location.

A typical backup routine involves duplicating all data files and application programs once a month. (Application files must be backed up as well as data files because programs can change too.)

- Incremental changes, that is, only those data elements and programs that have changed since the last full monthly backup, are backed up every week and kept at the main processing center. (Transporting the weekly backups to the offsite location is generally not cost-effective.)

In case of an interruption of normal processing, the organization's systems can be restored such that, at most, 3 weeks of business information is lost. This is not an ideal situation, but it is preferable to a complete loss of a company's files, which could essentially put it out of business.

Business Continuity Planning

A comprehensive computer security plan should be developed to provide reasonable assurance of safeguarding physical facilities and hardware and the privacy and integrity of data. Such a plan assists management in ensuring that benefits exceed costs.

Because absolute assurance of computer security cannot be provided, continuity (disaster) planning is necessary.

- Disaster recovery is the process of resuming normal information processing operations after the occurrence of a major interruption.
- Business continuity planning is the continuation of business by other means during the period in which computer processing is unavailable or less than normal.

Two major types of disasters must be planned for: those in which the data center is physically available and those in which it is not.

- Disasters in which the data center is physically available include power failures; random intrusions, such as viruses; and deliberate intrusions, such as hacking incidents. The organization's physical facilities are sound, but immediate action is required to keep normal processing going.
- Disasters in which the data center is not physically available are much more serious and necessitate the existence of an alternate processing facility. Examples include floods, fires, hurricanes, earthquakes, etc.

Dealing with Specific Types of Disasters

Power failures can be guarded against by the purchase of backup electrical generators.

- These can be programmed to automatically begin running as soon as a dip in the level of electric current is detected.
- This is a widespread practice in settings such as hospitals where 24-hour system availability is crucial.

Attacks such as viruses and denials-of-service call for a completely different response.

- The system must be brought down “gracefully” to halt the spread of the infection. The IT staff must be well trained in the nature of the latest virus threats to know how to isolate the damage and bring the system back to full operation.
- Antivirus software will stop most attacks. But this software may not detect certain viruses. One sign that a virus has infected a computer is that a program takes longer than usual to load or execute.

The most extreme disaster happens when the organization's main facility becomes uninhabitable because of flood, fire, earthquake, etc. It is to prepare for these cases that organizations contract for alternate processing facilities. The disaster recovery plan should include instructions for appointing a recovery team when a disaster occurs.

- An alternate processing facility is a physical location maintained by an outside contractor for the express purpose of providing processing facilities for customers in case of disaster.
- The recovery center, like the offsite storage location for backup files, must be far enough away that it will likely be unaffected by the same natural disaster that forced the abandonment of the main facility. Usually, companies contract for backup facilities in another city.
- Once the determination is made that processing is no longer possible at the principal site, the backup files are retrieved from the secure storage location and taken to the recovery center. The first step in restoration is to set up the operating system.

Recovery centers can take many forms. Organizations determine which facility is best by calculating the tradeoff between the cost of the contract and the cost of downtime.

- A **hot site** is a fully operational processing facility that is immediately available. A flying-start site is a hot site with the latest data and software that permit startup within a few minutes or even a few seconds.
 - A **mirrored data center** is a type of hot site that runs parallel to a company's main operations center. The primary center makes automatic backups to a geographically remote data storage facility, and special software instantly copies information from the primary data center to the secondary data center. Thus, the secondary data center can immediately take the place of the primary data center when needed, and there is no downtime.
- A **warm site** is a facility with limited hardware, such as communications and networking equipment, already installed but lacking the necessary servers and client terminals.
- A **cold site** is a shell facility lacking most infrastructure but readily available for the quick installation of hardware.

Study Unit Nineteen

Information Systems and Data Governance

19.1	<i>Accounting Information Systems</i>	2
19.2	<i>Data Governance and the Data Life Cycle</i>	7
19.3	<i>COSO Framework -- Internal Control for Data Governance</i>	12

This study unit is the **first of two on technology and analytics**. The relative weight assigned to this major topic in Part 1 of the exam is **15%**. The two study units are

- **Study Unit 19: Information Systems and Data Governance**
- Study Unit 20: Systems Development and Data Analytics

This study unit discusses information systems and data governance. Topics covered in this study unit include

- Data warehouses and data marts
- Enterprise performance management (EPM)
- The data life cycle
- Record retention policies



Author's Note

Data analytics, sometimes called analysis of **big data**, is a growing phenomenon in accounting. Big data refers to sets of data that are too large to be evaluated by traditional means of analysis. Thus, different software is needed than what is commonly used by managerial accountants and auditors. The challenges of big data include how to capture the data, how to store it, how to analyze it, and how to visualize what has been analyzed. A prerequisite to working with big data is a working knowledge of accounting information systems.

The area of technology and analytics was recently added to the CMA exam, and candidates will be expected to know everything from definitions to how to interpret analytical cases. Study Units 19 and 20 have been carefully developed to break down these concepts in an easy-to-understand manner.

19.1 Accounting Information Systems

A management information system (MIS) typically receives input from a transaction processing system, aggregates it, then reports it in a format useful to middle management in running the business. An information system is an essential part of a company's value chain. For this reason, MISs are often classified by function or activity, such as the following:

- Accounting: general ledger, accounts receivable, purchasing and accounts payable, payroll processing, fixed asset management, and tax accounting.
- Finance: capital budgeting, operational budgeting, and cash management.
- Manufacturing: production planning, cost control, and quality control.
- Logistics: inventory management and transportation planning.
- Marketing: sales analysis and forecasting.
- Human resources: projecting payroll, projecting benefits obligations, employment-level planning, and employee evaluation tracking.

These single-function systems, often called stovepipe systems because of their limited focus, are gradually being replaced by integrated systems that link multiple business activities across the enterprise. The most comprehensive integrated system is termed an enterprise resource planning (ERP) system.

An accounting information system (AIS) is a subsystem of an MIS that processes routine, highly structured financial and transaction data relevant to financial as well as managerial accounting. An AIS is composed of the **general ledger/financial reporting system (GL/FRS)**, **management reporting system (MRS)**, and **transaction processing system (TPS)**.

The **GL/FRS** is concerned with transactions with external parties (e.g., customers, suppliers, governments, owners, and creditors) reflected in financial statements prepared in conformity with GAAP. The GL/FRS typically produces the income statement, balance sheet, statement of cash flow, and other reports required by management.

The **MRS** provides information useful to decision making and internal management, including the internal activities recorded in the cost accounting system and the preparation of related reports and analysis. The MRS typically produces production reports, pro forma financial statements, budgets, cost-volume-profit analysis, and other internal reports.

The **TPS** is a system that performs the routine transactions necessary to conduct business. A transaction is a single discrete event that can be stored in an information system. Each transaction must succeed or fail as a complete unit; it can never be only partially complete. Transaction processing is designed to maintain a system's integrity.

Accounting Cycles

The accounting process can be described in terms of five cycles:

1. Sales to customers on credit and recognition of receivables
 2. Collection of cash from customer receivables
 3. Purchases on credit and recognition of payables
 4. Payment (disbursement) of cash to satisfy trade payables (includes both expense and capitalized transactions)
 5. Payment of employees for work performed and allocation of costs
-

Data, Databases, and Database Management System (DBMS)

A **database** is an organized collection of data in a computer system. Data in the database are integrated to eliminate redundancy of data items. A single integrated system allows for improved data accessibility.

When systems within the organization are not integrated, they not only may contain different data but also may define and update data in inconsistent ways. Thus, determining the location of data and ensuring their consistency are more difficult.

A DBMS is an integrated set of computer programs that

- Create the database
- Maintain the elements
- Safeguard the data from loss or destruction
- Make the data available to applications, programs, and inquiries

The DBMS allows programmers and designers to work independently of the technical structure of the database. DBMSs provide a common language for referring to databases, easing the design and coding of application programs.

- A DBMS includes security features. Thus, a specified user's access may be limited to certain data fields or logical views depending on the individual's assigned duties.
- The term "database" often includes the DBMS.

Databases and the associated DBMSs permit efficient storage and retrieval of data for formal system applications. They also permit increased access to data (e.g., to answer inquiries for data not contained in formal system outputs) as well as updating of files by transaction processing. These increased capabilities, however, result in increased cost because they require

- The use of sophisticated hardware (direct-access devices)
- Sophisticated software (the DBMS)
- Highly trained technical personnel (database administrator, staff)
- Increased security controls

Database Structure

Storing all related data on one storage device creates security problems. Should hardware or software malfunctions occur, or unauthorized access be achieved, the results could be disastrous. Greater emphasis on security is required to provide backup and restrict access to the database.

Relational Database Structure

A relational structure organizes data in a conceptual arrangement. An individual data item is called a field or column (e.g., name, date, amount).

- Related fields are brought together in a record or row (e.g., for a single sales transaction).
- Multiple records make up a file or table (e.g., sales).
- Tables can be joined or linked based on common fields rather than on high-overhead pointers or linked lists as in other database structures.
- Every record in a table has a field (or group of fields) designated as the key. The value (or combination of values) in the key uniquely identifies each record.
- Structured data file types are generally maintained by Structured Query Language (SQL). Files of this type are used for managing relational databases and performing various operations on the data in them.

The tremendous advantage of a relational data structure is that searching for records is greatly facilitated. For example, a user can specify a customer and see all the parts that customer has ordered, or the user can specify a part and see all the customers who have ordered it. Such queries were extremely resource-intensive, if not impossible, under older data structures.

A **distributed database** is stored in two or more physical sites using either replication or partitioning.

Additional Terminology

The **database administrator (DBA)** is the individual who has overall responsibility for developing and maintaining the database and for establishing controls to protect its integrity. Thus, only the DBA should be able to update data dictionaries. In small systems, the DBA may perform some functions of a DBMS. In larger applications, the DBA uses a DBMS as a primary tool.

- The responsibility for creating, maintaining, securing, restricting access to, and redefining and restructuring the database belongs to the DBA.

The **data dictionary** is a file that describes both the physical and logical characteristics of every data element in a database.

- The data dictionary includes, for example, the name of the data element (e.g., employee name, part number), the amount of disk space required to store the data element (in bytes), and what kind of data is allowed in the data element (e.g., alphabetic, numeric).
- The data dictionary contains the size, format, usage, meaning, and ownership of every data element. This greatly simplifies the programming process.

Data from a relational database can be displayed in graphs and reports, changed, and otherwise controlled using a program called **Query Management Facility (QMF)**.

An **object-oriented database** is a response to the need to store not only numbers and characters but also graphics and multimedia applications.

- Translating these data into tables and rows is difficult. However, in an object-oriented database, they can be stored, along with the procedures acting on them, within an object.

Advanced database systems provide for **online analytical processing (OLAP)**, also called multidimensional data analysis, which is the ability to analyze large amounts of data from numerous perspectives. OLAP is an integral part of the data warehouse concept.

- Using OLAP, users can compare data in many dimensions, such as sales by product, sales by geography, and sales by salesperson.

A **data warehouse** contains not only current operating data but also historical information from throughout the organization. Thus, data from all operational systems are integrated, consolidated, and standardized in an organization-wide database into which data are copied periodically. These data are maintained on one platform and can be read but not changed.

Data cleansing cleans up data in a database that is incorrect, incomplete, or duplicated before loading it into the database. It improves the quality of data. The need for data cleansing increases when multiple data sources are integrated.

Data mining, which is covered in Study Unit 20, Subunit 2, is the process of analyzing data from different perspectives and summarizing it into useful information. Data mining is facilitated by a data warehouse and ordinarily uses data mining software.

- For example, data mining software can help find abnormal patterns and unforeseen correlations among the data.

A **data mart** is a subset of the data warehouse that can be tailored to user data requirements. Because data marts are developed for specific groups of users, they are often created for individual business lines or departments.

Enterprise performance management (EPM) (also known as corporate performance management or business performance management) is enterprise software that helps organizations link their strategies to their plans and execution. EPM is associated with

- Business intelligence and enterprise resource planning (ERP is a subset of EPM and is covered in Study Unit 10, Subunit 2.)
- Budgeting and forecasting
- Financial reporting
- Analyzing performance results and identifying ways to improve
- Modeling and predictive analytics

19.2 Data Governance and the Data Life Cycle

Organizations need to be aware of the unique risks associated with a computer-based business information system. IT security (or **cybersecurity**) is information security applied to computer hardware, software, and computer networks. Safe computing can be achieved by using carefully crafted policies and procedures in conjunction with antivirus and access control software.

The most comprehensive indicator of an information system's compliance with prescribed procedures is the control the system has over the data. This includes the capacity and complexity of the system, as well as the accessibility of the data to the end-user.

System Availability

The ability to make use of any computer-based system is dependent on

- An uninterrupted flow of electricity
- Protection of computer hardware from environmental hazards (e.g., fire and water)
- Protection of software and data files from unauthorized alteration
- Preservation of functioning communications channels between devices

Risks to Data

Volatile Transaction Trails

In any computer-based environment, a complete trail useful for audit purposes might exist for only a short time or in only computer-readable form. In online and real-time systems, data are entered directly into the computer, eliminating portions of the audit trail traditionally provided by source documents.

Decreased Human Involvement

Because employees who enter transactions may never see the final results, the potential for detecting errors is reduced. Also, output from a computer system often carries a mystique of infallibility, reducing the incentive of system users to closely examine reports and transaction logs.

Uniform Processing of Transactions

Computer processing uniformly subjects like transactions to the same processing instructions, thereby virtually eliminating clerical error. It permits consistent application of predefined business rules and the performance of complex calculations in high volume.

- However, programming errors (or other similar systematic errors in either the hardware or software) will result in all like transactions being processed incorrectly.

Unauthorized Access

When accounting records were kept in pen-and-ink format, physical access to them was the only way to carry out an alteration. Once they are computer-based, however, access may be gained by parties both internal and external to the organization.

- Security measures, such as firewalls and user ID-and-password combinations, are vital to maintaining security over data in an automated environment.

Data Vulnerability

Destruction of hardware devices or units of storage media could have disastrous consequences if they contain the only copies of crucial data files or application programs. For this reason, it is vital that an organization's computer files be duplicated and stored offsite periodically.

Reduced Segregation of Duties

Many functions once performed by separate individuals may be combined in an automated environment. Receiving cash, issuing a receipt to the payor, preparing the deposit slip, and preparing the journal entry may once have been performed by separate individuals.

- In a computer-based system, the receipt, deposit slip, and journal entry may be automatically generated by the computer. If the same employee who receives the cash is also responsible for entering the relevant data into the system, the potential for fraud or error is increased.

Reduced Individual Authorization of Transactions

Certain transactions may be initiated automatically by a computer-based system. This is becoming more widespread as an increasing number of business processes become automated.

- For example, an enterprise resource planning system at a manufacturing concern may automatically generate a purchase order when raw materials inventory drops to a certain level. If the company shares an EDI system with the vendor, the purchase order may be sent to the vendor electronically without any human intervention.

This reduced level of oversight for individual transactions requires careful coding to ensure that computer programs accurately reflect management's goals for business processes. Independent verification of transactions is an important compensating control in the absence of segregation of duties and reduced individual authorization. A third party performs the verification to ensure that the transactions were appropriately processed.

Malicious Software (Malware)

Malware is a term describing any program code that enters a computer system that has the potential to degrade that system. Common forms of malware are discussed in Study Unit 18, Subunit 2.

IT Governance Focus Areas

IT governance has several focus areas:

- **Strategic alignment** is dedicated to ensuring the linkage of business plans with IT plans while defining, maintaining, and validating the IT value proposition. Furthermore, IT operations must be aligned with enterprise operations.
- **Value delivery** is concerned with implementing the value proposition throughout the delivery cycle. It ensures that IT delivers the promised benefits, while concentrating on optimizing costs and proving the intrinsic value of IT.
- **Resource management** deals with the optimal investment in, and the proper management of, critical IT resources.
- **IT risk** is the risk associated with the use, ownership, operation, involvement, influence, and adaption of IT within an organization.
- **Risk management** includes risk awareness by senior management, knowledge of compliance requirements, transparency about risks to the organization, and embedding risk management responsibilities into the entity's structure.
 - Establishing and maintaining controls are management functions. These are not under the purview of stockholders, the internal auditors, or the IT department (although internal auditors may evaluate the systems of internal controls).
- **Performance measurement** tracks and monitors the entire process, including strategy implementation, the completion of projects, resource usage and cost measures, process performance, and service delivery.

Data Life Cycle

A life cycle consists of phases, and each phase has its own characteristics. The following are seven phases of the data life cycle.

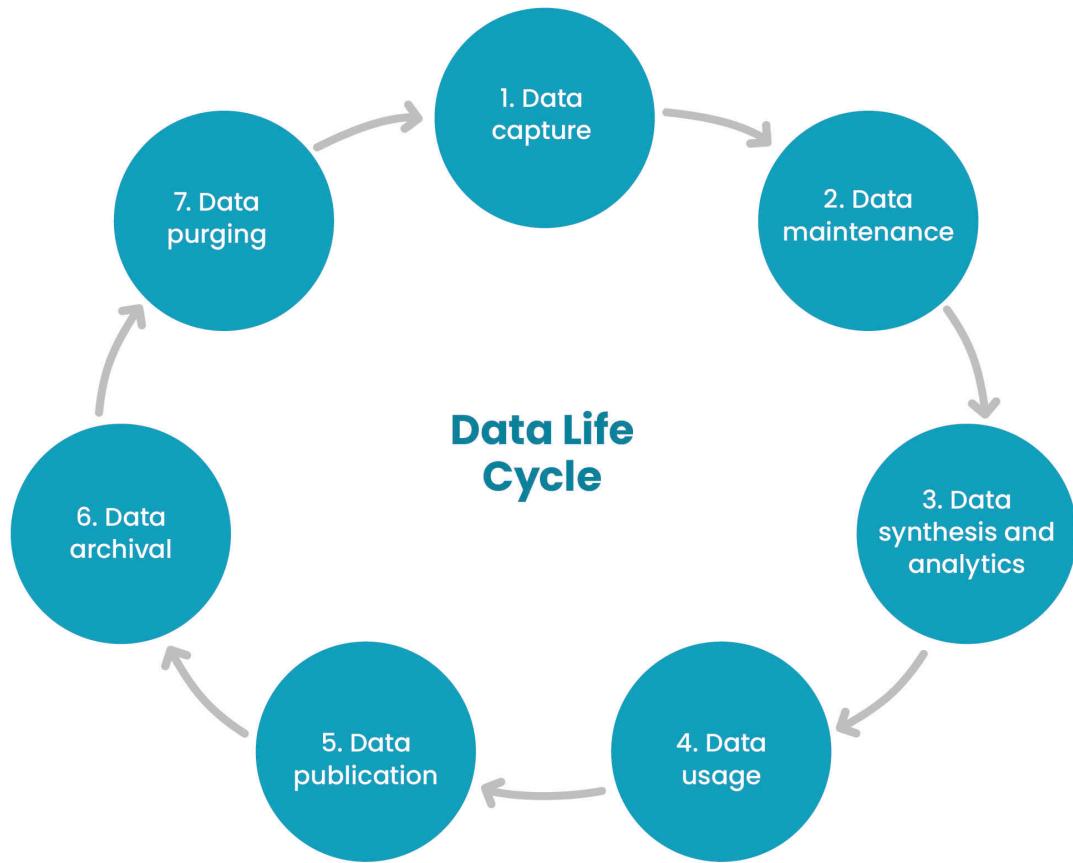


Figure 19-1

1. **Data capture** is the act of creating information that does not yet exist within the organization. The primary ways in which data can be captured include
 - **Utilizing data.** The organization obtains already existing data outside the organization, for example, it may buy or otherwise acquire data from an outside entity.
 - **Data entry.** New data values can be created within the organization.
 - **Signal reception.** The organization acquires data that has already been created by control systems within the organization.
2. **Data maintenance** supplies captured data to the points at which data synthesis and data usage occur. Data maintenance involves processing the data without deriving any value from it for the enterprise. It often involves cleansing and enrichment of the data.
3. **Data synthesis and analytics** is the creation of data values by using inductive logic. It typically involves using other data as inputs.
 - Analytics uses modeling, such as risk modeling, actuarial modeling, and modeling for investment decisions.

4. **Data usage** is the application of data to tasks the enterprise needs to run and manage itself. This typically includes activities outside the regular data life cycle.
 - Data usage may have data governance challenges. For example, is it legal to use the data in the ways management wants to use it? There may be regulatory or contractual constraints on how data may be used. The role of data governance is to ensure that legalities are observed.
5. **Data publication** refers to the sending of data to a location outside the organization, for example, in monthly statements to customers.
6. **Data archival** involves copying data that are no longer useful to a storage location in case the data are ever needed again.
 - Obsolete data are removed from active environments and stored in an archive, a location where data receive no regular maintenance and little usage.
7. **Data purging** involves removing every copy of a data item from the enterprise at the end of the data life cycle. This is typically done from the archive. This phase may pose a data governance challenge because disposing of all copies of data and proving that a full purge has actually occurred are often difficult.

Record Retention Policy

It is important for every organization to have a formal record retention policy (sometimes referred to as a records management policy), which provides for the retention and periodic destruction of documents and other records.

Keeping and maintaining too many records, or storing them longer than needed, can create unneeded costs for an organization.

- For example, if a company becomes involved in a legal dispute, the task of going through a voluminous amount of records to produce relevant material can become an enormous and costly challenge. However, that same legal dispute may be based on old records, so there is a fine balance between keeping records too long and not keeping them long enough.

For some types of documents, there are minimum retention periods imposed by law, such as those related to taxes and employees, and certain industries may be governed further by particular regulations. Even the minimum legal retention periods sometimes have uncertain descriptions.

- For example, tax records must be kept at least 7 years, unless fraud is suspected, in which case, there is no minimum. Thus, it is sometimes better to keep tax records longer than the minimum period in case the taxpayer needs to prove lack of fraud at some unforeseen point in the future.

If the records needed for a particular legal case have been destroyed pursuant to a well-established records retention policy that is routinely complied with, often the courts may assume the organization complied with its duty.

19.3 COSO Framework -- Internal Control for Data Governance



Success Tip

COSO requirements are covered in Study Unit 17, Subunit 2, with more detailed coverage of internal controls. However, the COSO material on data governance is highlighted in the section of the CMA exam testing data analytics. Thus, candidates should develop a thorough understanding of the COSO framework. Review the COSO coverage in Study Unit 17, Subunit 2, before continuing this study unit.

Effective corporate governance relies heavily on effective systems of internal control and enterprise risk management. The Committee of Sponsoring Organizations of the Treadway Commission (COSO) has established a widely accepted framework for each system.

- Although the COSO *Internal Control – Integrated Framework* is widely accepted as the standard for the design and operation of internal control systems, regulatory or legal requirements may specify another control framework or design.
- The COSO framework consists primarily of a definition of internal control, categories of objectives, components and related principles, and requirements of an effective system of internal control.

Relationship of Objectives, Components, and Organizational Structure

Recall from Study Unit 17, Subunit 2, that the five components of an internal control system are:

- Control environment
- Risk assessment
- Control activities
- Information and communication
- Monitoring

The COSO model may be represented by a cube with rows, slices, and columns. The rows are the five components, the slices are the three objectives, and the columns are an entity's organizational structure.

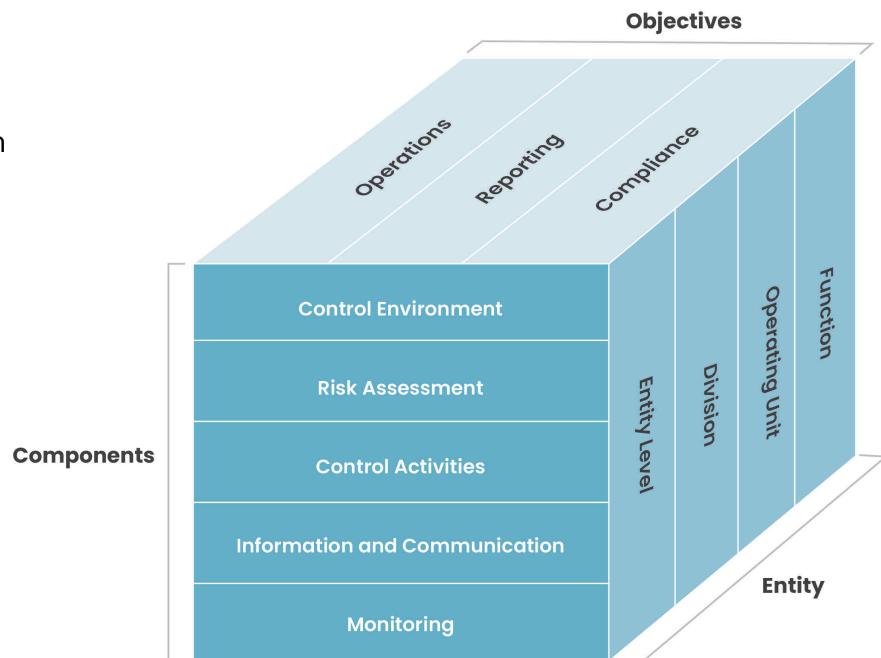


Figure 19-2

Requirements for Effective Internal Control

A system of internal control is effective if it provides **reasonable assurance** of achieving an entity's objectives relating to operations, reporting, and compliance. Such a system reduces the risk(s) of not achieving those objectives to an **acceptable level**.

An effective system of internal control requires that each of the five components of internal control, and relevant principles, is present and functioning.

- **Present** refers to whether the components and relevant principles exist in the design and implementation of the system of internal control.
 - **Functioning** refers to whether the components and relevant principles continue to exist in the operation of the system of internal control.
 - The five components should operate together in an integrated manner. **Operating together** refers to whether all five components collectively reduce the risk of not achieving an objective to an acceptable level.
-

Other Considerations

The use of **judgment** is required in designing, implementing, and conducting internal control and assessing its effectiveness.

The use of **outsourced service providers** for certain business processes does not relieve the organization of its responsibility for the system of internal control.

Although **technology innovation** creates opportunities and risks, the principles in the COSO framework do not change.

The **organization's size** may affect how it implements internal control.

- Senior management of smaller organizations typically have a wider span of control and greater direct interaction with personnel than senior management of larger organizations. Larger organizations may need to rely on more formal mechanisms of control (e.g., written reports, formal meetings, or conference calls).
- Larger organizations have more resources than smaller organizations. Consequently, a smaller organization may have to outsource all, or parts, of its internal audit function or incur higher costs relative to larger organizations because of the lack of economies of scale.

Roles and Responsibilities Regarding Internal Control

Everyone in the organization is expected to competently perform his or her appropriate control activities and inform those higher in the organization about ineffective control.

Senior management sets the **tone at the top** and has primary responsibility for establishing proper ethical culture. Senior management sets objectives and has **overall responsibility** for designing, implementing, and operating an effective system of internal control. These responsibilities include

- Maintaining oversight and control over the entity's risks
 - Guiding the development and performance of control activities at the entity level
 - Assigning responsibility for establishing more specific internal controls at the different levels of the entity
 - Communicating expectations
 - Evaluating control deficiencies
-

Limitations

Internal control only provides **reasonable assurance** of achieving objectives. It cannot provide absolute assurance because any system of internal control has the following **inherent limitations**:

- Established objectives must be **suitable** for internal control.
 - For example, if an entity establishes unrealistic objectives, the system of internal controls will be ineffective.
- Human **judgment** is faulty, and controls may fail because of simple errors or mistakes.
- Controls may fail due to **breakdowns** (e.g., employee misunderstanding, carelessness, or fatigue).
- **Management** may inappropriately **override** internal controls, e.g., to fraudulently achieve revenue projections or hide liabilities.
- Manual or automated controls can be circumvented by **collusion**.
- **External events** are beyond an organization's control.

Study Unit Twenty

Systems Development and Data Analytics

20.1	<i>Technology-Enabled Finance Transformation</i>	2
20.2	<i>Analytics and Big Data</i>	11

This study unit is the **second of two** on **technology and analytics**. The relative weight assigned to this major topic in Part 1 of the exam is **15%**. The two study units are

- Study Unit 19: Information Systems and Data Governance
- **Study Unit 20: Systems Development and Data Analytics**

This study unit discusses technology-enabled finance transformation and data analytics concepts tested on the CMA exam. Topics covered in this study unit include

- Systems development life cycle (SDLC)
- Robotic process automation (RPA)
- Artificial intelligence
- Cloud computing
- Big data
- The 4 Vs
- Business intelligence
- Data mining
- Analytics tools
- Data visualization

20.1 Technology-Enabled Finance Transformation

Systems Development Life Cycle (SDLC)

The SDLC approach is the traditional methodology applied to the development of large, highly structured application systems. A major advantage of the life-cycle approach is enhanced management and control of the development process. SDLC consists of the following:

- **Systems strategy** requires understanding the organization's needs.
- **Project initiation** is the process by which systems proposals are assessed.
- **In-house development** is generally chosen for unique information needs.
- **Commercial packages** are generally chosen for common needs rather than developing a new system from scratch.
- **Maintenance and support** involves ensuring the system accommodates changing user needs.

The **phases and component steps of a traditional SDLC** are described on the following pages.

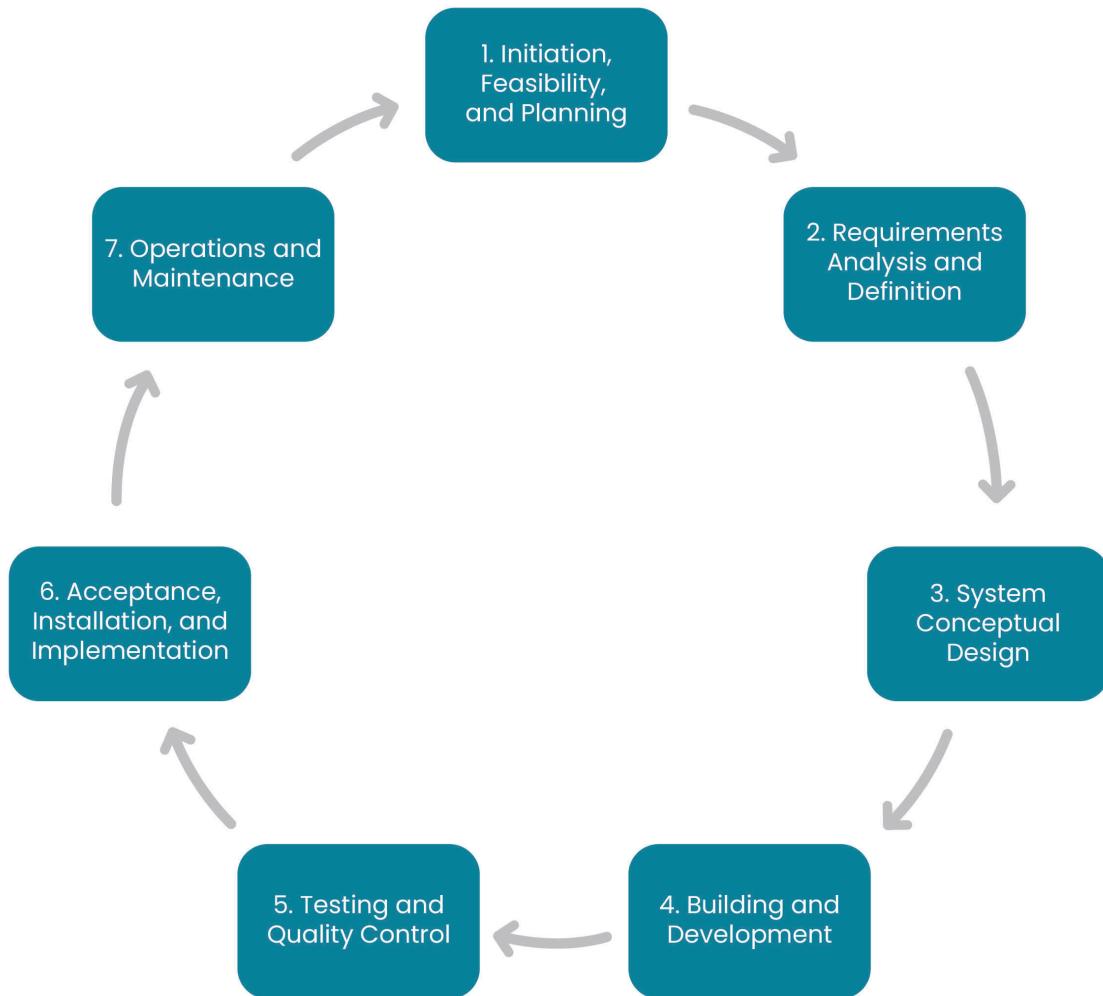


Figure 20-1

Phase 1 – Initiation, Feasibility, and Planning

The SDLC begins by recognizing there is a need for a new system, gaining an understanding of the situation to determine whether it is feasible to create a solution, and formulating a plan.

Phase 2 – Requirements Analysis and Definition

A formal proposal for a new system is submitted to the IT steering committee, describing the need for the application and the business function(s) that it will affect. Feasibility studies are conducted to determine

- What technology the new system will require
- What economic resources must be committed to the new system
- How the new system will affect current operations

Once reviewed, the steering committee gives its go-ahead for the project.

Phase 3 – System Conceptual Design

Logical design consists of mapping the flow and storage of the data elements that will be used by the new system and the new program modules that will constitute the new system.

- Data flow diagrams, system interface diagrams, and structured flowcharts are commonly used.
- Some data elements may already be stored in existing databases. Good logical design ensures that they are not duplicated.

Physical design involves planning the specific interactions of the new program code and data elements with the hardware platform (existing or planned for purchase) on which the new system will operate.

Phase 4 – Building and Development

The actual program code and database structures that will be used in the new system are written. Hardware is acquired, and physical infrastructure is assembled.

Phase 5 – Testing and Quality Control

Testing is performed during system development with the intent of identifying errors or other defects. The job of testing is an iterative process because when one error is corrected, it can illuminate other errors or even create new ones. Testing determines whether the system

- Meets the requirements that guided its design and development
- Responds correctly to all kinds of inputs
- Performs its functions within an acceptable time
- Achieves the general result its stakeholders desire

Although the number of possible tests to apply is almost limitless, developers cannot test everything. All testing uses strategy to select tests that are feasible for the available time and resources.

Acceptance testing is conducted to determine whether the system meets the organization's needs and is ready for release.

Phase 6 – Acceptance, Installation, and Implementation

User acceptance testing is the final step before placing the system in live operation. IT must demonstrate to the users who submitted the original request that the system performs the desired functions. Once the users are satisfied with the new system, they acknowledge formal acceptance and implementation begins.

Four strategies for converting to the new system can be used.

1. With **parallel** operation, the old and new systems both run at full capacity for a given period. This strategy is the safest because the old system is still producing output (in case there are major problems with the new system), but it is also the most expensive and time-consuming.
2. With **direct changeover** (direct cutover) conversion, the old system is shut down and the new one takes over processing at once. This is the least expensive and time-consuming strategy, but it is also the riskiest because the new system cannot be reverted to the original.
3. Under **pilot** conversion, one branch, department, or division at a time is fully converted to the new system. Experience gained from each installation is used to benefit the next one. One disadvantage of this strategy is extension of the conversion time.
4. In some cases, **phased** conversion is possible. Under this strategy, one function of the new system at a time is placed in operation.
 - For instance, if the new system is an integrated accounting application, accounts receivable could be installed, then accounts payable, cash management, materials handling, etc.
 - The advantage of this strategy is that the users are able to learn one part of the system at a time.

Training and documentation are critical in this stage of the SDLC.

- The users must feel comfortable with the new system and have plenty of guidance available, either in hard copy or online.
- Documentation consists of more than just operations manuals for the users. Layouts of the program code and database structures must also be available for the programmers who must modify and maintain the system.

Phase 7 – Operations and Maintenance

After a system becomes operational, it should be monitored to ensure ongoing performance and continuous improvement. Systems follow-up or post-audit evaluation is a subsequent review of the efficiency and effectiveness of the system after it has operated for a substantial time (e.g., 1 year).

Business Process Analysis and Design

The organizational needs assessment is a detailed process of study and evaluation of how information systems can be deployed to help the organization meet its goals. The four steps in the assessment are as follows:

1. Determine whether current systems support organizational goals.
2. Determine the needs unmet by current systems.
3. Determine the capacity of current systems to accommodate projected growth.
4. Propose a path for information systems deployment to achieve organizational goals within budgetary constraints.

A business process is a flow of actions performed on goods and/or information to accomplish a discrete objective.

- Examples include hiring a new employee, recruiting a new customer, and filling a customer order.

Some business processes are contained entirely within a single functional area; e.g., hiring a new employee is performed by the human resources function. Other processes cross functional boundaries. Filling a customer order requires the participation of the sales department, the warehouse, and accounts receivable.

The automation of a process, or the acquisition of an integrated system, presents the organization with an opportunity for business process reengineering. **Business process reengineering** involves a complete rethinking of how business functions are performed to provide value to customers, that is, radical innovation instead of mere improvement and a disregard for current jobs, hierarchies, and reporting relationships.

Robotic Process Automation (RPA)

RPA is a form of machine learning technology that enables a computer to acquire knowledge and mimic the actions of the person(s) using it to perform a task. RPA systems capture data through a graphical interface and process the data used for repetitive tasks.

Benefits of RPA include, but are not limited to, the following:

- ✓ Robots can perform continuously without needing to take time off.
- ✓ It eliminates the element of human error and improves efficiency (subsequent to successful programming and implementation).
- ✓ Although initial implementation requires capital investment, long-term costs associated with RPA are considerably lower than labor costs.

Artificial Intelligence (AI)

AI is computer software designed to perceive, reason, and understand.

- Historically, computer software works through a series of if/then conditions in which every operation has exactly two possible outcomes (yes/no, on/off, true/false, one/zero).
- Human reasoning, on the other hand, is extremely complex, based on deduction, induction, intuition, emotion, and biochemistry, resulting in a range of possible outcomes.

AI attempts to imitate human decision making, which hinges on this combination of knowledge and intuition (i.e., remembering relationships between variables based on experience).

The advantages of AI in a business environment are that IT systems

- ✓ Can work 24 hours a day
- ✓ Will not become ill, die, or be hired away
- ✓ Are extremely fast processors of data, especially if numerous rules (procedures) must be evaluated

There are several types of AI:

- **Neural networks** are a collection of processing elements working together to process information much like the human brain, including learning from previous situations and generalizing concepts.
- **Case-based reasoning systems** use a process similar to that used by humans to learn from previous, similar experiences.
- **Rule-based expert systems** function on the basis of set rules to arrive at an answer. These cannot be changed by the system itself. They must be changed by an outside source (i.e., the computer programmer).
- **Intelligent agents** are programs that apply a built-in or learned knowledge base to execute a specific, repetitive, and predictable task, for example, showing a computer user how to perform a task or searching websites for particular financial information.
- An **expert system** is an interactive system that attempts to imitate the reasoning of a human expert in a given field. It is useful for addressing unstructured problems when there is a local shortage of human experts.

The following are ways AI can be utilized to improve the efficiency and effectiveness of processing accounting data:

- ✓ Automating data entry and analysis
 - Information obtained from document images (e.g., expense reports, vendor invoices, customer payments, etc.) is automatically assigned to applicable accounting general ledger accounts.
 - By continuously repeating the data entry process, the computer eventually learns to identify variances and anomalies; thus, corrections can be made earlier and the integrity of accounting reports is strengthened.
- ✓ Reducing fraud
 - Generally, auditors are capable of reviewing only a small fraction of disbursement documents (e.g., vendor invoices, contract payments, employee expense reports, etc.) manually, whereas AI has the capability of reviewing the entire population of documents. Because AI has the capability to learn by analyzing vast amounts of data, it is more efficient and effective at identifying fraud.
- ✓ Strengthening expenditure disbursement policies
 - The entire population of scanned disbursement documentation, such as purchase requisitions and purchase orders, vendor invoices, credit card activity, and employee expense reports (including supporting documents), can be analyzed to identify disbursements not in compliance with policy.

Cloud Computing

Cloud computing (“the cloud”) is a popular term relating to on-demand access to resources that are accessed on the Internet and shared by others.

- Advantages of using cloud computing include fast access to software, a reduced need for investment in IT infrastructure, and the ability to use “pay as you go” services.
- IT security in the cloud is potentially more difficult due to the convenience and ease of access to sensitive data provided by cloud computing services.

There are three primary categories of cloud services:

1. Infrastructure-as-a-Service (IaaS)

2. Platform-as-a-Service (PaaS)

- PaaS is a form of cloud computing wherein a third-party provides both hardware and software tools. These tools are typically for application development.

3. Software-as-a-Service (SaaS)

- SaaS is a software distribution model in which customers can subscribe to web-based applications. An example is a cloud storage service like Dropbox, which enables customers to store, share, and synchronize files across devices.
- Benefits of SaaS include
 - ✓ Users do not have to buy, maintain, support, or update as much computer hardware or software. SaaS products are maintained and updated by the third-party host.
 - ✓ Users can subscribe for only the amount of time the service is needed.
 - ✓ Users can choose only the basic service or add select features.
 - ✓ Users can access the software from anywhere, allowing for work at home or on site with the client.
- SaaS can also have disadvantages.
 - ✗ Users must rely on outsiders to keep the software running and maintain a secure environment for the company's data.
 - ✗ Providers can have service disruptions or experience a security breach, the latter of which can release the user's data to a fraud perpetrator.

Cloud computing has benefited from the rise of smartphones and tablets. Because these devices have limited memory, personal data (e.g., pictures, contacts, etc.) may be stored on the cloud to be retrieved later so that available memory can be used for application software.

- Generally, smart machine technology characteristics include, but are not limited to
 - Learning and operating on their own
 - Adapting their behavior based on experience (learning)
 - Generating unanticipated results

Analysts must have a detailed understanding of the available data and possess some sense of the answers they are looking for. The data are only as valuable as the business outcomes they make possible. The way businesses make use of data allows full recognition of the data's true value and their potential to improve decision-making capabilities and measure them against the results of positive business outcomes.

Blockchain

A blockchain is an innovative technology that has the potential to change accounting. A **blockchain** is a type of digital database (or ledger) that provides proof of who owns what at any moment in time because each transaction has been added to the ledger.

- The ledger is a type of **distributed ledger** that is encrypted, public, and shared widely for anyone to view. Every transaction makes the ledger grow larger. Data is not centralized; therefore, there is no central administrator.
- The term “blockchain” derives from the nature of a ledger. It contains the history of every transaction and forms a **chain**. When a change of ownership occurs, a new “block” is linked to the original chain to form a new chain.
- A **block** is the current part of a blockchain. It records some or all of the recent transactions and becomes a permanent database in the blockchain.

A blockchain is primarily used to verify financial transactions within digital currencies (i.e., cryptocurrency transactions), though it is possible to digitize, code, and insert practically any document into the blockchain.

- **Cryptocurrency** is a digital asset designed to be a medium of exchange using cryptography (encryption) to secure the transactions, control the creation of additional units of the currency, and verify the transfer of funds. Bitcoin is a type of cryptocurrency.
- Owning a **bitcoin**, which uses a blockchain, indicates that the owner has a piece of information (or a block) within the blockchain ledger.
- The blockchain allows each bitcoin owner to transfer a quantity of currency directly to another party connected to the same network without the need for a financial institution to mediate the process.

A key element of a blockchain is a **consensus mechanism**. It is a cryptographic process that takes control of the ledger from one party (i.e., the firm) and allows it to be examined and maintained by multiple independent entities. No centralized organization controls the chain. The official chain is agreed upon by a majority of the participating miners.

- For example, blockchains and consensus mechanisms are similar to Google Docs. Users in a Google Doc can edit documents at the same time, and the most updated versions are always available. All users of the document must agree to any changes made.

In accounting, a company’s ledger can be edited secretly, and the changes may not necessarily be obvious. But, using blockchain technology, editing of a chain is immediately obvious because the majority of third parties have a different chain. Thus, if anyone tries to alter a previous transaction, the public can see that the ledger has been tampered with and is presumably wrong. In the future, blockchain technology could potentially remove bookkeeping from private firms and turn it over to the public.

- Falsifying records using a blockchain requires changing over 50% of the peer chains in the ecosystem. In the case of Bitcoin, which has over 10,000 miners at any moment in time, a bad actor would have to control many computers to alter a chain.

Smart Contracts

Smart contracts are computerized transaction protocols that execute the terms of a contract. A smart contract is a collection of code and data (sometimes referred to as function and state) that is deployed using cryptographically signed transactions on a blockchain network.

The general objectives of smart contract design are to satisfy common contractual conditions (such as payment terms, liens, confidentiality, and even enforcement), minimize exceptions (both malicious and accidental), and minimize the need for trusted intermediaries (e.g., lawyers).

- The code, being on a blockchain, is also tamper evident and tamper resistant and therefore can be used as a trusted third party.
- A smart contract can perform calculations, store information, expose properties to reflect a publicly exposed state, and, if appropriate, automatically send funds to other accounts.
- Smart contracts must be deterministic (i.e., given an input, they must always produce the same output based on that input).

20.2 Analytics and Big Data

Business Intelligence (BI)

BI is associated with the collection of applications, tools, and best practices that transform data into actionable information for managerial control, strategic planning, and making better decisions.

- BI gives upper management information about the present status of the organization and how to steer it in the intended direction.
- BI gives an executive immediate information about an organization's critical success factors.

BI tools rely on advanced software to search vast amounts of data obtained from both within and outside the organization to discover patterns, trends, and relationships.

BI tools display information about the organization as bar graphs, pie charts, columnar reports, or any other format considered appropriate to upper management's decision making. These displays are sometimes grouped into what is termed a **digital dashboard**.

- Stock price trends, sales by region and date, on-time delivery performance, instantaneous cash balances, and profitability by customer are possible metrics.

Data Analytics (DA)

DA involves qualitative and quantitative methodologies and procedures to retrieve data out of data sources and then inspect the data (in accordance with predetermined requirements) based on data type to facilitate the decision-making process.

- A **data type** specifies the type of value and the applicable mathematical, relational and non-relational, or logical operation methodologies that can be applied without resulting in an error.

For-profit entities, not-for-profit entities, and government agencies (federal, state, and local) utilize DA to reach a conclusion based on evidence and reasoning to make well-supported decisions and formulate strong business models. Organizations can also use business analytics to rule out proposed strategic plans and models that would not be beneficial or work for the organization.

Management utilizes DA to evaluate operational, financial, and other data to identify any deviations from the norm (e.g., anomaly detection, potential risks) and opportunities for enhancement or advancement.

Data analytics contains five stages as follows:



Figure 20-2

Stage 1 – Define Questions

Goals and objectives that the organization is trying to achieve should be identified. Key performance indicators (KPIs) must be identified to assist with measuring whether an organization is progressing towards its goals and objectives.

- Clearly defined goals and objectives assist the IT team with selecting the most appropriate technology source to use for the analysis.
- Early adoption of goals and KPIs helps keep the analysis on course and avoid worthless analysis.

Stage 2 – Obtain Relevant Data (Information Discovery)

Access to every piece of data available allows for

- Valuable analysis
- More precise correlations
- Construction of meaningful analysis models and forecasts
- Identification of actionable insights

Stage 3 – Clean/Scrub/Normalize Data

In data analytics, the **ETL (Extract, Transform, Load)** process collects data from various sources, refines it into a uniform format, and stores it in a database ready for analysis. This streamlined data supports entities in detecting trends, predicting potential scenarios, and driving data-based decisions. Furthermore, ETL assures the data's accuracy, uniformity, and dependability, all of which are vital for precise and effective data analytics.

- **Data cleaning** consists of, but is not limited to, flushing out useless information (e.g., duplicated data) and identifying missing data.
- Data governance assists with ensuring data are accurate and usable.
- **Data normalization** involves storing each data element as few times as necessary. It results in **data reduction** and strengthened data integrity for use toward a specific purpose.
 - **Integrity** is ensuring that data accurately reflect the business events underlying them and that any anomalies are rectified.
- If data are collected from different sources, the process of combining and cleaning the data is referred to as **data consolidation**.

Stage 4 – Analyze Data

As the data collected are analyzed, a determination can be made as to whether the data are the exact data needed. The determination includes, but is not limited to

- Assessing whether additional data are needed
- Collecting new and/or different data
- Revising the original question
- Formulating additional questions

Data analytics methods include the following application types:

- **Descriptive analytics** is the most basic and most used method. It concentrates on reporting actual results.
- **Diagnostic analytics** provides insight into the reason certain results occurred.
- **Predictive analytics** involves applying assumptions to data and predicting future results.
- **Prescriptive analytics** concentrates on what an organization needs to do in order for the predicted future results to actually occur.
- **Anomaly detection** identifies unusual patterns or deviations from the norm or expected results.
- **Network analysis** consists of analyzing network data and statistics to find patterns.
- **Text analysis** involves the utilization of text mining and natural language algorithms to find patterns in unstructured text.

Type of Data Analytics	Types of Questions to Ask	How
Descriptive	Report: What happened?	Query, reporting, and search functions
	Monitoring: What is happening now?	Score cards (a simpler form of dashboard that usually has an explanatory KPI)
Diagnostic	Why did it happen?	Online analytical processing (OLAP) and visualization tools
Predictive	What might happen?	Regression, experience, and forecasting
Prescriptive	What needs to be done?	Experience and judgment

- A data analytics **dashboard** is a visual representation of data that presents multiple KPIs and metrics. It allows different types of visual data to be displayed together, making it easier to understand and interpret related information. The KPIs and metrics displayed could consist of any combination of the types of analytics discussed above.
 - For example, an interactive dashboard can show current results and simultaneously update forecasts. Thus, in this example, the dashboard shows characteristics of descriptive and predictive analytics at the same time.

Personnel generally will select data to trace to supporting source documentation, such as invoices, contracts, and payments, and perform the following additional procedures:

- Review and confirm the details of the data selected.
- Analyze the findings and determine compliance or non-compliance with policy.
- Analyze the findings for accuracy.
- Identify internal controls requiring enhancement or, if no controls exist, assist with control creation.

Stage 5 – Communicate Results

The primary purpose of communicating results with appropriate management is to ensure the accuracy of the information used, conclusions, and recommendations.

- Data visualization or graphic illustrations (e.g., charts, graphs, network analysis, etc.), written repetition (e.g., summaries), and itemized lists (bulleted or numbered) are good ways of emphasizing information. Using visual aids to support a discussion of major points results in the most retention of information.
- Generally, language should be fact-based and neutral. Using too strong a word or a word inappropriate for the particular recipient may induce an unwanted response. Thus, high-connotation language should be chosen carefully to appeal to the specific recipient.

Data Mining

Data mining is the search for unexpected relationships among data. It combines information technology and statistics with a goal of analyzing data from different perspectives and summarizing it into useful information.

- The classic example of the use of data mining was the discovery by convenience stores that diapers and beer often appeared on the same sales transaction in the late evening.
- Another example is the process Netflix uses to make decisions about which new shows to acquire and produce. Data scientists at Netflix gather information on trends in what and how consumers are watching, then draw conclusions from those trends on what consumers are most likely to watch in the future.

Common tasks performed during data mining to achieve the goals of revealing patterns and providing insights include

- **Detecting anomalies** to identify data that deviates from what is expected
 - Outlier data can help find fraud, software issues, or other unexpected occurrences.
- **Clustering** to find relationships between variables to sort data into clusters that differ from known structures
 - Clustering can be challenging because discovering new group structures may take multiple rounds of trial and error.
- **Classifying** data within the boundaries of known structures that have been generalized to accommodate new data sets
 - Both clustering and classification are used to categorize data. The difference is that classification has predefined categories into which to sort the data, but clustering does not.
- Performing **regression analysis**, including both linear regression and multiple regression, to model the relationships among the data as accurately as possible
- **Summarizing** the data so it can be presented to those who would make use of the information
 - Summarizations can be visual representations of the data or documents containing aggregated information.

Data mining is an iterative process by means of continuous review and rethinking (i.e., enhancements of previous analysis) while working to obtain the desired results. Once a finding has been made, further data mining may lead to even more conclusions.

Some people say data mining is a science because a computer system is used to find solutions, while others say it is an art because distinguishing meaningful patterns from the output is highly dependent on the judgment, expertise, and intuition of the analyst. Data mining involves the following five steps:

1. The first step is finding an anomaly, such as an outlier, cluster, unexpected change, or a deviation from what was expected. This involves identifying unusual data records, which might be interesting, or perhaps data errors that could require further investigation.
2. The next step is to find relationships between variables and then cluster (group) those relationships in some way. Clustering is not always easy because the group structure is not known in advance.
3. Once the data have been clustered, the next step is to generalize the relationships so that the demonstrated structure applies to new data as well as the original database.
4. Regression analysis, including both linear regression and multiple regression, attempts to find a quantitative function or equation that models the data with the least error, that is, to estimate the relationships among the data or data sets.
5. The final step in data mining is to represent the data set, such as in visualizations and reports.

Query tools can be used to assist with the retrieval of data during a data mining exercise.

- Structured query language (SQL) is used to access and manipulate data within relational database management systems (RDBMSs). Queries are constructed and executed using a set of commands to create, update, and retrieve information. Queries can be used to join multiple tables to manipulate or retrieve joined records with a single command.

Regression Analysis

Regression analysis is the process of deriving a linear equation that describes the relationship between two variables. Simple regression is used for one independent variable and is covered in detail in Study Unit 12, Subunit 1. Multiple regression is used when there is more than one independent variable.

The simple regression equation is the algebraic formula for a straight line.

$$y = a + bx$$

If:
 y = the dependent variable
 a = the y intercept
 b = the slope of the regression line
 x = the independent variable

Multiple Regression

Multiple regression is used when there is more than one independent variable. For example, sales might depend on the amount of advertising, the number of salespeople in the field, the price of the product, and perhaps other independent variables. Multiple regression will show how much each of the independent variables contributes to the overall level of sales.

- Multiple regression allows a firm to identify many factors (independent variables) and weigh each one according to its influence on the overall outcome.

The **coefficient of determination (r^2)**, or the coefficient of correlation squared, is a measure of the fit between the independent and dependent variables.

- The coefficient of determination is the proportion of the total variation in the dependent variable that is accounted for by the independent variable.
- The value of r^2 ranges from 0 to 1. The closer the value of r^2 to 1, the more useful the independent variable (x) is in explaining or predicting the variation in the dependent variable (y).

Example 20-1 Coefficient of Determination

A car dealership determines that new car sales are a function of disposable income with a coefficient of correlation of .8. Thus, 64% (.8²) of the variation of new car sales from the average can be explained by changes in disposable income.

Standard Error

The standard error measures how well the linear equation represents the data. It is the vertical distance between the data points in a scatter diagram and the regression line.

- The closer the data points to the regression line, the lower the standard error.

Aspects of Regression Analysis

The linear relationship established for x and y is valid only across the relevant range, the range from the highest to the smallest measures in the data set. The user must identify the relevant range and ensure that projections lie within it.

- Regression analysis assumes that past relationships are a basis for valid projections.
- Regression does not determine causality.
 - Although x and y move together, the apparent relationship may be caused by some other factor. For example, car wash sales volume and sunny weather are strongly correlated, but car wash sales do not cause sunny weather.

The **goodness-of-fit test** assists with determining whether the sample is representative of the population (validates assumptions).

- The **confidence level** is the percentage of times that a sample is expected to be representative of the population; i.e., a confidence level of 95% should result in representative samples 95% of the time.
 - A person selecting an item at random from a normally distributed population can be, for example, 95% confident that the value of the item is within 1.96 standard deviations of the mean and 99% confident that it will fall within 2.57 standard deviations of the mean.
- A **confidence interval** for a given confidence level is the range around a sample value that is expected to contain the true population value. It is constructed using the confidence coefficient for the number of standard deviations (based on the normal distribution) for the confidence level chosen.
 - If repeated random samples are drawn from a normally distributed population and the auditor specifies a 95% confidence level, the probability is that 95% of the confidence intervals constructed around the sample results will contain the population value.

Advantages of regression analysis include the following:

- ✓ It uses data efficiently.
- ✓ Good results can be obtained with relatively small sets of data.
- ✓ The theory associated with linear regression is well-understood and allows for construction of different types of easily-interpretable statistical intervals for predictions, calibrations, and optimizations.

The disadvantages and limitations of regression analysis include the following:

- ✗ Outputs of regression can lie outside the relevant range.
- ✗ The shapes that linear models can assume over long ranges are limited.
- ✗ Sometimes the extrapolation properties will be poor.
- ✗ The regression line may be ultrasensitive to outliers.

Logistic regression is a statistical model that is used for classification and predictive analytics. It estimates the probability of an event occurring given a dataset of independent variables. Examples include estimating the probabilities of the following binary events:

- Candidate will pass or candidate will fail
 - Borrower will default on loan or borrower will pay back loan
 - Email is spam or email is not spam
 - Transaction is fraud or transaction is not fraud
 - Patient will have heart attack or patient will not have heart attack
-

Various Approaches to Quantify or Understand Risk

Sensitivity Analysis

Sensitivity analysis uses trial-and-error to determine the effects of changes in variables or assumptions on final results. It is useful in deciding whether expending additional resources to obtain better forecasts is justified.

- The trial-and-error method inherent in sensitivity analysis is greatly facilitated by the use of computer software.
 - A major use of sensitivity analysis is in capital budgeting. Small changes in interest rates or payoffs can make a significant difference in the profitability of a project.
- Sensitivity analysis is limited due to
 - The use of assumptions instead of facts
 - The consideration of variables individually as opposed to all together

Simulation

This method is a sophisticated refinement of probability theory and sensitivity analysis. The computer is used to generate many examples of results based on various assumptions.

- Project simulation is frequently expensive. Unless a project is exceptionally large and expensive, full-scale simulation is usually not worthwhile.

Monte Carlo Simulation

This method often is used in simulation to generate the individual values for a random variable. The performance of a quantitative model under uncertainty may be investigated by randomly selecting values for each of the variables in the model (based on the probability distribution of each variable) and then calculating the value of the solution.

- Performing this process many times produces the distribution of results from the model.

Time Series Analysis

Time series analysis (also called trend analysis) is the process of projecting future trends based on past experience. It is a regression model in which the independent variable is time.

- A **seasonal** pattern often exists when a time series is influenced by seasonal factors (e.g., the quarter of the year, the month, or the day of the week).
 - For example, a ski resort will typically show a seasonal pattern for its revenues.
 - Seasonality is normally always of a known period. Thus, seasonal time series are sometimes called periodic time series.
 - Similarly, a manufacturer of lawn mowers will have greater production during the winter and spring than during the summer and fall months.
- A **cyclical** pattern exists when data points show rises and falls that are not of a fixed or seasonal pattern. The duration of these cyclical fluctuations is usually at least a couple of years.
 - An example is business cycles, which typically last several years, but the length of the current cycle is never known in advance.
 - Cyclical behavior is often confused with seasonal behavior. However, if the fluctuations are not of a fixed period, they are cyclical; if the period is unchanging and associated with some aspect of the calendar, the pattern is seasonal.
 - Normally, the average length of cycles is longer than the length of a seasonal pattern, and the magnitude of the depth and rise of cycles tends to be more variable than the magnitude of seasonal patterns, the latter of which occur at least annually.
- An irregular pattern exists when random or unplanned factors occur. A time series does not occur with irregular information.
 - For instance, a ski resort's revenues may generally be expected to be high during winter; however, the resort may experience an unplanned increase in revenues in March or April due to an unexpected snow storm.

Benefits of time series analysis include

- ✓ The ability to project expected upcoming activities. For example, sales of snow jackets are higher during winter than summer.
- ✓ Identifying components or elements that impact the anticipated occurrence in the future.
- ✓ Analyzing current results against activity in the past to determine trend shifts.

Limitations of time series analysis include the following:

- ✗ Components or elements that play a role in projections may become less reliable over time.
- ✗ The conclusions resulting from the analysis could be misleading. For example, higher sales of snow jackets could be the result of an increase in population or could be increasing at a decreasing rate.
- ✗ Predictability of applicable components or elements in the past are assumed to remain unchanged for the future.

Predictive Analytics

Predictive analytics is technology that uses data (historical, current, and predicted), statistical algorithms, and machine learning techniques to draw insights on such trends as consumer or industry behavior patterns. Additionally, recommendations can be made based on underlying assumptions to data and predicting future results.

The likelihood of predicted scenarios can be assessed by calculating probabilities to illustrate their feasibilities. Assumptions (e.g., product type, units sold, unit costs, seasonal product status, etc.) must be true to life to ensure the accuracy and quality of the results of the analysis.

Recommendations can then be made of what would be required in order to achieve each predicted scenario.

A common use of predictive analytics in the retail sector occurs when a customer selects an item to purchase online and prepares to finalize the transaction; the web page then displays additional products other customers purchased in conjunction with the initial item.

- For example, a customer purchases a table saw and, upon checking out, the web page displays images of saw blades, eye-protection goggles, and gloves that other customers bought along with the table saw.
-

Exploratory Data Analysis (EDA)

EDA is an approach to data analysis that differs from traditional modeling and analytic techniques by encouraging the data itself to reveal its underlying structure rather than prematurely applying a hypothesis or statistical method. It is often used as a first step or pre-step in the data analysis process.

- The main role of EDA is to open-mindedly explore in order to gain some new, often unsuspected, insight into the data.

EDA seeks to

- Maximize insight into a data set
- Uncover an underlying structure
- Identify important variables
- Check for outliers and anomalies
- Test underlying assumptions
- Develop parsimonious models
- Determine optimal factors

EDA often uses visual and graphical tools, such as histograms and scatter plots.

What-If Analysis

What-if analysis is a process of determining the effects on outcomes in a model through changes in scenarios.

- For example, an analyst could build a model that projects potential profits for
 - Every 50, 100, or 150 units sold
 - A decrease in distribution costs by 5% for every 50 units sold
 - An increase in sales labor hours by 5% for every 50 units sold

Goal seeking occurs when the decision maker has a specific outcome in mind and needs to determine how it can be achieved.

Big Data

Big data is an evolving term that describes any voluminous amount of structured, semi-structured, or unstructured data that has the potential to be mined for information to reveal relationships and dependencies or to predict outcomes and behaviors.

- **Structured data** refers to data that are highly organized into predefined groupings and are typically maintained in relational databases. The data are predefined such that each item falls into a specific anticipated data type (e.g., string, float, integer, date, boolean) that can easily be sorted and searched by computer programs. For example, sales data are mostly structured.
- **Semi-structured data** refers to data that are not as highly organized as structured data but still have some identifying information that can be used for organization by computer programs. With certain processes, semi-structured data can be stored in relational databases, which can be handled in the same way as structured data. For example, XML and XBRL data can be converted and stored in relational databases for analysis.
- **Unstructured data** refers to information that has little or no predefined organizational structure. This lack of organization makes such data much more difficult for computer programs to search, sort, and analyze. For example, audios, videos, and images are data types that are difficult for computer programs to analyze.

Big data includes information collected from numerous sources, including popular social media sites, Internet-enabled devices, machine data, videos, and even voice recordings. The information collected is converted from low-density data into high-density data (data that has value).

- Data are processed with analytic and algorithmic tools to reveal meaningful information.

Data functions as a strategic asset when processing the data results in information (end product) that is relevant, high-quality, and timely. The information is then provided to decision makers who use sound judgment to

- Make well-informed and timely decisions
 - Identify valuable trends and patterns
 - Identify demand opportunities for products or services
 - Formulate plans based on identified trends and patterns in order to enhance results
-

The “4 Vs”

Big data is often characterized by **The “4 Vs”** -- volume, variety, velocity, and veracity.

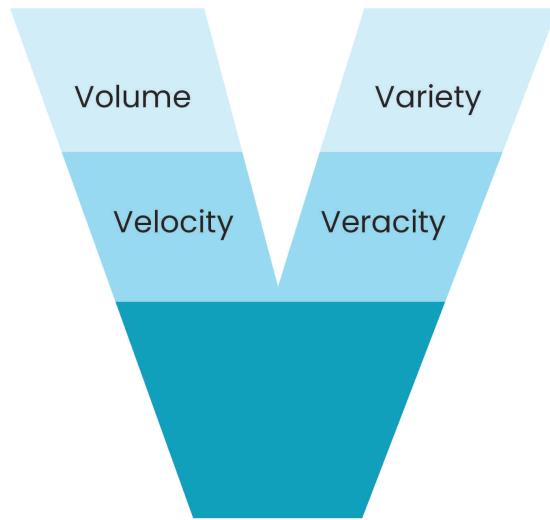


Figure 20-3

Volume

Volume is used to describe the large amount of data captured over time.

- Depending on the amount of data, the number of servers required could range from a single server to thousands of servers.
- Real-time sensors used in the Internet of Things (IoT) have become one of the top sources of data.
 - IoT is a system of interrelated computing devices that are provided with real-time sensors and have the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. Therefore, IoT submits large amounts of data that contribute to a high volume of captured data.

Variety

Data exist in a wide variety of file types.

- Structured data file types are generally maintained by Structured Query Language (SQL). Files of this type are used for managing relational databases and performing various operations on the data in them.
- Unstructured data file types (i.e., streaming data from sensors, text, audio, images, and videos) are maintained by non-relational databases (i.e., NoSQL).

Velocity

Velocity refers to the speed at which big data must be analyzed.

- Analysts must have a detailed understanding of the available data and possess some sense of what answer(s) they are looking for. The ability to look for these answers makes data analytics as much an art as a science.
- The computing power required to quickly process large volumes and varieties of data can overwhelm a single server or even multiple servers. Organizations must apply adequate computing power to big data tasks to achieve the desired velocity.
- Businesses are hesitant to invest in an extensive server and storage infrastructure that might only be used occasionally to complete big data tasks. As a result, cloud computing has emerged as a primary source for hosting big data projects.

Veracity

Veracity refers to the trustworthiness of the data.

- The user wants to know that the data are representative of the population. Collecting large amounts of statistics and numbers is of little value if they cannot be relied upon and used.

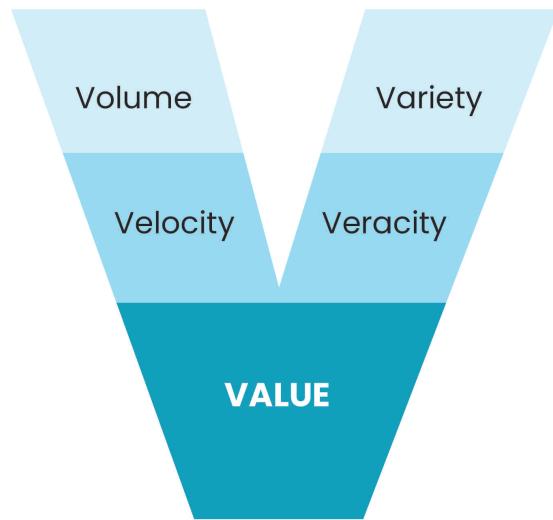


Figure 20-4

The “5th V”

More and more businesses are using big data because of the **value** of the information resulting from the culmination of analyzing large information flows and identifying opportunities for improvement.

- Use of big data is only as valuable as the business outcomes it makes possible. It is how businesses make use of data that allows full recognition of its true value and potential to improve decision-making capabilities and enhance positive business outcomes.
- **Volume-based value.** The more data businesses have on customers, both recent and historical, the greater the insights. This leads to better decisions about acquiring, retaining, increasing, and managing customer relationships.
- **Variety-based value.** In the digital era, the capability to acquire and analyze varied data is extremely valuable. Varied data enable businesses to develop and personalize customer platforms, which increase engagement and awareness of customer needs and expectations.
- **Velocity-based value.** The faster businesses process data, the more time they will have to ask the right questions and seek answers. Quick analysis capabilities provide businesses with the right data in time to achieve their customer relationship management goals. For example, learning that a woman is pregnant based on her buying habits is only valuable if a business can develop an advertising program instantly to sell the woman pre-natal care items.

Uses of Big Data

Big data uses inductive statistics and combines them with concepts from nonlinear system identification (i.e., output is not directly proportional to the input) to deduce inferences from large sets of data, which reveals relationships and interdependencies. Alternatively, big data can be used to predict outcomes and behaviors.

- Big data can be used to identify opportunities for
 - Cost reductions
 - Time reductions
 - New product development and optimized offerings
 - New customers
 - Big data analytics tools can complete missing pieces through **data fusion**, which is the process of integrating data and knowledge representing the same object into a consistent and useful representation of the population.
-

Key Technologies

Data management means that data need to be high-quality and complete before they can be reliably analyzed. Thus, businesses need to

- Establish processes that build and maintain standards for high-quality data
- Establish a master data management program

Data mining examines large amounts of data to discover patterns. It sifts through repetitive noise in data, pinpoints what is relevant, uses that information to assess likely outcomes, and then accelerates the pace of informed decision making.

Predictive analytics uses a combination of data, statistical algorithms, and machine-learning techniques (such as expert systems) to identify the probability of future outcomes based on historical data.

Text mining analyzes text data from the Web, comment fields, books, and other text-based sources through the use of machine learning or natural language processing technology. It can be used to identify new topics and term relationships.

Limitations of Big Data (Including Other Data Analytics)

Data analytics is not suitable for all applications and analyses. Situations in which data analytics may be unsuitable include, but are not limited to, those in which

- ⦿ **User-level data results are incomplete.** Generally, the data available to an organization are restricted to data obtained from individuals who visited the organization's Internet resources (i.e., website) or viewed the organization's advertisements on the Internet.
 - The data are only representative of the target market; thus, untapped markets could potentially exist, the data of which are not being captured.
 - ⦿ **Providing the answer to why the analysis results are what they are is difficult.** Data are processed by (1) separating data into groups and applying analytic methods or (2) analyzing data directly using algorithmic methods. Both processes can result in forecasting outcomes and providing guidance, but algorithmic analytic methods tend to make it more difficult for non-technical people to justify choosing a certain course of action over another course of action (e.g., spending more capital expenditures on product Z over product P).
 - ⦿ **Data are subject to useless information (commonly known as noise).** A single incorrect or useless variable can corrupt the results and require additional labor hours to work with the data in order to attain meaningful results.
 - ⦿ **User-level data results require interpretation prior to use.** Generally, collected data are converted from text format to data visualizations. Data visualizations assist with identifying trends and correlations that run the risk of going undetected in text-based data.
-

Data Visualization

Data visualization refers to any effort to help readers or other users understand the significance of data by placing it in a visual context, such as a graph or chart. Trends, correlations, or other arrangements that might often be overlooked in text-based data can be illustrated and thus recognized more easily with data visualization software. Visualizations are for the benefit of decision makers; the computers themselves do not use or need visualizations for decision making.

Data visualization tools may provide interactive capabilities that allow users to manipulate data or drill into the data for what-if-type analysis.

- Visualizations facilitate visual comparisons between data elements, which helps decision makers identify patterns, deviations from patterns, and outliers in the analysis stage. This is accomplished in an efficient manner.
- Visualizations are usually understood by a wider audience because they reduce the message to its core components and use minimal jargon.
- Visualization options include histograms, boxplots, scatter plots, dot plots, tables, dashboards, bar charts, pie charts, line charts, and bubble charts. Additionally, adding colors and shapes assists with more effectively communicating results by decreasing the burden of decision makers interpreting vast amounts of information and instead concentrating on the more vital information.
- Business intelligence tools include the capability of grouping the various visualization options onto a **digital dashboard**. The dashboard allows the user to pre-select the chart types he or she will use for assistance with decision making.

Statistical Control Charts

Statistical control charts are graphic aids for monitoring the status of any process subject to acceptable or unacceptable variations during repeated operations.

Example 20-2 Statistical Control Chart

The chart below depicts 2 weeks of production by a manufacturer who produces a single precision part each day. To be usable, the part can vary from the standard by no more than ± 0.1 millimeter.

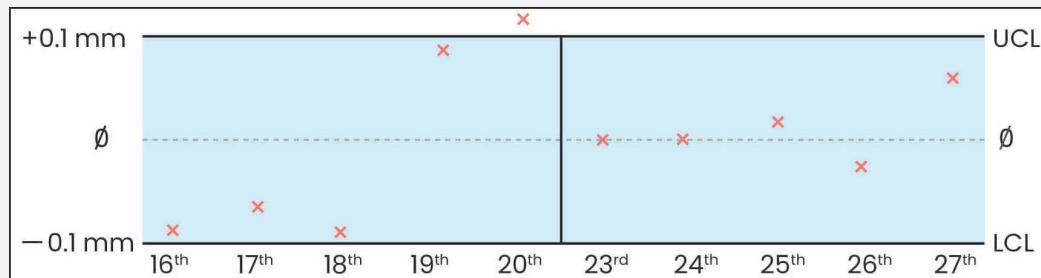


Figure 20-5

The part produced on the 20th had to be scrapped, and changes were made to the equipment to return the process to the controlled state for the following week's production.

Pareto Diagrams

A Pareto diagram is a bar chart that assists managers in quality control analysis.

Example 20-3 Pareto Diagram

The chief administrative officer (CAO) wants to know which departments are generating the most travel vouchers that have to be returned to the submitter because of incomplete documentation.

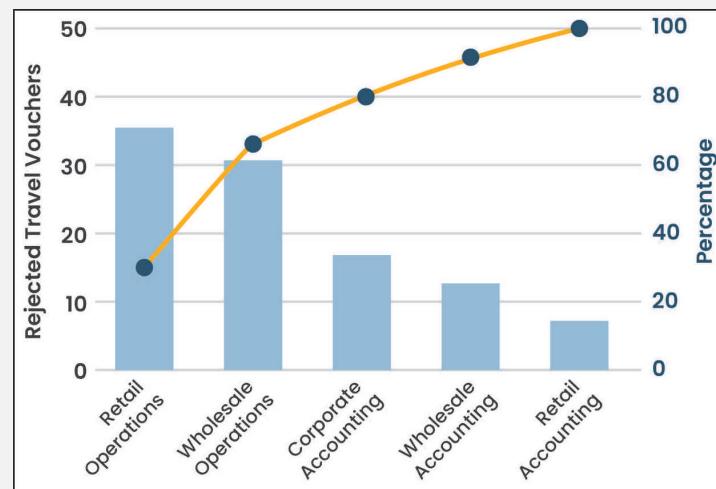


Figure 20-6

Histograms

A histogram is similar to a Pareto diagram. The major distinction is that histograms display a continuum for the independent variable.

Example 20-4 Histogram

The CAO wants to know the amount of a typical rejected travel voucher.

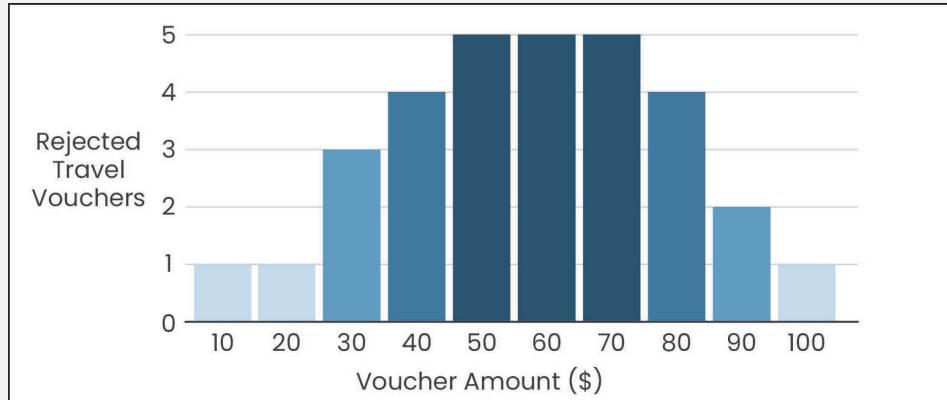


Figure 20-7

Fishbone Diagrams

A fishbone diagram (also called a cause-and-effect diagram) is a total quality management process improvement method that is useful in studying causation (why the actual and desired situations differ).

Example 20-5 Fishbone Diagram

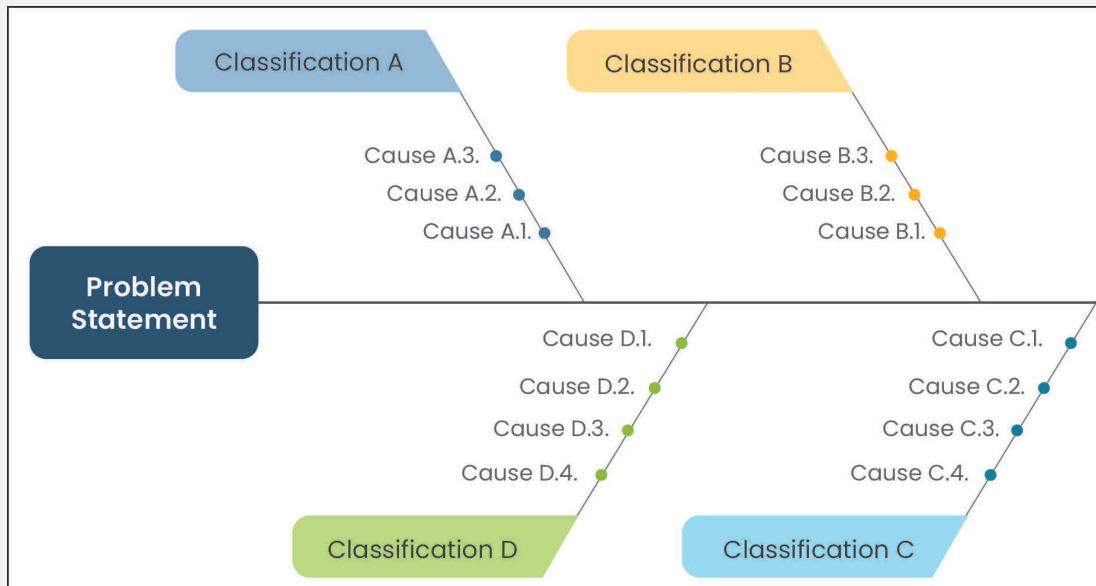


Figure 20-8

Boxplots

A boxplot provides a visual to illustrate how tight or spread out data are and whether any outliers exist by displaying the data distribution in quartiles.

Example 20-6 Boxplot

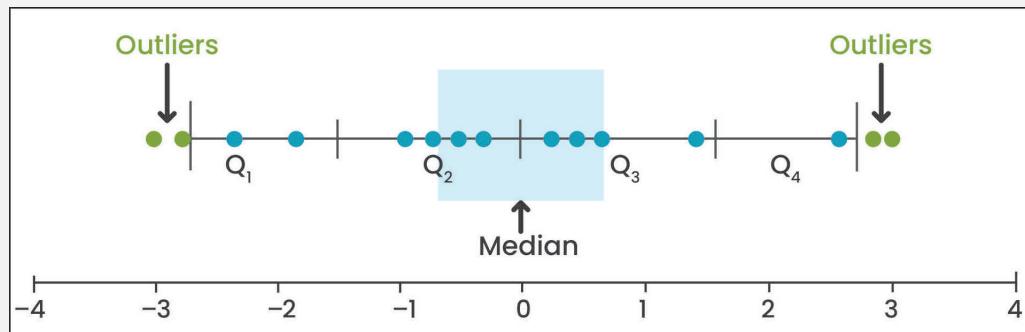


Figure 20-9

Tables

A table illustrates data in rows and columns.

Example 20-7 Table

Type of beverage for refreshments					
Beverage	Soda	Sports Drink	Water	Wine	Beer
Women	6	2	4	3	5
Men	5	1	3	5	6

Dot Plots

A dot plot (similar to a histogram) is a graph that illustrates the distribution for each factor using dots.

Example 20-8 Dot Plot

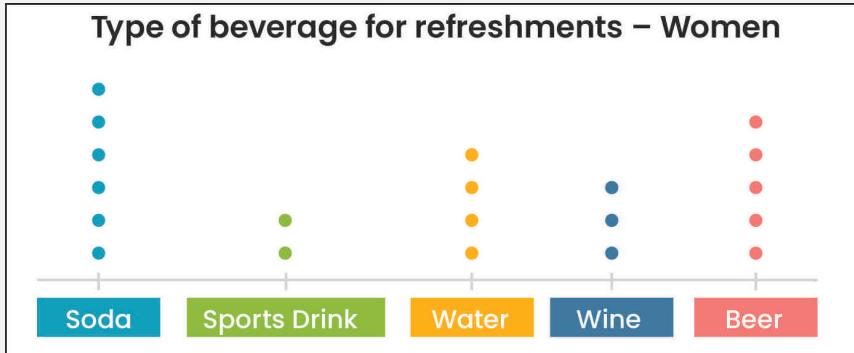


Figure 20-10

Line Charts

A line chart illustrates information as a series of data points (commonly known as markers) connected by a straight line. It is effective for identifying patterns.

Example 20-9 Line Chart

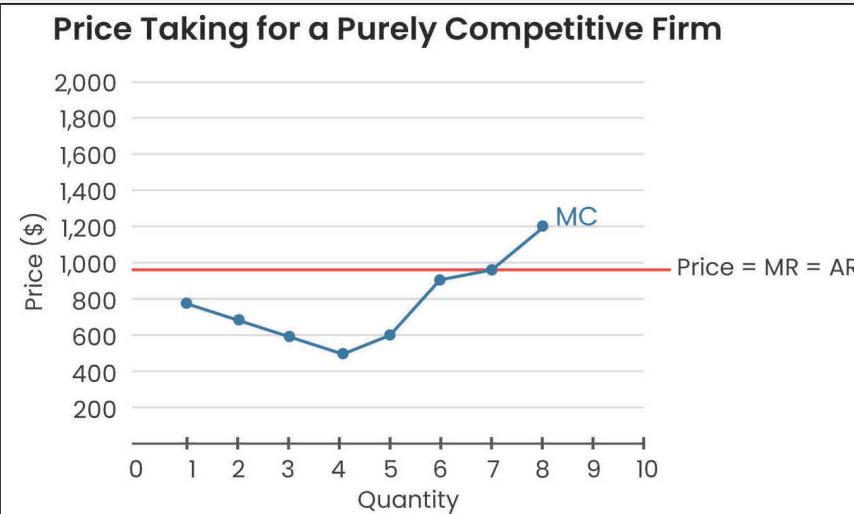


Figure 20-11

Scatter Plots

A scatter plot (similar to a line chart) utilizes the horizontal (variable x) and vertical (variable y) axes to illustrate the correlation among two variables.

- A positive correlation is identified by the data points forming a relatively straight line with the x and y values increasing and decreasing together.
- A negative correlation (or inverse correlation) is identified by the data points forming a relatively straight line, where the value on one axis increases as the value of the other axis decreases.
- A lack of correlation is identified by the scattering of data and the general absence of a straight line among the plotted data.

Example 20-10 Scatter Plot

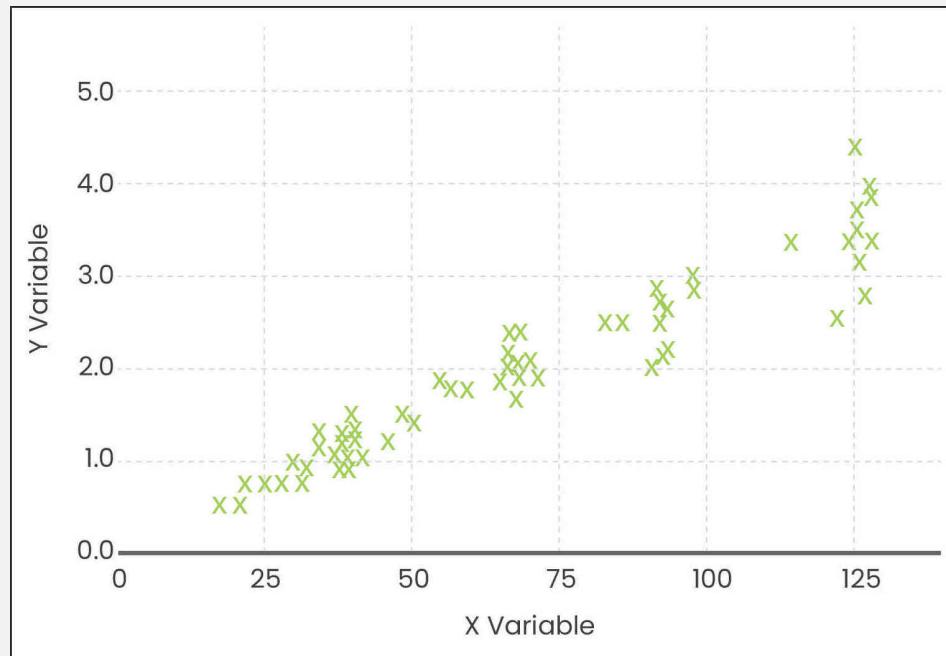


Figure 20-12

Bubble Charts

A bubble chart is similar to a scatter plot; however, a bubble chart incorporates a third variable consisting of a grouping of data points represented by the size of the bubble.

Example 20-11 Bubble Chart

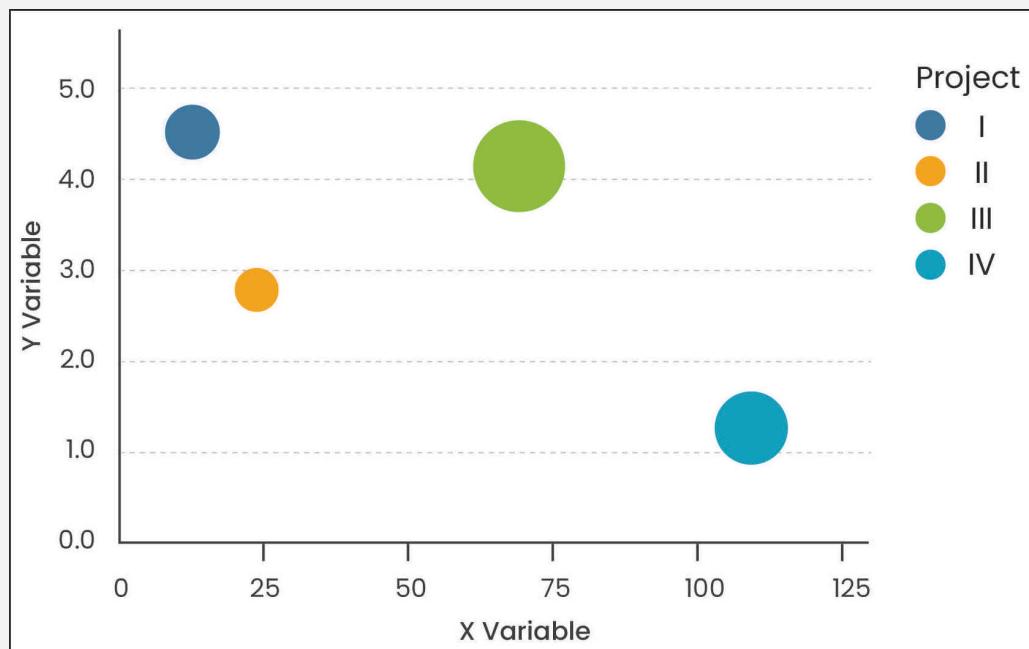


Figure 20-13

Pie Charts

A pie chart is a graph in the shape of a circle with each “pie slice” representing relative sections of a whole population size.

- ⊖ A limitation of pie charts is that too many slices makes comparability extremely difficult, which makes them less precise than other charts.

Example 20-12 Pie Chart

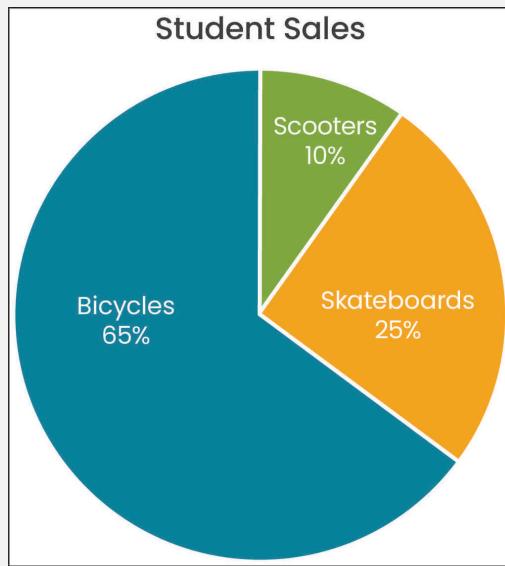


Figure 20-14

Limitations of Visualizations

- ⊖ Visualizations can be misleading. The coder who creates an image can influence the viewer's interpretation of that image.
- ⊖ Visualization tools can be manipulated to present a biased picture.

Example 20-13 Biased Chart Scales

An increase in expenses from \$500,000 to \$501,000 is hardly noticeable on a chart that shows expenses on a scale from \$0 to \$1 million. However, if the chart shows expenses on a scale from \$499,000 to \$502,000, the expense line will show a steep vertical tendency.

In the first instance, the coder may have wanted to show that expenses had been flat, while in the second case, the coder may have wanted to show that expenses had increased tremendously.

Best Practices for Visualization Tools

To avoid distortion in the communication of complex information, best practice guidelines for chart and graph design include, but are not limited to, the following:

- Utilize the full axis by ensuring the axis begins with zero and does not skip values.
- Do not overload the design with too much information.
- Limit the amount of colors used to ensure differences among data points stand out.
 - Avoid using variant shades of the same color (e.g., use red and not light red, soft red, medium red, etc.).
- Ensure the design does not require the user to interpret relationships among data.
 - Display calculations to avoid misinterpretation.
- Ask others for feedback on the design before finalizing the chart. Keep in mind that what might be clear to one person may actually be confusing to others.