Chapter 9

Introduction to Managerial Accounting and Cost Concepts

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Learning Objectives

- Distinguish between financial accounting and managerial accounting.
- Recognize the primary ethical responsibilities of the management accountant.
- Define, distinguish, and illustrate key cost concepts.
- Describe the differences in cost flows among service, merchandising, and manufacturing enterprises.
- Explain product cost elements.
- Describe and formulate a cost function.
- Distinguish between the behavior of variables and fixed costs.
- Apply the concept of contribution margin and its variations.

Chapter Outline

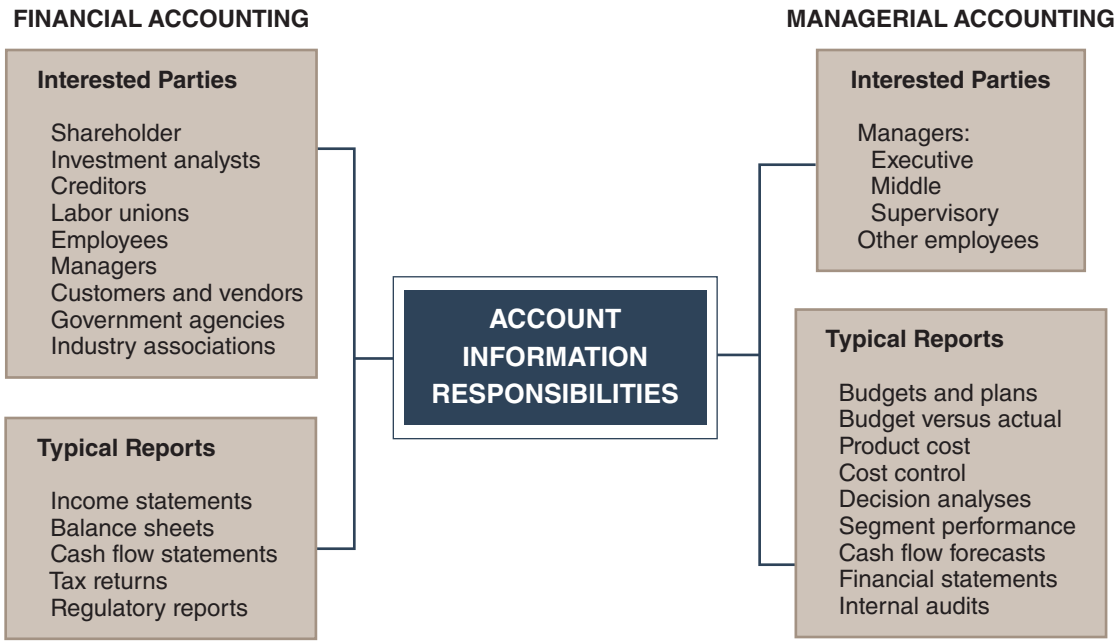
Introduction

Managers select one alternative from a set of choices. Making the best choice depends on the manager's goals, the expected results from each alternative, and the information available when the decision is made. The first part of this text focused on financial reporting; now we will shift our focus to how you can use this financial information to make managerial decisions. Collecting, classifying, reporting, and analyzing relevant information are fundamental to every action that managers take. Management accountants prepare information for decision makers. In this chapter, the stage is set for discussing how management accountants are involved in decision making. First, we discuss the distinction between financial and managerial accounting.

9.1 Managerial Accounting and How It Differs From Financial Accounting

The accounting system generates the information that satisfies two reporting needs that coexist within an organization: financial accounting and managerial accounting. Figure 9.1 shows the primary interested parties and the typical reports generated to serve these two user groups.

Figure 9.1: Scope of financial and managerial accounting



Financial accounting, as we discussed in previous chapters, is the branch of accounting that organizes accounting information for presentation to interested parties outside of the organization under a strict set of rules called GAAP. We discussed accounting principles and briefly introduced managerial accounting in Chapter 2.

In this section of the course, we will focus on managerial accounting, which is the branch of accounting that meets managers' information needs. Because managerial accounting is designed to assist the firm's managers in making business decisions, relatively few restrictions are imposed by regulatory bodies and generally accepted accounting principles. Therefore, a manager must define which data are relevant for a particular purpose and which are not.

Several important differences distinguish managerial accounting from financial accounting. First, managerial accounting is not subject to the same rules and principles as is financial accounting. In many cases, "common sense" is the most important guide for decision makers.

A second difference is that financial accounting relies on accounting principles structured around the accounting equation. Management reports, on the other hand, are designed to meet managers' needs. These reports often use estimates and forecasts, use different values for the same events, do not balance in a debit/credit sense, and are designed for particular decisions or analyses. The expression "different costs for different purposes" has long been used to describe relevance. Relevant information has an impact on the decision analysis. Irrelevant data have no impact.

Another difference is that managerial accounting focuses on segments of the organization as well as on the whole organization. The primary interest of financial accounting is the company as a whole. In managerial accounting, however, the segment is of major importance. Segments may be products, projects, divisions, plants, branches, regions, or any other subset of the business. Tracing or allocating costs, revenues, and assets to segments creates difficult issues for managerial accountants.

Two important similarities do exist. The transaction and accounting information systems discussed earlier are used to generate the data inputs for both financial statements and management reports. Therefore, when the system accumulates and classifies information, it should do so in formats that accommodate both types of accounting. The other similarity is the manner in which accountants measure costs, define assets, and specify accounting periods. Many concepts underlie accounting information, whether the data are later used for financial or managerial reporting. Recording the results of events is often based on rationales that are common to both financial and managerial accounting. We must understand what is a common thread and what must be independently collected.

9.2 Role of the Management Accountant

Although the top accounting-oriented people in an organization are the chief financial officer and the controller, the accounting and financial management functions contain a range of jobs. A variety of careers is available, as shown in Figure 9.2; these careers can frequently be paths to executive management.

Figure 9.2: Management accounting job titles

Accounting systems analyst	Internal auditor
Bid cost estimator	International controller
Budget performance analyst	Labor negotiations cost analyst
Capital investment analyst	Master budget coordinator
Cast disbursement manager	Payroll accountant
Cash flow analyst	Physical asset accountant
Cash receipts manager	Plant controller
Computer controls auditor	Product cost/profit analyst
Corporate financial accountant	Project controller
Corporate tax planner	Risk management analyst
Cost accountant	Quality cost analyst
Cost forecasting analyst	Statistical cost analyst
Customer or sales analyst	Strategic planner
Efficiency cost analyst	Transfer pricing analyst

Management Accountant

A **management accountant** maintains accounting records, prepares financial statements, generates managerial reports and analyses, and coordinates budgeting efforts. The management accountant is an advisor, an internal consultant, and an integral part of management. The **controller** is responsible for managing the entire accounting function. The controller influences management when answering questions like: What information should be reported? What format best displays the information? How can data be collected and processed? By the nature of the job, the management accountant applies management principles and often is a major player in decision making itself.

Certified Management Accountant

The Certified Management Accounting program recognizes a person's achievement of a specific level of knowledge and professional skill. Becoming a **Certified Management Accountant (CMA)** is considered an important professional step for anyone desiring to become a management accounting or financial executive. The CMA program was founded on the principle that a management accountant is a contributor to and a participant in management.

To qualify for the CMA designation, candidates must pass a comprehensive examination and meet specific educational and professional standards. To remain a CMA, a person must meet continuing educational requirements and adhere to the program's "Standards of Ethical Conduct for Management Accountants." The Institute of Management Accountants (IMA) is the professional organization of management accountants and sponsors the CMA designation.

Ethical Conduct of Management Accountants

In the preceding pages, we discussed managers' needs for accounting information. We assumed that whatever information the accounting system generates is presented and used in an ethical manner. Ethical conduct is a necessary asset of a managerial accountant. The credibility of the information provided, analyses done, and opinions offered depends heavily on the reputation of the responsible accountant. Independence, competence, lack of bias or favoritism, trust, and objectivity are key elements in establishing credibility.

While true for all managers, management accountants in particular must maintain integrity and ethical behavior and must make top management aware of unethical behavior on the part of others within the organization. This does not mean the management accountant is a police officer. Rather, the management accountant promotes and encourages ethical behavior in all aspects of business life.

Ethical standards of businesspersons have been given much more visibility and scrutiny in recent years. Issues that appear again and again in management careers test the ethical standards of everyone. Among common ethical issues are:

- Business practices and policies. Practices that seem harmless on the surface may encourage or require employees or managers to be deceitful or dishonest.
- Objective reporting. Because situations exist where prejudiced reporting of certain numbers may influence decisions, accountants are guided by goals of unbiased reporting and professional judgment.
- Colleague behavior. Even if we have high ethical standards, people around us may not be so disposed. Many policies and internal controls are in place in organizations to prevent wrongdoing and to encourage proper behavior. In addition, you should not compromise your personal integrity by condoning unethical behavior in others.
- Competitors. Winning is part of the business "game." But to do so in a fair environment is critical. Using true product and competitor data; following corporate policies; and abhorring bribes, kickbacks, and other similar payments are easy examples. Many firms provide behavior guidelines and policies to purchasing and sales personnel who are at particular risk in giving and receiving favors and improper inducements.
- Tax avoidance and evasion. Tax burdens can be significant. Proper planning and careful use of tax laws to minimize the organization's tax liability are acceptable. Tax avoidance is legitimate. Inappropriate use of the same laws or use of deceit to hide income or overstate deductions is tax evasion, which is unethical as well as illegal.
- Confidentiality. Keeping secrets is still "in." Internal data are developed for managers' use. Disclosures outside the firm often require review and approvals. Privacy of competitive, personnel, and negotiating data is critical. Negative examples of overheard conversations in elevators, on golf courses, and at lunches that lead to lost business, embarrassment, and law suits are unfortunately common. Confidentiality also demands that "insider" information should not be used for anyone's personal advantage.
- Appearance of independence. The accountant should be independent in situations where the resulting information is used for analysis and decision making. Independence applies to both actual independence and the appearance of independence. If it appears that the management accountant is biased because of that person's conduct, associations, or vested interests (possible promotion, salary increases or bonuses, or investments), the information provided is tainted and open to doubt by other decision makers.
- Corporate loyalty and personal advancement. Many situations exist in which, because of an unethical act, the reputation of the firm itself is in danger. Alternately, an unethical act may seem to ensure your personal enhancement in some manner. Sometimes reporting an unethical act will endanger the future of the person reporting the act. These are all difficult dilemmas, pitting right against wrong, and not always in an obvious way.

While space and time do not allow us to develop approaches for resolving these problems here, it is clear that ethical issues underlie management accountants' professional and day-to-day activities.

Each person must develop a method of handling ethical problems. Of primary importance is the ability to see an ethical dilemma when it faces us. Once identified, the situation may well cause us to request advice. Numerous sources are available for guidance, including:

- Personal values. We would like to think that our own value system is "ethical" and provides enough guidance. Clearly, this is our main line of defense against "wrong."
- Corporate policies and ethics statements. Many firms have statements on expected employee behavior or written policies and procedures on how a range of situations should be handled. These statements do set limits or barriers and may describe expected levels of behavior.
- Laws. "If it's legal, it must be okay" is often used a basis for defining ethical behavior. This is absolutely not true. Laws are developed in a political process, often without much serious consideration for the ethical conduct of any parties involved. But it is highly probable that if the behavior is illegal, it is also unethical.
- Professional standards. Most professions have developed a statement of ethical standards for their members. Figure 9.3 presents a statement developed for management accountants. These statements are basic standards of behavior and give professional guidance in many areas.
- Supervisors, internal auditors, and other company officials. These are often persons with more experience and broader understanding of conflicting issues and of corporate attitudes. An ethical situation, however, may involve a supervisor or other corporate official, which may make the dilemma much more sensitive and severe. A few companies have created an ombudsperson position to assist employees in handling delicate situations.
- Counselors from outside of the organization. This is a last resort and generally violates another ethical consideration—confidentiality. While close friends, a spouse, or a personal counselor may seem like logical sources of advice and support, the nature of the dilemma may well require confidentiality until all other avenues of resolution are exhausted. Merely consulting outsiders presents serious risks of unauthorized disclosure, which may only further complicate an issue.

Even though all of these options may exist, we each need to develop a rational approach to identifying, analyzing, and deciding on ethical issues that confront us. Management accountants must be aware of ethical dilemmas, perhaps more so than the typical manager, because of their responsibility for decision-making information and their involvement in many decision-making processes.

The Institute of Management Accountants believes ethics is a cornerstone of its organization and recognizes the importance of providing ethical guidance. The IMA has developed Standards of Ethical Professional Practice. That statement is presented in Figure 9.3. The

Standards are broken into four sections: competence, confidentiality, integrity, and credibility. Competence refers to the skills that the accountant brings to the job. Confidentiality is defined as protecting the access to and use of information. Integrity focuses primarily on the personal behavior and interactions of the management accountant. Credibility, as defined here, is primarily directed toward disclosure of unbiased information.

Figure 9.3: Institute of Management Accountants' Standards of Ethical Professional Practice

I. COMPETENCE
Each member has a responsibility to:
1. Maintain an appropriate level of professional expertise by continually developing knowledge and skills.
2. Perform professional duties in accordance with relelvant laws, regulations, and technical standards.
3. Provide decision support information and recommendations that are accurate, clear, concise, and timely.
4. Recognize and communicate professional limitations or other constraints that would preclude responsible judgment or successful performance of an activity.

II. CONFIDENTIALITY
Each member has a responsibility to:
1. Keep information confidential except when disclosure is authorized or legally required.
2. Inform all relevant parties regarding appropriate use of confindential information. Monitor subordinates' activities to ensure compliance.
3. Refrain from using confidential information for unethical or illegal advantage.

III. INTEGRITY
Each member has a responsibility to:
1. Mitigate actual conflicts of interest; regularly communicate with business associates to avoid apparent conflicts of interest. Advise all parties of any potential conflicts.
2. Refrain from engaging in any conduct that would prejudice carrying out duties ethically.
3. Abstain from engaging in or supporing any activity that might discredit that profession.

IV. CREDIBILITY
Each member has a responsibility to:
1. Communicate information fairly and objectively.
2. Disclose all relevant information that could reasonably be expected to influence an intended user's understanding of the reports, analyses, or recommendations.
3. Disclose delays or deficiencies in information, timeliness, processing, or internal controls in conformance with organization policy and/or applicable law.

"Standards of Ethical Professional Practice." (2012). Institute of Management Accountants. Montvale, NJ. Retrieved from http://www.imanet.org/PDFs/Public/Press_Releases/STATEMENT OF ETHICAL PROFESSIONAL PRACTICE_2.2.12.pdf

Much of managerial accounting deals with cost information. Understanding cost behavior and knowing which costs to consider and which to ignore are critical to making decisions in business and in everyday life situations. Managers use cost information in many different ways. Cost data are especially important in these areas:

- Planning. Estimating future costs in preparing budgets and in projecting operating activities.
- Decision making. Selecting and formatting costs relevant to a wide variety of decision-making processes.
- Cost control. Measuring costs incurred; comparing these costs with budgets, goals, targets, or standards; and evaluating differences or variances.
- Income measurement. Determining the costs of products and services sold to determine this time period's profitability for the entire business or some segment of the business, such as a contract, a product, or a customer.

9.3 The Nature of Cost

Cost, broadly defined, is the amount of resource given up to gain a specific objective or object. Generally, cost refers to the monetary measurement (exchange price) attached to acquiring goods and services consumed by some activity. Cash outlays are monetary measurements; occasionally, goods and services are also obtained by exchanging other assets, such as receivables or property, or by taking on debt.

The **cost objective** is defined as anything for which one accumulates costs. A cost objective is the reason for making decisions, costing products, planning spending levels, or evaluating actual performances. It is the "why" of cost analysis.

Businesspeople undertake activities to achieve some output or result. Often these activities incur costs—purchasing materials, hiring people, and renting space—and are known as **cost drivers**. To achieve a cost objective, activities occur and resources are used. And resources cost money. Determining a product's cost means finding the cause-and-effect connection between inputs and outputs. A cost driver links activities that create outputs and resources that are used.

Figure 9.4 presents the fundamental relationship among resources, activities, and products. Activities are at the core of all we do in business. Activities drive the use of resources; from the activities come products. This is the traditional input-to-output cycle, understanding that work is done in the middle box—meaning tasks are performed with labor, machines, or hired resources. Costs are incurred by cost drivers and are attached to the products, given whatever cost objective managers have in mind for a particular decision. These linkages will be used over and over as we progress through our costing analyses to aid decision making.

Figure 9.4: Activity-centered costing relationships

Cost, in many respects, is an elusive term. It is a noun that needs an adjective, such as incremental, average, or avoidable. Cost has meaning only for a particular purpose and situation. Consequently, meaningful use of the term "cost" requires an adjective to define its use. Each adjective indicates certain attributes, and those attributes dictate the relevance of each cost.

Since costs are resources given up to obtain a specific good or service, that good or service may be consumed, or it may still be an asset at the end of an accounting period. In many managerial analyses, the distinction among cost, expense, and asset is clouded. The words "cost" and "expense" are used interchangeably, as is done throughout this text. Yet for profit measurement, cost dollars imply assets, and expenses are subtracted from revenues.

9.4 Comparing Service, Merchandising, and Manufacturing Organizations

Many similarities exist when we compare service, merchandising, and manufacturing organizations. Providing a service to a client in a law firm or repairing a washing machine in a fix-it shop has strong similarities to manufacturing calculators in spite of different physical and business settings. In service industries, resources are brought together to provide the service, just as they are brought together to create a product in a factory environment.

Differences in measuring profits are largely a function of inventoried costs. Service firms have only supplies inventories. Most businesses in the healthcare industry are service businesses. Merchandising firms buy and sell products and hold merchandise inventories. Medical equipment suppliers and drug stores would fit into the category of merchandising firms. Manufacturing firms buy materials and convert these inputs into salable products. Inventories here include yet-to-be-used materials, work in process inventory (partially complete products), and finished goods inventory (completed and ready-to-sell products). Manufacturing of medical equipment and drugs are two types of businesses in the healthcare industry that would fit the manufacturing classification. Exhibit 9.1 compares income statements and selected balance sheet accounts for the three business types.

Exhibit 9.1: Measuring income in service, merchandising, and manufacturing firms

Income Statements for the Year			
	Services Firms Kalwerisky Clinics	**Merchandising Firms** Burchfield Medical Supplies Store	**Manufacturing Firms** Holbrook Medical Equipment
Sales	$ 8,000,000	$ 8,000,000	$ 8,000,000
Cost of goods sold			
Cost of goods manufactured			
Purchases of direct materials			$ 2,300,000
+ Beginning direct material inventory			360,000
– Ending direct materials inventory			(310,000)
Materials used			$ 2,350,000
+ Direct labor			920,000
+ Manufacturing overhead			2,300,000
Total manufacturing costs			$ 5,570,000
+ Beginning work in process			320,000
+ Ending work in process			(340,000)
Cost of goods manufactured			$ 5,500,000
Purchases		$ 7,000,000	
+ Beginning finished goods inventory		510,000	600,000
+ Ending finished goods inventory		(480,000)	(620,000)
Cost of goods sold		$ 7,030,000	$ 5,530,000
Direct patient expenses	5,800,000		
Gross margin	$ 2,200,000	$ 970,000	$ 2,470,000
Operating expenses:			
Selling expenses	$ 610,000	$ 550,000	$ 980,000
Administrative expenses	1,270,000	260,000	1,030,000
Total operating expenses	$ 1,880,000	$ 810,000	$ 2,010,000
Net operating income	$ 320,000	$ 260,000	$ 460,000
Selected Balance Sheet Information for Year-End			
Accounts receivable	$ 1,350,000	$ 80,000	$ 1,020,000
Materials inventory			310,000
Work in process inventory			340,000
Finished goods inventory		480,000	620,000
Accounts payable	220,000	110,000	460,000

Service Organizations

A service business performs an activity for a fee. Costs of performing the service may include salaries of professionals and support personnel, supplies, purchased services, and routine costs such as rent and utilities. In Exhibit 9.1, the expenses of Kalwerisky Clinics, a firm that operates medical clinics, are reported as either direct client expenses or operating expenses. Some service organizations report all expenses as operating expenses.

Essentially, all operating costs incurred by the firm are **period costs**; they become expenses of the time period in which the costs are incurred. Only receivables, payables, supplies, depreciation, and perhaps costs not yet billed to patients or insurers would cause accrual net income to differ from operating cash flow.

In a service organization, the problems of measuring performance, such as the profitability of specific contracts and matching direct costs with specific revenues, are surprisingly similar to manufacturing cost analyses.

Internally, financial reports for service firms often separate revenues and expenses by type of service or customer. For example, hospitals track revenues by procedure type and attempt to measure costs of those procedures. Professional firms, such as physicians, accountants, lawyers, and architects, measure the direct costs of performing services by client or patient. Lawyers record time spent on each case, both for billing purposes and for tracing salary costs. In Exhibit 9.1, Kalwerisky Clinics apparently serves multiple patients and can identify professional time, service costs, and other traceable costs with specific patient contacts.

Merchandising Organizations

A merchandising business purchases products for resale. Generally, a merchandising firm is a link in the physical distribution chain, acting as a wholesaler or retailer. Exhibit 9.1 introduces cost of goods sold to the income statement of Burchfield Medical Supplies, a retail medical supply store. Again, supporting the reported totals would be detailed revenues and costs of sales for various segments, such as medical equipment and medical supplies departments.

Merchandise costs are inventoriable or **product costs**, meaning that they are an asset until sold. All other expenses in the medical supplies operation are treated as period costs.

Manufacturing Organizations

Manufacturing generally occurs in a factory, defined as a place where resources are brought together to produce a product. Examples include:

Soft-drink bottling company—mixing batches and filling bottles of root beer

University dorm cafeteria—preparing and serving meals

Pharmaceutical manufacturer—producing medications

Breakfast cereal manufacturer—processing grains into cereal

Medical equipment manufacturer—joining parts and subassemblies to create medical equipment

But, after some thought, you can see how many service firms really do "produce" the service using our definition of a factory.

Pharmacy—filling prescriptions

Tax return preparation firm—preparing tax returns

Hospital surgery department—performing heart bypass operations

As Exhibit 9.1 illustrates, manufacturing firms have more complexity in determining cost of goods sold. A new income statement section, **cost of goods manufactured**, is introduced. It includes:

- the costs of inputs to the manufacturing process: direct materials, direct labor, and manufacturing overhead, and
- direct materials inventory and work in process inventory needed for factory activities.

The sum of the product inputs is **total manufacturing costs**, the total cost of resources used in production during a time period.

Figure 9.5 compares a factory to a large bucket. When the whistle blows to start the production period, the bucket already has resources in it—beginning work in process inventory. During the period, more resources are poured into the bucket—total manufacturing costs (materials used, direct labor, and factory overhead). Flowing out of the bucket are all products that are finished during the period and either sold or added to finished goods inventory. This is cost of goods manufactured. When the whistle blows to end the period, ending work in process inventory remains in the bucket.

Figure 9.5: The factory as a "bucket" of costs

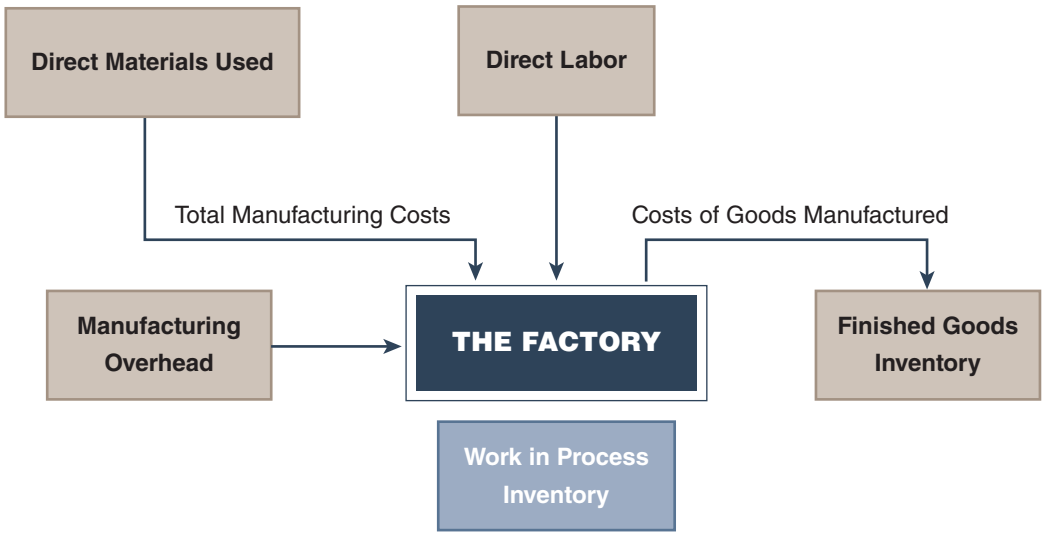
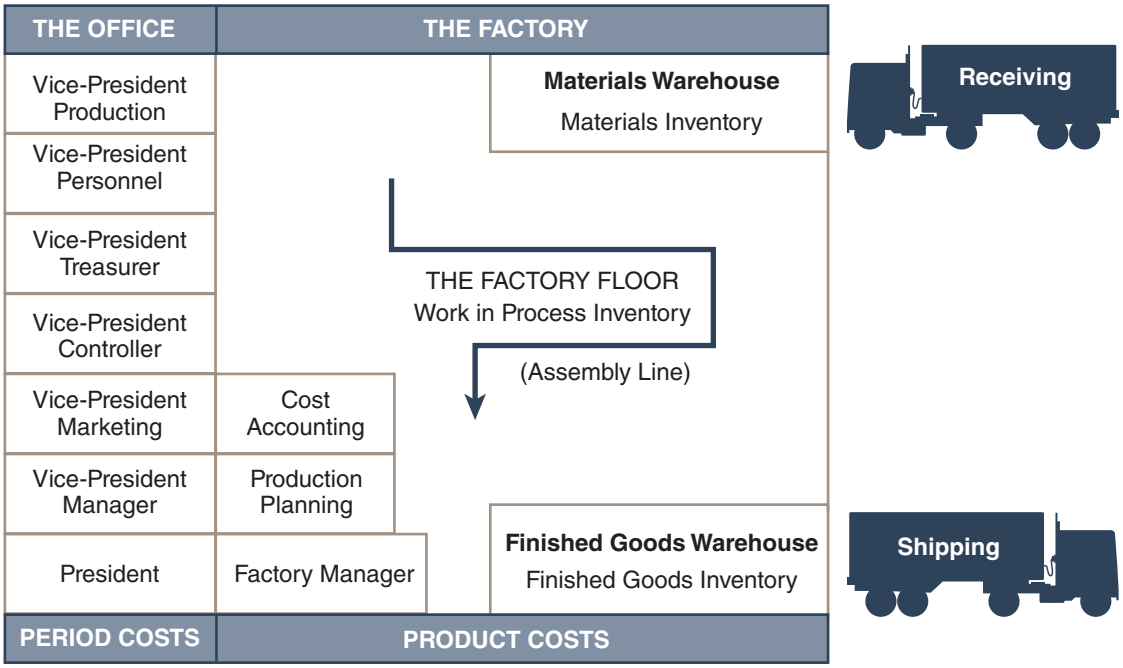


Figure 9.6 illustrates a simplified version of the Holbrook Medical Equipment factory. Here resources are brought together for producing MRI components. An assembly line in the factory is the focus of "manufacturing" activities.

Materials (primarily parts and components) are purchased for production, and factory employees work to convert parts into finished products. Many support services are used, and expenses are incurred for materials handlers, equipment maintenance workers, heat, power, employee benefits, factory accountants, supervisors, and depreciation on equipment and the building.

Figure 9.6: The Holbrook Medical Equipment factory



In Figure 9.6, the business is divided into office and factory areas. Obviously, this example is simplified and avoids many business complexities. But, it shows the following:

- Product and period costs. In general, any expense incurred in the office area is an operating expense and a period cost. Any cost incurred in the factory is a manufacturing cost, an inventoriable cost, and a product cost. All other costs are period costs or expenses.
- Location of inventories. Manufacturing requires three production inventories: materials, work in process, and finished products. Materials purchases are received and stored in the materials warehouse, and their costs recorded in **Materials Inventory**. When materials are requisitioned for use on the factory floor, direct materials costs are transferred to **Work in Process Inventory**. This is production that is started but not completed. Completed products are physically sent to the finished goods warehouse; work in process costs are moved to **Finished Goods Inventory**. These products are ready for sale to customers. And

when a sale occurs and is shipped, finished goods product costs are moved to **Cost of Goods Sold**, an expense account.

- Flow of costs and products. Figure 9.6 assumes an assembly process, but many different production systems exist. Materials are added, workers process, and other activities support; a physical flow and a cost flow coexist.

Traditional Groupings of Product Costs

Exhibit 9.1 illustrates the income measurement for Holbrook Medical Equipment. Product cost accounting combines three groups of manufacturing costs: direct materials, direct labor, and factory overhead. While automated manufacturing and cost systems can create many more or fewer cost groups, these three have historically been used in nearly all manufacturing costing.

Direct materials costs are costs of physical components of the product. The range of materials includes natural resources, such as oil, metals, or lumber, and partially processed components (another company's finished product). Often, a complete list of all materials used in a product is prepared and is called a **bill of materials**. Materials issued to production are **direct materials used**. To find materials used, take materials purchases, add beginning inventory, and subtract ending inventory. Supplies like nails, glue, lubricants, and paints could be included in direct materials, or, more commonly, indirect materials, which are factory overhead costs. At McDonald's, potatoes used to make French fries would be direct materials, while the salt added to the fries would be indirect materials.

Direct labor costs are wages paid to workers who directly process the product. In Figure 9.6, assembly line workers would be direct labor. At McDonald's, the wages paid to the cooks would be direct labor costs. Direct labor costs could include fringe benefit costs, such as health insurance, pension costs, and various employer payroll taxes. For example, a $15 per hour wage rate can easily grow to $25 per hour when all employer-paid benefit costs are added.

Factory overhead costs include all manufacturing costs that are not materials or direct labor. In its simplest form, **overhead** is defined as an ongoing expense that is not related to the products and services provided by an organization. Manufacturing overhead, factory burden, and indirect manufacturing costs are other names for factory overhead costs. Obviously, a wide variety of costs can fall into this category, such as maintenance staff wages, factory managers' salaries, factory utilities costs, and factory equipment depreciation and repair costs. Hundreds of different cost accounts could be grouped under manufacturing overhead. Certain workers' tasks could be overhead in one company and direct labor in another. For example, materials handlers and quality control personnel costs could be accounted for as either direct or indirect labor. Generally, if the worker has direct contact with the product or the production process, the cost is direct labor, and support tasks are commonly considered indirect labor—part of overhead. At McDonald's, a particular restaurant manager's salary would be an indirect labor cost.

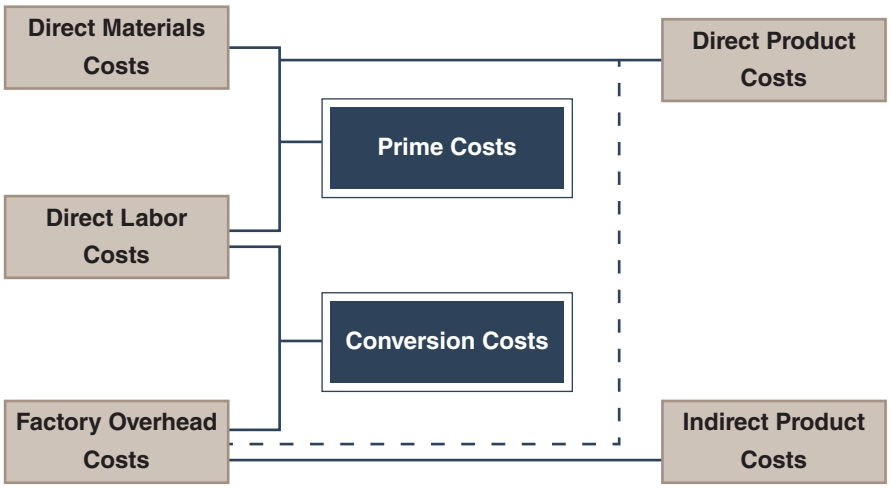
Historically, the three cost groups were assumed to be about equal portions of total product cost. Today, automation reduces direct labor and causes factory overhead to increase. As more production is generated from the same capacity, materials as a percentage of total cost may also increase.

Thus, managers have paid more attention to materials and overhead costs because they have grown as a portion of total manufacturing costs.

Types of Product Costs

Materials and direct labor costs are often viewed as **direct product costs** since they are easily identified with specific products and units of product. Factory overhead is usually thought of as **indirect product costs**. Factory overhead is not easily traced to specific products or units. For example, the plant manager's salary cannot be tied to specific product units in a multiproduct factory, since the manager is responsible for all activities in the factory. An exception may exist for a few overhead costs that may be traced to specific products and be considered direct costs. Figure 9.7 illustrates these concepts and shows a dotted line between manufacturing overhead and direct costs to indicate this possibility. At McDonald's, the cost of hamburger buns would be direct product costs, while the restaurant's electricity costs would be indirect product costs.

Figure 9.7: Product costs and product cost groups



Direct materials and direct labor are also known as the **prime costs** of a product. These costs are easily traceable to a specific product. Direct labor and factory overhead are called **conversion costs**. In the factory, materials are "converted" into finished product using labor and all of the factory's supporting resources—overhead costs.

Calculating Unit Costs

Product costing attaches costs to units of product. The simplest approach is to divide the number of units produced into total manufacturing costs. For example, a highly automated factory produces a variety of wheelchairs. The same production processes are used for all models with minimal changeover costs. Ten thousand wheelchairs roll off the line every month. Different widths distinguish the models. March production data by wheelchair product line are as follows:

	Basic	Narrow	Wide	Total
Direct materials costs	$ 150,000	$62,500	$100,000	$312,500
Indirect other costs				50,000
Total costs				$362,500
Units produced	5,000	2,500	2,500	10,000
Direct materials costs per unit	$ 30.00	$ 25.00	$ 40.00	$ 31.25
Indirect other costs per unit	5.00	5.00	5.00	5.00
Product cost per unit	$ 35.00	$ 30.00	$ 45.00	$ 36.25

The easiest costing approach is to divide the total costs of $362,500 by 10,000 wheelchairs. However, the $36.25 average cost hides the different direct costs of each model of wheelchairs. A second approach identifies materials costs as direct to each model and averages all other costs over all units. This produces a high cost of $45 for wide models and a low cost of $30 for narrow models. More complex costing is needed if different models use different amounts of resources. The goal is to find the most detailed unit cost, given our decision-making needs.

9.5 Cost Behavior

To say that a cost "behaves" in a certain way is somewhat misleading. Costs result from taking actions or from the mere passage of time. Something drives a cost—some activity, decision, or event. Selling one more hamburger involves a burger, a bun, a container, a napkin, and any condiments used. But selling one more hamburger has no impact on supervision, equipment rental, or advertising costs. Building lease expense will not change unless the lease includes a rental payment based on a percentage of sales. **Cost behavior**, then, is the impact that a cost driver has on a cost.

Which costs can be expected to remain constant when the amount of work activity increases or decreases? Also, which costs increase as more work is performed? If costs are to be estimated and controlled, we need to know whether or not costs will change if conditions change, and, if so, by what amount.

Cost behavior often divides cost into either variable or fixed categories. But in the real world, many behavior patterns exist, since most costs are not strictly variable or fixed. Thus, the concepts of semivariable and semifixed costs add complexity to cost behavior studies. It may oversimplify the analysis, but a split between variable and fixed is common and is used frequently.

Variable Costs

A **variable cost** changes in total in direct proportion to changes in activity or output. A decrease in activity brings a proportional decrease in total variable cost, and vice versa. For example, direct materials costs are usually variable costs, since each unit produced

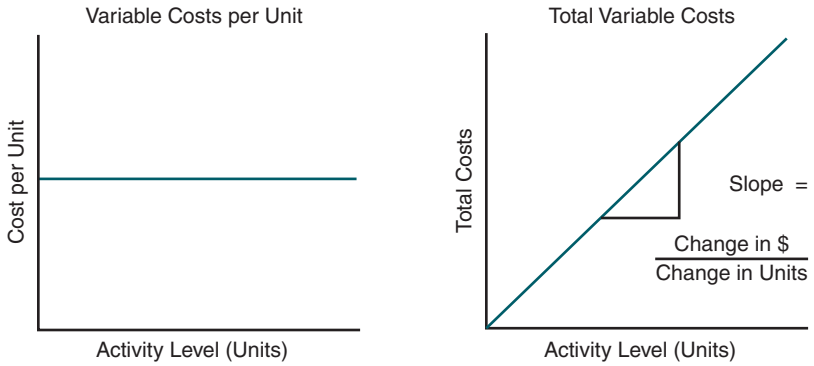
requires the same amount of materials. Thus, materials costs change in direct proportion to the number of units manufactured. At McDonald's, the cost of raw hamburger meat would be a variable cost.

A proportional relationship between activity and cost has these important characteristics:

> Variable cost is a rate per unit of activity or output. A variable cost per unit remains constant across a reasonable range of activity. And, the slope of the total variable cost curve is the variable cost per unit—the added cost divided by the added units.

For example, if a product costs $4.00 per unit, the expression $4*X* yields the total variable cost at *X* level. Figure 9.8 shows the behavior of variable costs on a per unit basis and in total, and also highlights the variable cost line's slope.

Figure 9.8: Behavior of variable costs



Fixed Costs

A **fixed cost** is constant in total amount regardless of changes in activity level. Costs such as the plant manager's salary, depreciation, insurance, and rent usually remain the same regardless of whether the plant is above or below its expected level of operations. At McDonald's, the cost of heating the restaurant would be a fixed cost.

Important characteristics of a fixed cost are:

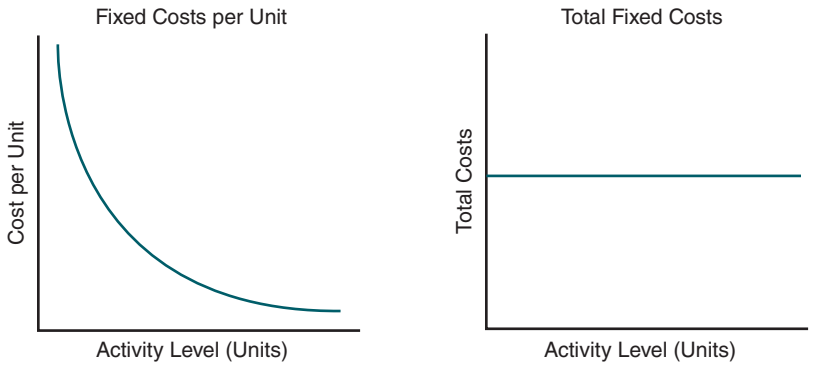
> Fixed cost is a lump of costs that is not normally divisible and does not change as activity or volume changes. A fixed cost remains constant across a reasonable range of activity. The fixed cost per unit decreases as activity or volume increases and increases as activity or volume decreases.

For example, March's rent is quoted as a dollar amount for that month, not as an amount per unit of output or even per hour of use.

By definition, total fixed costs are constant, causing the fixed cost per unit to vary at different levels of activity. Figure 9.9 shows the behavior of fixed costs on a per unit basis

and in total. When a company produces a greater number of units, the fixed cost per unit decreases. Conversely, when fewer units are produced, the fixed cost per unit increases. This variability of fixed costs per unit creates problems in product costing. The cost per unit depends on the number of units produced or on level of activity.

Figure 9.9: Behavior of fixed costs



Certain fixed costs can be changed by management action. These are discretionary fixed costs. **Discretionary fixed costs** are expenditures that managers can elect to spend or not to spend. For example, a clinic might budget the cost of nurses at $20,000 per month for the coming year. But the contract states that the company can cancel the contract at any time. Management maintains discretionary control over the spending. On the other hand, if the contract guarantees the nurse a 12-month relationship and the contract has been signed, a committed fixed cost has been created. A **committed fixed cost** is one over which a manager has no control and must incur. Advertising cost for McDonald's would be a discretionary fixed cost. Depreciation on McDonald's restaurant equipment would be a committed fixed cost.

An interesting observation is necessary here. Managers can, with time and intent, change the cost behavior of certain activities. For example, variable direct labor costs can be converted into a fixed cost by guaranteeing full-time employment for some period, such as a 3-year union contract. Or equipment could be leased on a short-term basis (day to day or even hourly) instead of purchased—converting a fixed cost into a variable cost. Also, automated equipment with a fixed rent or depreciation could replace variable-cost manual labor. Thus, we recognize that managers can act to change certain cost behavior, particularly over time.

Expressing Variable and Fixed Costs—A Cost Function

Since a variable cost is a rate, it is a function of an independent variable—an activity or output level. Variable costs can be converted into total variable costs only by knowing the activity or output level. Fixed costs are first expressed as an amount, a constant. Fixed costs can be converted into a rate per unit only if the activity or output level is known. In the following example, the cost per unit of $7 and total costs of $700,000 can be found only if the output of 100,000 units is known.

	Costs of 100,000 Units			Costs of 120,000 Units		
	Cost per Unit		Total Costs	Cost per Unit		Total Costs
Variable costs	$4.00	→	$400,000	$4.00	→	$480,000
Fixed costs	3.00	←	300,000	2.50	←	300,000
Total	$7.00		$700,000	$6.50		$780,000

If the production level increases to 120,000, both the cost per unit and total costs change. A decrease in the cost per unit from $7 to $6.50 results from spreading fixed costs of $300,000 over more units—120,000 instead of 100,000. The increase in total cost equals the variable costs for the additional 20,000 units. A decrease in volume has similar reverse impacts—the cost per unit increases, but total costs decline.

Three factors must generally be known to perform cost analyses:

1. the variable cost rate,
2. the fixed cost amount, and
3. the level of activity or output.

Notice that if we know the bold numbers in the example above and the activity level, we can calculate all other numbers.

These factors can be brought together in a **cost function**—an expression that mathematically links costs, their behavior, and their cost driver. In the example, the expression is:

Total costs = $300,000 + $4($X$), where X is the number of units produced.

This expression can be symbolically shown as:

Total costs = $a + b(X)$, where a is fixed costs and b is variable costs per unit.

This is an important formula in managerial accounting. Understanding these relationships can give insight into cost behavior for planning, control, and decision making. By knowing the activity level and cost function, we can find either total costs or costs per unit. The reverse is also true.

Finding the Cost Function Using Total Costs and Activity Levels

In this example, let's assume we know the total costs ($700,000 and $780,000) at both activity levels (100,000 and 120,000 units). How do we find the cost function? First, we calculate the variable cost per unit as follows:

$$\frac{\textit{Change in cost}}{\textit{Change in activity level}} = \frac{(\$780{,}000 - \$700{,}000)}{(120{,}000 - 100{,}000)} = \frac{\$80{,}000}{20{,}000} = \$4 \text{ per unit}$$

This is b in our cost function. The change in cost from a change in activity yields the slope of the total variable cost line.

To find the fixed cost, which is *a* in the cost function, we take the total costs at either activity level and subtract the variable costs at that level, as follows:

$$\$780{,}000 - (\$4 \times 120{,}000 \text{ units}) = \underline{\underline{\$300{,}000}}$$

or

$$\$700{,}000 - (\$4 \times 100{,}000 \text{ units}) = \underline{\underline{\$300{,}000}}.$$

We now have both *a* and *b*. The cost function is $\$300{,}000 + \$4(X)$.

Finding the Cost Function Using per Unit Costs and Activity Levels

Using the same example, per unit costs were $7 at the 100,000 units activity level and $6.50 at 120,000 units. First, we find total costs at each level by multiplying the cost per unit by the activity level as follows:

$$\$7 \text{ per unit} \times 100{,}000 = \underline{\underline{\$700{,}000}} \text{ and } \$6.50 \text{ per unit} \times 120{,}000 = \underline{\underline{\$780{,}000}}.$$

Second, we follow the same procedure as shown previously in converting total costs into the cost function. The same calculations could be applied separately to total variable costs for *b* and to total fixed costs for *a*. Calculations at both levels produce the same cost function.

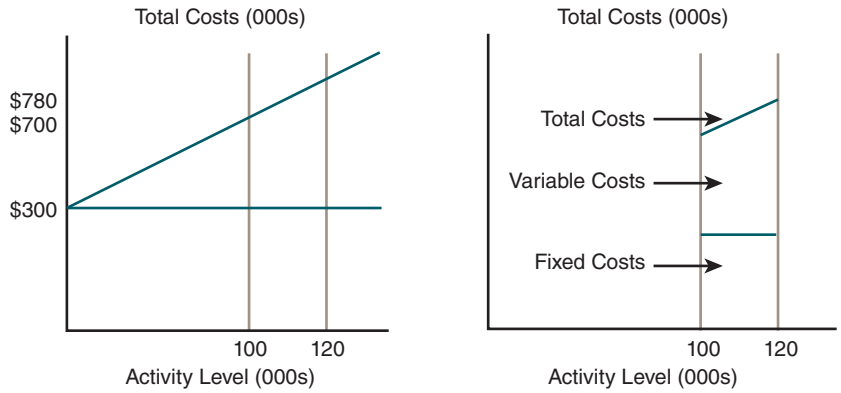
One danger in converting fixed cost lumps into cost per unit is that the unit cost can be misinterpreted. It might be assumed that $7 is the variable cost—forgetting that the $300,000 is a fixed cost. At different activity levels, the per unit cost will be different. Even in solving homework problems, students are in danger of missing the impact of volume changes on total costs and unit costs if only costs per unit or total costs are used.

Relevant Range

In Figures 9.8 and 9.9, activity is assumed to start at zero and go to very high levels. Realistically, the cost function holds only for a much narrower range of activity—a relevant range. A **relevant range** is the normal range of expected activity. Management does not expect activity to exceed a certain upper bound nor to fall below a lower bound. Production activity is expected to be within this range, and costs are budgeted for these levels. In cost analysis, costs are expected to behave as defined within the relevant range. The cost function is assumed to be valid for this range of activity. Usually, past experience establishes the relevant range.

Fixed costs are fixed and variable costs are variable within the relevant range. In the above example, the volume range was between 100,000 and 120,000 units. The cost function of $300,000 plus $4 per unit is valid between 100,000 and 120,000 units, as shown in Figure 9.10. If planned production were 130,000 units, our cost function might not be valid or useful.

Figure 9.10: Cost patterns using a relevant range

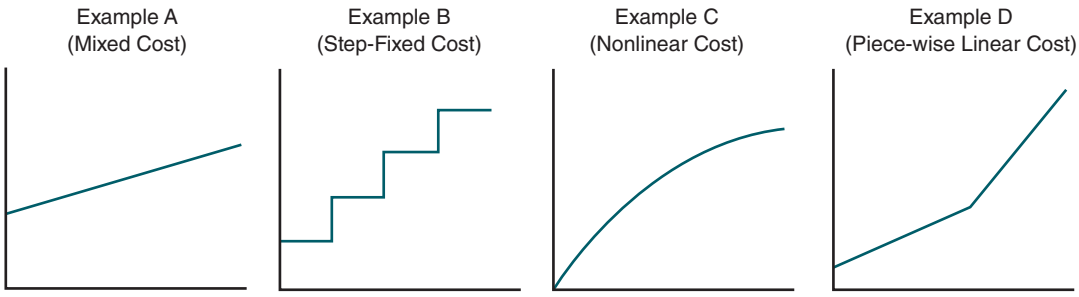


Semivariable and Semifixed Costs

Figure 9.11 illustrates cost functions that are neither strictly variable nor fixed. In the real world, very few costs are truly variable or fixed. **Semivariable costs** change but not in direct proportion to the changes in output. Some semivariable costs, called **mixed costs**, may be broken down into fixed and variable components, thus making it easier to budget and control costs. Using the cost function techniques shown previously, fixed and variable parts can be identified. In Example A of Figure 9.11, telephone expenses may include a monthly basic connection fee (fixed) plus a charge for each local call (variable).

Semifixed costs or **step-fixed costs** are typified by step increases in costs with changes in activity, as shown in Example B in Figure 9.11. Activity can be increased somewhat without a cost increase. However, at some activity level, additional fixed cost must be incurred to expand capacity. If many narrow steps exist, a step-cost pattern may approximate a variable cost. Or with wide steps, one step may encompass the entire relevant range, and the step cost appears as a fixed cost.

Figure 9.11: Examples of semivariable and semifixed cost patterns



X-axis is activity level; *Y*-axis is total costs.

Example C shows a cost that increases but at a lower cost per unit as activity increases. An example is increased worker efficiency as activity increases, resulting in a lower per unit cost. This is a **nonlinear cost**. Example D shows a **piece-wise linear cost**. It is a constant variable rate until a certain activity level is reached, and then the variable cost per unit increases. Perhaps an electric utility offers a low per kilowatt rate for the first 500 kilowatts and a higher rate beyond that level.

Many expenses have both fixed and variable components. Chapter 10 examines techniques that can help separate the fixed and variable portions and that can quantify the cost function.

9.6 Cost Concepts for Planning and Controlling

Often, cost terms can be explained using contrasts. In other situations, great care must be exercised to distinguish different cost meanings, even subtle differences. For others, similar terms can be substituted for each other.

Direct Costs Versus Indirect Costs

Costs are often defined as being direct or indirect with respect to a cost objective—an activity, a department, or a product. If a cost can be specifically traced to the cost objective, it is a **direct cost** of that objective. A direct cost is also called a **traceable cost**. The cost of surgically implanting a knee joint replacement is a direct cost of that surgery because it is a unique piece. However, if no clear link between a cost and the cost objective is apparent, the cost is an **indirect cost** (also called a common cost). For example, the heating cost for a physical therapy center is an indirect cost to each patient being served there.

The same cost can be direct for one purpose and indirect for another. For example, the salary of the St. Louis office manager is a direct cost of that branch. But within the branch office where numerous products are sold, the manager's salary is an indirect cost of specific products. At McDonald's, cleaning supplies would be a direct cost for a particular restaurant, but corporate legal expenses would be an indirect cost for a particular restaurant.

Cost Allocations

Indirect costs not traceable to particular products or departments may need to be allocated to those objectives. A cost objective may use a resource, but the amount used may not be easily measured. For example, an eye clinic occupies 2,000 square feet of a 50,000 square medical clinic and accounts for 10% of sales and 6% of profits. If the rent for the entire facility is $300,000 per year, how much should be allocated to the eye clinic—$12,000 (space), $18,000 (profits), $30,000 (sales), or some other amount? No cost allocation is absolutely correct, and different viewpoints will argue for different allocations. The allocation process should attempt to link the cost, the use of the resource, and the activity or output.

Controllable Costs Versus Noncontrollable Costs

Another important aspect of cost is the distinction between costs that can and cannot be controlled by a given manager. This cost classification, like the direct and indirect cost classification, depends on a point of reference. If a manager is responsible for a cost, that cost is a **controllable cost** with respect to that manager. If that manager is not responsible for incurring a cost, it is a **noncontrollable cost** with respect to that manager. The entire cost control system rests on who can control each cost.

All costs are controllable at some level of management. Every cost in an organization is controllable by some manager in that organization. Costs should be planned or budgeted by the manager who has responsibility for that cost. For a McDonald's restaurant manager, the cost of utilities would be controllable, while property insurance costs would be noncontrollable.

9.7 Contribution Margin and Its Many Versions

Thus far, we have defined cost terms. But managerial responsibility for profit measurement is even more important. Revenue is added to the analysis. While net profit evaluates the entire firm, measuring profitability of parts of a firm requires more finely tuned profit yardsticks. The term we use is **contribution margin**, which is the revenue minus certain costs, a margin. This margin contributes to covering all remaining costs and to earning a net profit. Figure 9.12 shows five versions used in different situations.

Figure 9.12: Versions of contribution margin

Variable Contribution Margin:	Sales price per unit	Sales percentage
Total sales	– Variable cost per unit	– Variable cost percentage
– Total variable costs	Contribution margin per unit	Contribution margin percentage
Variable contribution margin		or Contribution margin ratio
or Contribution margin		
Controllable Contribution Margin:		**Direct (or Segment) Contribution Margin:**
Total sales		Total sales
– Controllable costs		– Direct (or Segment) costs
Controllable contribution margin		Direct (or Segment) contribution margin

Variable Contribution Margin—Per Unit, Ratio, and Total Dollars

The basic and most common definition of contribution margin is sales minus variable costs. **Variable contribution margin** is a more explicit term because only variable items (revenue and costs) are included in the calculation. This contribution margin pays for fixed costs and includes any net profit. We use this definition of contribution margin in Chapter 10.

As an example, a medical supply salesperson is selling a product for $20 per unit. The firm buys the item for $12 per unit and pays the salesperson a 10% commission. The firm expects to sell 10,000 units. Variable contribution margin can be shown as follows:

	Variable Contribution Margin		
	Per Unit	**Ratio**	**Total Dollars**
Sales (10,000 units)	$20	100%	$200,000
Variable costs:			
Cost of sales and commissions ($12 plus 10% of $20)	14	70	140,000
Variable contribution margin	$ 6	30%	$ 60,000

Thus, the contribution margin can be expressed as either $6 per unit, 30% of sales, or $60,000. Depending on the analysis needed, we may use one, two, or all three versions. From total variable contribution margin, we subtract fixed expenses—the remaining expenses—to arrive at net profit.

Controllable and Direct Contribution Margins

The next contribution margin concept looks at managerial control and is used when a manager has revenue and cost responsibility. Costs controllable by the manager are typically variable costs and controllable fixed costs. These costs are subtracted from sales to yield **controllable contribution margin** or controllable margin. This represents the money available to pay any noncontrollable expenses and includes any company net profit. Note that the definitions of controllable and noncontrollable developed previously are used for both revenue and costs. Controllable contribution margin is used to evaluate managerial performance. However, this is not the net profit that the manager generates for the company, since noncontrollable costs must be paid before any net profit is earned.

Direct or **segment contribution margin** (or segment margin) is a segment's revenue minus its direct costs. A segment might be a product, a region, or a division. Definitions of direct and indirect were discussed earlier and focus on traceability. As an example, the direct contribution margin of a product line is sales less product-line cost of sales, product-line advertising costs, and any other costs traceable to that product line. The product line's direct contribution margin is the revenue remaining to pay for company common costs and to earn company profits.

Illustration of All Contribution Margin Concepts

Sandra Banks owns three Eye Express locations. Exhibit 9.2 presents a summary income statement, expanded for the Grand Avenue location. Variable contribution margin is shown in total dollars for each store and also as a ratio for the Grand Avenue store. **Direct controllable fixed expenses** include assistant managers' salaries, maintenance services, and other fixed costs that the store manager controls. The controllable contribution

margin is the profit on which the Grand Avenue manager will be evaluated and rewarded (a bonus for meeting profit goals or profit improvement). **Direct noncontrollable fixed expenses** include rent on the building and the outlet manager's salary, which are probably controlled by Banks.

Exhibit 9.2: Contribution margin analysis by store

Contribution Analysis by Store for the Month of September

	River Road	Pine Street	Grand Avenue		Totals
Sales	$ 120,000	$ 96,000	$ 185,000	100%	$ 401,000
Variable eye glass expenses	$ 55,500	$ 46,000	$ 85,100	46%	$ 186,000
Other variable expenses	6,000	4,500	11,100	6	21,600
Total variable expenses	$ 61,500	$ 50,500	$ 96,200	52%	$ 208,200
Variable contribution margin	$ 58,500	$ 45,500	$ 88,800	48%	$ 198,800
Direct controllable fixed expenses	12,600	13,900	20,400		46,900
Controllable contribution margin	$ 45,900	$ 31,600	$ 68,400		$ 145,900
Direct noncontrollable fixed expenses	24,400	21,300	38,900		84,600
Direct contribution margin	$ 21,500	$ 10,300	$ 29,500		$ 61,300
Common corporate expenses					$ 36,900
Net profit					$ 24,400

This direct or store contribution margin is used to measure the profit performance of each store. Measuring store profitability stops at the direct contribution margin. Direct contribution margin is the finest-tuned profit measure that is free of allocations. Common corporate expenses, which include Banks' salary and other corporate expenses, cannot be traced to the three locations.

Contribution margin per unit requires more detail. Banks has set target contribution margins for her three eyeglass products as follows:

	Average for			
	Basic Glasses	Sun-glasses	Bifocals	All Glasses
Selling price per unit	$50.00	$65.00	$100.00	$71.67
Variable eyeglass costs per unit	25.00	26.00	35.00	28.67
Variable contribution margin per unit	25.00	39.00	65.00	43.00
Variable contribution margin ratio	50%	60%	65%	60%

Note that the other variable expenses (probably supplies) in Exhibit 9.2 cannot be traced accurately to each product. Now, actual eyeglass margins can be compared across all stores and to margin targets.

Ms. Banks has numerous versions of profitability for each location. She will use each to answer specific questions about her products, managers, and stores.

Common use of the term "contribution margin" frequently means variable contribution margin. But play it safe—define which contribution margin you are using.

Case Study: Community Clinic

The Community Clinic at Western State University has contracted with the Fiscal Planning Office (FPO) of the state legislature to do economic analyses and forecasting. Most of the work involves patient services for low-income patients. The contract calls for payment of all direct costs of personnel with limits on the amount of chargeable time per quarter. An overhead rate is applied to personnel charges at 60% of direct personnel costs. This rate is developed by the university to cover common costs of operating the clinic plus personnel benefits of the persons working on the project.

Patient services costs are reimbursed on a cost basis and include additional equipment needed to perform the services.

An auditor from the state's Auditor General's Office has just finished a routine audit of this contract and has written a report critical of the Community Clinic. Among the items noted are:

1. An x-ray machine was leased by the Community Clinic to perform patient services on patients who are patients eligible for community services as well as patients not eligible for the free services of community clinic.
2. Personnel time was billed to the contract using a rate based on the contracting faculty person's annual salary divided by 250 workdays. But the auditor found that the work was actually done by a graduate student earning about 20% of the faculty person's salary.
3. The medical equipment purchased for Community Clinic contract use has been used to perform services for the clinic's patients as well as other patients served by medical facilities at Western State. The faculty members use the medical equipment at night and on weekends when the Community Clinic is closed.

Case Study Exercises

1. Identify the parties that have an economic interest in these issues.
2. Does the Community Clinic appear to be costing the contract with the FPO fairly? Evaluate each issue, given the information available.

Key Terms

bill of materials A complete list of all materials used in a product.

Certified Management Accountant (CMA) A person who has passed a qualifying examination sponsored by the Institute of Management Accountants, has met an experience requirement, and participates in continuing education.

committed fixed cost A fixed cost over which a manager has no control and must incur.

contribution margin Sales revenue less variable costs.

controllable contribution margin Variable contribution margin less direct controllable fixed expenses (represents the money available to pay any noncontrollable expenses and includes any company net profit).

controllable cost A cost that a manager has the ability to influence.

controller The person responsible for managing the entire accounting function.

conversion costs Direct labor plus manufacturing overhead (costs incurred to convert raw materials into finished products).

cost The amount of resources given up to gain a specific objective or object.

cost behavior How a cost changes with changes in business activity.

cost drivers Measures that link activities, which create outputs to resources that are used.

cost function An expression that mathematically links costs, their behavior, and their cost driver.

cost objective Any purpose for accumulating costs.

cost of goods manufactured Total cost of goods completed during the period.

cost of goods sold The total of direct materials, direct labor, and manufacturing overhead costs associated with the goods that have been sold during the period.

direct contribution margin Controllable contribution margin less direct noncontrollable fixed expenses (reflects the amount remaining to pay for common costs and earn profits).

direct controllable fixed expenses Fixed expenses that are traceable and that a manager has the ability to influence.

direct cost A cost that is traceable to a cost objective.

direct labor costs Wages paid to workers who work directly on the product.

direct materials cost Cost of the physical components of the product.

direct materials used Materials issued to production.

direct noncontrollable fixed expenses Fixed expenses that are traceable, but that a manager is not able to influence.

direct product costs Costs that can be traced to specific products.

discretionary fixed costs Expenditures that managers can elect to spend or not to spend.

factory overhead costs All manufacturing costs that are not direct materials or direct labor.

finished goods inventory Products that have been completed and are ready for sale.

fixed cost A cost that remains constant, regardless of changes in a company's activity.

indirect cost A cost that has no clear link to a specific cost objective. Also known as *common cost*.

indirect product costs Manufacturing costs that cannot be traced to a specific product.

management accountant An accountant who prepares information for a company's decision makers.

materials inventory Materials that are stored by the company.

mixed cost A cost that contains both variable and fixed elements.

noncontrollable cost A cost that a manager is not able to influence.

nonlinear costs A cost for which the cost function cannot be represented as a straight line.

overhead The ongoing expenses for operating a business not directly related to providing the business's products or services. For example, utilities are a common overhead expense.

period costs Operating costs that are expensed in the period in which they are incurred.

piece-wise linear cost A cost function consisting of connected straight lines with differing slopes.

prime costs Direct materials cost plus direct labor cost.

product costing The process of attaching costs to units of product.

product costs Costs that are treated as assets until the products are sold.

relevant range Normal range of expected activity.

segment contribution margin A segment's revenues minus its direct costs.

semifixed costs Costs that are typified by step increases in costs with changes in activity.

semivariable cost A cost composed of a mixture of fixed and variable components.

step-fixed costs Costs that are typified by step increases in costs with changes in activity.

total manufacturing costs The sum of direct materials, direct labor, and factory overhead costs.

traceable cost A cost that can be directly linked to a cost objective.

variable contribution margin Sales revenues less all variable expenses.

variable cost A cost that changes in proportion to a change in a company's activity.

work in process inventory The cost of products that have been started in the manufacturing process but have not yet been completed.

Review Questions

The following questions relate to several issues raised in the chapter. Test your knowledge of these issues by selecting the best answer. (The odd-numbered answers appear in the answer appendix.)

1. Briefly describe three ways in which financial accounting and managerial accounting are different. Name two ways in which they are the same or similar.

2. Briefly describe the management accountant's responsibility for ethical behavior with respect to competence, confidentiality, integrity, and credibility.

3. What are sources of counsel and guidance on ethical dilemmas available to a manager?

4. Define the terms "cost objective" and "cost driver." How do they relate to resources and resource costs?

5. What does the mathematical expression \$100,000 + \$12 (X) mean in terms of measuring product cost?

6. Identify at least two ways in which fixed costs pose difficulties for cost accountants and managers.

7. In a recent speech, controller Judy Koch said, "I rarely see a real variable cost or a truly fixed cost." What did she mean? She also commented, "Some of my friends define semivariable costs, semifixed costs, step costs, and mixed costs differently. Other friends often use these terms interchangeably. And I like all of my friends." Was she just trying to be funny, or is there truth in her quip? Explain.

8. Will an indirect cost be reduced by eliminating a product? Explain. Give an example of where an indirect cost might be reduced and of where it might not be reduced.

9. Leah Starkman supervises the admissions department at Tender Care Hospital. The hospital accountant includes Leah's salary among the direct expenses in her departmental expense report. Leah claims she cannot control her own salary; therefore, it should not be in admissions department's expense report. Is Leah correct? Explain.

10. We have 15 subsidiaries. All corporate costs are allocated to the subsidiaries. In evaluating the profitability of our French subsidiary, we find it generates a net loss. Why might this number not be a good indicator of the profit contribution that this subsidiary makes to the corporation as a whole?

Exercises

1. **Ethical dilemma**. You are on your way to lunch and the elevator is packed. Two persons from a firm that competes with your employer happen to be talking about a business deal, which involves one of your customers. Your computer-like mind lists your alternatives: plug your ears, tell them that you are with a competitor, listen and then delete the information from your brain, immediately go back to the office and act on the new information, or call their supervisor and report the conversation you just overheard. What should you do?

2. **Ethical conduct**. Comment on the following frequently heard statements about ethical conduct:

   a. "You can't teach ethics. If people don't know right from wrong by now, they'll never learn."
   b. "It's legal. My attorney says so. Therefore, it's okay."
   c. "Are you trying to impose your values on me?"
   d. "I believe in situational ethics. What's right or wrong depends on the situation."
   e. "I can't be ethical all the time. My competitors would eat me alive!"
   f. "Everyone does it."

3. **Cost flows in manufacturing**. The following data are from the Westerman Medical Supplies Company for August production activities:

Inventories:	August 1	August 31
Direct materials	$18,000	$10,000
Work in process	12,000	16,000
Finished goods	45,000	38,000
Month of August		
Factory overhead	$120,000	
Cost of goods manufactured	?	
Direct materials purchased	80,000	
Direct labor	30,000	

   a. What was the cost of direct materials used during August?
   b. What was the cost of goods manufactured?

4. **Cost measurement in manufacturing**. D.W. Wheelchair Manufacturing Company of Hong Kong used materials costing HK$200,000 in the production of 10,000 units of product. No materials were on hand at the beginning or at the end of the year. Labor costs of HK$50,000 were incurred. Other costs of manufacturing, such as factory supervision, utilities, taxes, and insurance, are all fixed costs and amounted to HK$250,000 for the year. Administrative and marketing costs were HK$60,000. No finished goods inventory existed at the beginning of the year, and 8,000 units of product were sold during the year.

   a. Find the cost per unit to manufacture the product. Break down the cost by traditional product cost elements.
   b. Show where total manufacturing costs are at the end of the year.

5. **Finding and using a cost function**. Blackmore Medical Equipment Corporation, located in London, United Kingdom, has collected the following data on the costs of electricity and machine hours used for 3 months:

	Cost of Electricity	Machine Hours
October	£17,000	3,000
November	22,000	4,000
December	12,000	2,000

The production manager thinks that a pattern exists for electricity costs.

a. Using the approach discussed in the chapter, does a cost function exist for electricity?
b. If so, does one cost function work for all 3 months? Explain.
c. If the plant manager expects fixed costs to increase by £1,500 per month and variable cost to increase by 5%, what total costs should be expected for next year, if machine hours are expected to average 3,500 hours per month?

6. **Variable contribution margin**. Bob David's Lab performs blood tests in its laboratory. Data from the third quarter of the past year include:

Selling price	$15 per test
Variable lab costs	$8 per test
Variable administrative and shipping expenses	$3 per test
Total fixed lab costs	$25,000 per quarter
Total fixed administrative expenses	$15,000 per quarter
Tests performed	15,000 tests

a. Prepare an income statement showing several forms of variable contribution margin plus net income.

7. **Direct and controllable costs**. Gus Undheidt is manager of Allergy Relief Services in the Frankfurt, Germany, office and has the authority to buy supplies, hire labor, and maintain equipment for the office. Costs in euros for January appearing in the Frankfurt office performance report are:

Home office general manager's salary allocated to Frankfurt office	€3,000
Home office operating expenses allocated to Frankfurt office	2,200
Home office marketing costs allocated to Frankfurt office	1,700
Equipment maintenance charges—Frankfurt office	2,600
Supplies used—Frankfurt office	1,400
Salary—Gus Undheidt	2,500
Labor cost—Frankfurt office	14,600
Home office depreciation allocated to Frankfurt office	1,100
Equipment depreciation—Frankfurt office	2,300
Total	€31,300

a. Identify costs that can be controlled by Gus Undheidt.
b. Identify costs that can be traced directly to Frankfurt office.
c. Identify costs allocated to Frankfurt office from the home office. Suggest a cost driver that might have been used to allocate these costs at the home office for each cost.

Problems

1. **Classifying facility costs**. Rabin Medical Clinic operates from a facility in Augusta. It sees patients, performs basic outpatient surgery procedures, and provides radiology imaging services. The following selected costs relate to the clinic's activities.

   a. supplies used for radiology imaging
   b. hourly wages of personnel in radiology imaging department
   c. clinic property taxes and insurance
   d. supplies used, which changes with patient volume in outpatient surgery department
   e. contract signed by radiology imaging department manager for an annual maintenance fee on radiology imaging machinery
   f. equipment depreciation in radiology imaging department
   g. building depreciation
   h. commissions for representatives
   i. advertising agency contract costs for a special program
   j. annual computer staff; uses the same number of staff all year—half for operations, which includes the radiology and surgery departments, and half for administrative work

   Instructions

   Based on reasonable assumptions about Rabin Medical Clinic, classify each cost as

   a. variable or fixed cost.
   b. controllable or noncontrollable by the supervisor of the radiology or surgery departments.
   c. direct or indirect product costs or period costs.

2. **Finding production costs**. Shirley Brickman knows the following about the production process in her plant, which builds wheelchairs:

   Department 1:

   Conversion costs are $200,000.

   Prime costs are $300,000.

   Materials purchases are $200,000.

   Increase in materials inventory is $20,000.

   Decrease in work in process inventory is $40,000.

Instructions

a. Find factory overhead costs.

Department 2:

Direct product costs are materials and direct labor.

Conversion costs are 300% of materials.

Indirect product costs are 50% of conversion costs.

Total manufacturing costs are $600,000.

Instructions

a. Find materials costs.

Department 3:

Conversion costs are 40% of total manufacturing costs.

Direct labor is 25% of conversion costs.

Factory overhead is $600,000.

Instructions

a. Find total manufacturing costs.

3. **Determining unknowns**. Find the missing values in the following manufacturing income statement for a medical equipment supplier:

	2014	2015	2016
Sales	$?	$118,700	$?
Cost of goods sold:			
Direct materials inventory 1/1	$ 8,000	$?	$?
+ Direct materials purchases	?	20,000	30,000
Direct materials available	$?	$ 26,000	$?
− Less direct materials inventory 12/31	?	−9,000	−12,300
Direct materials used	$?	$?	$?
Direct labor	20,000	23,500	?
Factory overhead	16,000	?	24,000
Total manufacturing costs	$53,000	$?	$ 90,900
+ Work in process inventory 1/1	12,000	18,000	?
− Work in process inventory 12/31	?	−16,300	−22,300
Cost of goods manufactured	$?	$ 63,500	$ 84,900
+ Finished goods inventory 1/1	?	?	?
Goods available for sale	$62,000	$ 84,500	$103,200
− Finished goods inventory 12/31	−21,000	?	?
Cost of goods sold	$?	$?	$ 78,200
Gross profit	$60,000	$?	$ 46,800

4. **Finding cost of goods sold**. Asnien Medical Supplies makes scrubs. The general manager has a special board on his office wall where he writes key statistics. For March, the board shows the following:

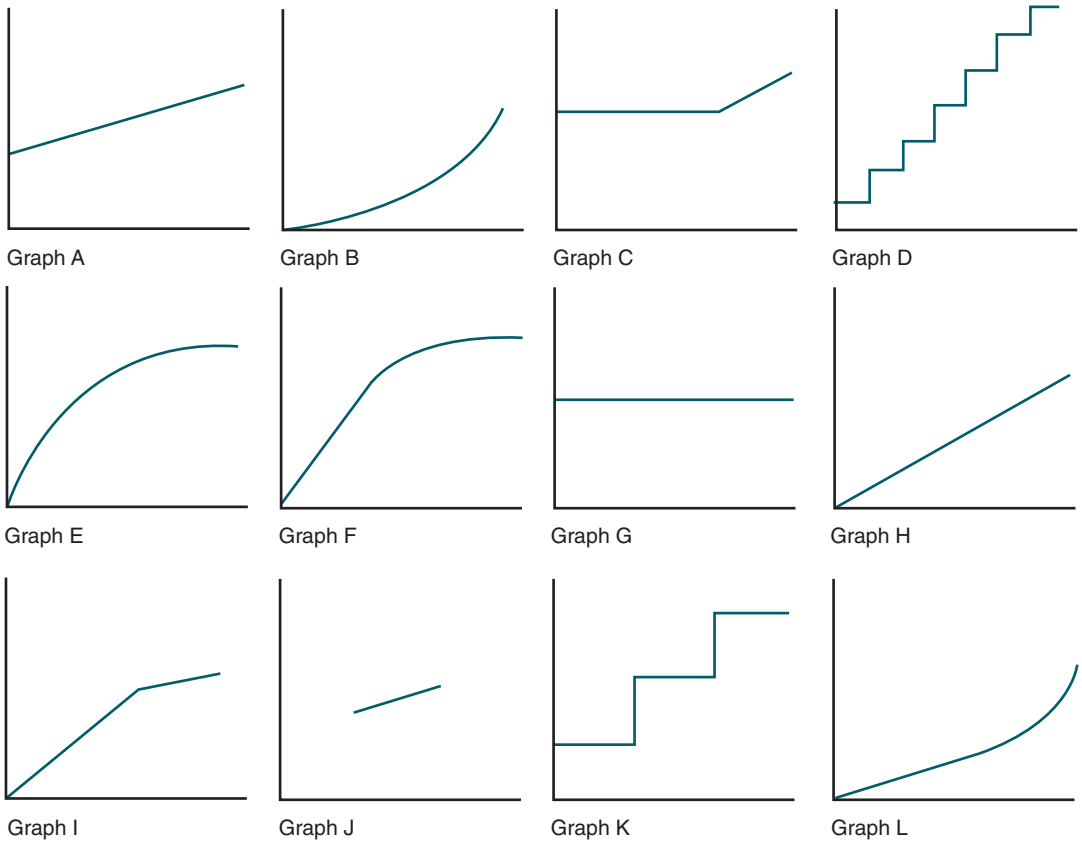
Production output	25,000 units
Materials costs	$50,000
Direct labor costs	2,000 hours at $10 per hour
Factory overhead	$2 per outfit plus $40,000 per month
Selling expenses	$1 per outfit sold plus $50,000 per month

He heard the sales manager brag about selling 22,000 scrubs outfits this month.

Instructions

a. From the data, what was the cost of producing a scrubs outfit in March?
b. What was cost of goods sold in March?
c. What are the total product and period costs that will appear on Asnien Medical Supplies's income statement for March?

5. **Identifying cost patterns**. Match the graphs in the summary of costs classifications, provided below, with the descriptions provided below. Indicate any assumptions you are making. The *X*-axis is activity; the *Y*-axis is total dollars of cost.



Instructions

Use the figure provided above to match each graph with one of the descriptions listed below.

a. $a + b\ (X)$, where a and b are not equal to zero
b. straight-line depreciation expense (a classic fixed cost)
c. shift supervision salaries (shifts added as demand increases)
d. municipal utility costs where the rate increases as usage increases (Usage increases with activity increases.)
e. sales commissions paid to salespersons
f. workers' wages plus overtime premium (Overtime is needed after a certain activity level is reached. Workers are less efficient when they work a lot of overtime.)
g. water and wastewater costs with a fixed-cost base charge plus a per-gallon rate beyond a certain level
h. payroll taxes that are based on the first $30,000 of each employee's wages (All employees earn more than this at high activity levels.)
i. mixed costs within a relevant range
j. cost of hourly messenger service for a regional bank with a reduced rate after 2,000 hours of chargeable time
k. wage costs as more hourly telephone callers are added in a telemarketing campaign
l. materials costs where cost per pound decreases as we purchase larger quantities

6. **Cost behavior using cost functions**. The following situations have been observed by a services industry cost consultant:

a. Jacquet Medical Transport transports patients. Costs for Week 1 were $28,000 when 700 patients were transported. In Week 2, $36,000 was spent to move 1,100 patients.
b. Stoia Hospital's credit checking department's cost function is $5 per credit check plus $2,000.

Instructions

a. Determine the cost function for Jacquet Medical Transport based on the information provided.
b. Determine how well the actual costs follow the cost function for Stoia Hospital's credit checking department if $13,200 was spent and 2,100 credit checks were performed.