

LEARNING OBJECTIVES

After studying this chapter, you should be able to:

1. Define and illustrate a cost object
2. Distinguish between direct costs and indirect costs
3. Explain cost drivers, variable costs, and fixed costs
4. Understand why unit costs must be interpreted with caution
5. Distinguish between service sector, merchandising sector, and manufacturing sector companies
6. Differentiate between capitalized costs and noncapitalized costs
7. Describe the three categories of inventories commonly found in many manufacturing sector companies
8. Explain how different ways of computing product costs are appropriate for different purposes

Cost Objects

Accountants usually define **cost** as a resource sacrificed or forgone to achieve a specific objective. Most people consider costs as monetary amounts (such as dollars, pesos, pounds, or yen) that must be paid to acquire goods and services. For now we can think of costs in this conventional way.

To guide their decisions, managers often want to know how much a certain thing (such as a new product, a machine, a service, or a process) costs. We call this “thing” a **cost object**, which is anything for which a separate measurement of costs is desired. Exhibit 2-1 provides examples of several different types of cost objects.

Cost Accumulation and Cost Assignment

A costing system typically accounts for costs in two basic stages:

- ◆ **Stage 1.** It *accumulates* costs by some “natural” (often self-descriptive) classification such as materials, labour, fuel, advertising, or shipping.
- ◆ **Stage 2.** It *assigns* these costs to cost objects.

Cost accumulation is the collection of cost data in some organized way through an accounting system. **Cost assignment** is a general term that encompasses both (1) tracing accumulated costs to a cost object and (2) allocating accumulated costs to a cost object. Costs that are traced to a cost object are direct costs, and costs that are allocated to a cost object are indirect costs. Nearly all accounting systems accumulate **actual costs**, which are the costs incurred (historical costs), as distinguished from budgeted or forecasted costs.

EXHIBIT 2-1
Examples of Cost Objects

Cost Object	Illustration
Product	A ten-speed bicycle
Service	An airline flight from Toronto to London
Project	An airplane assembled by Boeing for Singapore Airlines
Customer	All products purchased by Loblaw's (the customer) from General Foods
Brand category	All soft drinks sold by a Pepsi-Cola bottling company with “Pepsi” in their name
Activity	A test to determine the quality level of a television set
Department	A department within a government environmental agency that studies air emissions standards
Program	An athletic program of a university

| Cost Tracing and Cost Allocation

Factors Affecting Direct/Indirect Cost Classifications

Several factors will affect the classification of a cost as direct or indirect:

1. **The materiality of the cost in question.** The higher the cost in question, the more likely the economic feasibility of tracing that cost to a particular cost object. Consider a mail-order catalogue company. It would probably be economically feasible to trace the courier charges for delivering a package directly to each customer. In contrast, the cost of the invoice paper included in the package sent to the customer is likely to be classified as an indirect cost, because it is not economically feasible to trace the cost of this paper to each customer. The benefits of knowing the exact number of (say) \$0.05 worth of paper included in each package typically do not justify the costs of money and time in tracing the costs to each package.
2. **Available information-gathering technology.** Improvements in this area are enabling an increasing percentage of costs to be classified as direct. Bar codes, for example, allow many manufacturing plants to treat certain materials previously classified as indirect costs as direct costs of products. Bar codes can be read into a manufacturing cost file by waving a “wand” in the same quick and efficient way supermarkets now enter the cost of many items purchased by its customers.
3. **Design of operations.** Facility design can impact cost classification. For example, classifying a cost as direct is helped if an organization’s facility (or part thereof) is used exclusively for a specific product or specific cost object, such as a particular customer.
4. **Contractual arrangements.** For example, a contract stating that a given component (an Intel Pentium chip) can be used only in a specific product (an IBM PC) makes it easier to classify the component as a direct cost of the product.

This book examines different ways to assign costs to cost objects. For now, be aware that one particular cost may be both direct and indirect. How? *The direct/indirect classification depends on the choice of the cost object.* For example, the salary of an assembly department supervisor may be a direct cost of the assembly department at Ford but an indirect cost of a product such as the Ford Taurus.

The continuous cost reduction efforts of competitors create a never-ending need for organizations to reduce their own costs. Cost reduction efforts frequently focus on two key areas:

1. Doing only **value-added activities**, that is, those activities that customers perceive as adding value to the products or services they purchase
2. Efficiently managing the use of the cost drivers in those value-added activities

A **cost driver** (also called a *cost generator* or *cost determinant*) is any factor that affects total costs. That is, a change in the level of the cost driver will cause a change in the level of the total cost of a related cost object.

Exhibit 2-2 presents examples of cost drivers in each of the business functions of the value chain. Some cost drivers are financial measures found in accounting systems (such as direct manufacturing labour costs and sales dollars), while others are nonfinancial variables (such as the number of parts per product and the number of service calls). We now discuss the role of cost drivers in describing cost behaviour.

Cost management is the set of actions that managers take to satisfy customers while continuously reducing and controlling costs. A caveat on the role of cost drivers in cost management is appropriate. Changes in a particular cost driver do not automatically lead to changes in overall costs. Consider the number of items distributed as a driver of distribution labour costs. Suppose that management reduces the number of items distributed by 25%. This reduction does not automatically translate to a reduction in distribution labour costs. Managers must take steps to re-

EXHIBIT 2-2

Examples of Cost Drivers of Business Functions in the Value Chain

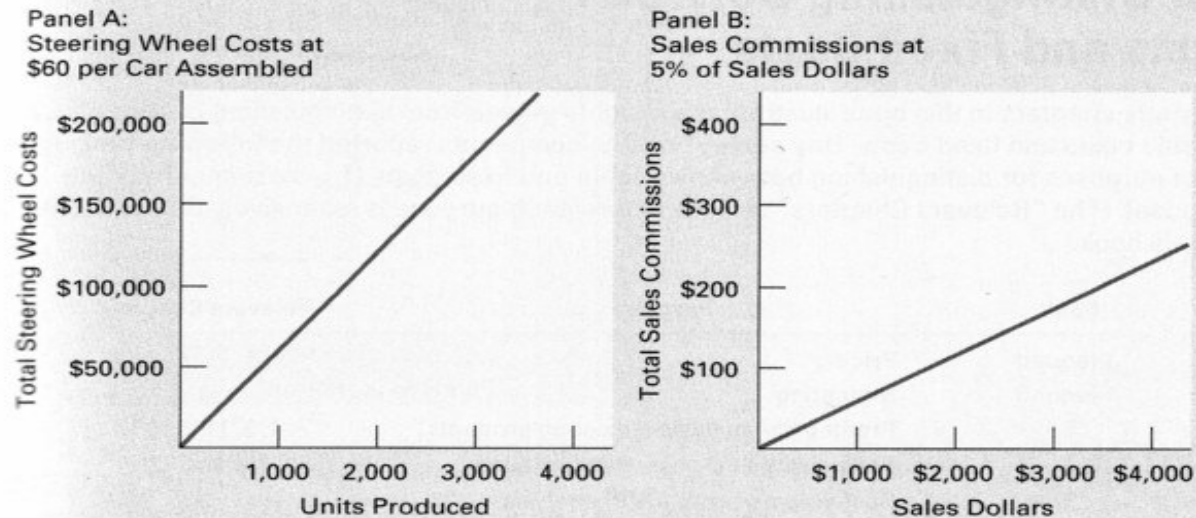
Business Function	Cost Driver
Research and development	<ul style="list-style-type: none">◆ Number of research projects◆ Personnel hours on a project◆ Technical complexity of projects
Design of products, services, and processes	<ul style="list-style-type: none">◆ Number of products in design◆ Number of parts per product◆ Number of engineering hours
Production	<ul style="list-style-type: none">◆ Number of units produced◆ Direct manufacturing labour costs◆ Number of setups◆ Number of engineering change orders
Marketing	<ul style="list-style-type: none">◆ Number of advertisements run◆ Number of sales personnel◆ Sales dollars
Distribution	<ul style="list-style-type: none">◆ Number of items distributed◆ Number of customers◆ Weight of items distributed
Customer service	<ul style="list-style-type: none">◆ Number of service calls◆ Number of products serviced◆ Hours spent servicing products

Management accounting systems record the cost of resources acquired and track their subsequent use. Tracing these costs allows managers to see how these costs behave. Let us now consider two basic types of cost behaviour patterns found in many of these systems—variable costs and fixed costs. A **variable cost** is a cost that changes in total in proportion to changes in a cost driver. A **fixed cost** is a cost that does not change in total despite changes in a cost driver.

- ◆ **Variable costs.** If General Motors buys a steering wheel at \$60 for each of its Saturn cars, then the total cost of steering wheels should be \$60 times the number of cars assembled. This is an example of a variable cost, a cost that changes *in total* in proportion to changes in the cost driver (number of cars). The variable cost per car does not change with the number of cars assembled. Exhibit 2-3 (Panel A) illustrates this variable cost. A second example of a variable cost is a sales commission of 5% of each sales dollar. Exhibit 2-3 (Panel B) shows this variable-cost example.
- ◆ **Fixed costs.** General Motors may incur \$20 million in a given year for the leasing and insurance of its Saturn plant. Both are examples of fixed costs, costs that are unchanged in total over a designated range of the cost driver during a given time span. Fixed costs become progressively smaller on a per-unit basis as the cost driver increases. For example, if General Motors assembles 10,000 Saturn vehicles at this plant in a year, the fixed cost for leasing and insurance

EXHIBIT 2-3

Examples of Variable Costs



per vehicle is \$2,000 ($\$20 \text{ million} \div 10,000$). In contrast, if 50,000 vehicles are assembled, the fixed cost per vehicle becomes \$400.

Do not assume that individual cost items are inherently variable or fixed. Consider labour costs. An example of purely variable labour costs is the case where workers are paid on a piece-unit basis. Some textile workers are paid on a per-shirt-sewed basis. In contrast, labour costs are appropriately classified as fixed when lifetime employment exists or where union conditions severely restrict an organization's flexibility to assign workers to any area that has extra labour requirements.

Major Assumptions

The definitions of variable costs and fixed costs have important underlying assumptions:

1. Costs are defined as variable or fixed with respect to a specific cost object.
2. The time span must be specified. Consider the \$20 million rent and insurance General Motors pays for its Saturn plant. This amount may be fixed for one year. Beyond that time, the rent and insurance may be renegotiated to be, say, \$22 million for a subsequent year.
3. Total costs are linear. That is, when plotted on ordinary graph paper, a total variable-cost or fixed-cost relationship to the cost driver will appear as an unbroken straight line.
4. There is only one cost driver. The influences of other possible cost drivers on total costs are held constant or deemed to be insignificant.
5. Variations in the level of the cost driver are within a relevant range (which we discuss in the next section).

Variable costs and fixed costs are the two most frequently recognized cost behaviour patterns in existing management accounting systems. Additional cost behaviour patterns are discussed in subsequent chapters (see Chapters 5 and 10).

Relevant Range

A **relevant range** is the range of the cost driver in which a specific relationship between cost and driver is valid. A fixed cost is fixed only in relation to a given relevant range (usually wide) of the cost driver and a given time span (usually a particular budget period). Consider the Thomas Transport Company (TTC), which operates two refrigerated trucks that carry agricultural produce to market. Each truck has an

annual fixed cost of \$40,000 (including an annual insurance cost of \$15,000 and an annual registration fee of \$8,000) and a variable cost of \$1.20 per kilometre of hauling. TTC has chosen kilometres of hauling to be the cost driver. The maximum annual usage of each truck is 120,000 kilometres. In the current year (19_7), the predicted combined total hauling of the two trucks is 170,000 kilometres.

Exhibit 2-4 shows how annual fixed costs behave at different levels of kilometres of hauling. Up to 120,000 kilometres, TTC can operate with one truck; from 120,001 to 240,000 kilometres, it can operate with two trucks; and from 240,001 to 360,000, it can operate with three trucks. This pattern would continue as TTC added trucks to its fleet. The bracketed section from 120,001 to 240,000 is the range at which TTC expects the \$80,000 to be valid given the predicted 170,000 kilometre usage for 19_7.

Fixed costs may change from one year to the next. For example, if the annual registration fee for refrigerated trucks is increased in 19_8, the total level of fixed costs will increase (unless offset by a reduction in other fixed items).

EXHIBIT 2-4
Fixed-Cost Behaviour at Thomas Transport Company

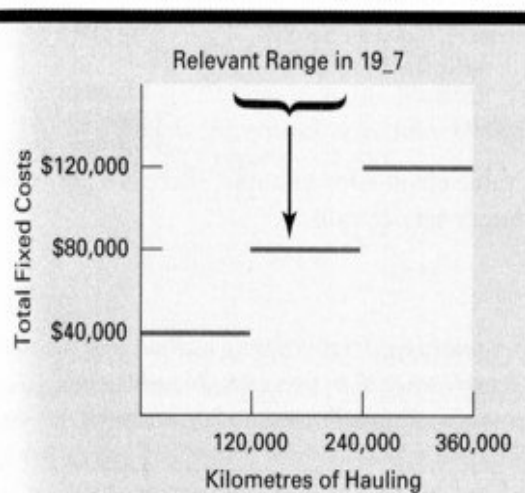


EXHIBIT 2-5
Examples of Simultaneous Direct/Indirect and Variable/Fixed-Cost Classifications

		Assignment of Costs to Cost Object	
		Direct Cost	Indirect Cost
Cost Behaviour Pattern	Variable Cost	<i>Cost object:</i> Assembled automobile <i>Example:</i> Tires used in assembly of automobile	<i>Cost object:</i> Assembled automobile <i>Example:</i> Power costs where power usage is metered only to the plant
	Fixed Cost	<i>Cost object:</i> Marketing department <i>Example:</i> Annual leasing cost of cars used by sales force representatives	<i>Cost object:</i> Marketing department <i>Example:</i> Monthly charge by corporate computer centre for marketing's share of corporate computer costs

Relationships of Types of Costs

We have introduced two major classifications of costs: direct/indirect and variable/fixed. Costs may simultaneously be:

- ◆ Direct and variable
- ◆ Direct and fixed
- ◆ Indirect and variable
- ◆ Indirect and fixed

Exhibit 2-5 presents examples of simultaneous cost classifications with each of the four cost types.

Meaning of Unit Costs

Accounting systems typically report both total-cost and unit-cost numbers. A **unit cost** (also called an **average cost**) is computed by dividing some total cost by some number of units. Suppose that \$980,000 of manufacturing costs were incurred to produce 10,000 units of a finished good. Then the unit cost would be \$98:

$$\frac{\text{Total manufacturing costs}}{\text{Number of units manufactured}} = \frac{\$980,000}{10,000} = \$98 \text{ per unit}$$

If 8,000 units are sold and 2,000 units remain in ending inventory, the unit-cost concept helps in the assignment of total costs for the income statement and balance sheet:

Cost of goods sold in the income statement, 8,000 units × \$98	\$784,000
Ending inventory of finished goods in the balance sheet, 2,000 units × \$98	<u>196,000</u>
Total manufacturing costs of 10,000 units	<u><u>\$980,000</u></u>

Unit costs are found in all areas of the value chain—for example, there are unit costs for product design, sales calls, and customer service calls.

Use Unit Costs Cautiously

Unit costs are averages. As we shall see, they must be interpreted with caution. For decision-making, it is best to think in terms of total costs rather than unit costs. Nevertheless, unit-cost numbers are frequently used in many situations. For example, assume the president of a university social club is deciding whether to hire a musical group for an upcoming party. The group charges a fixed fee of \$1,000. The president may intuitively compute a unit cost for the group when thinking about an admission price. Given the fixed fee of \$1,000, the unit cost is \$10 if 100 people attend, \$2 if 500 attend, and \$1 if 1,000 attend. Note, however, that with a fixed fee of \$1,000 the *total cost* is unaffected by the attendance level, while the *unit cost* is a function of the attendance level. In this example, each attendee is considered to be one unit.

Costs are often neither inherently fixed nor variable. Much depends on the specific context. Consider the \$1,000 fixed fee that we assumed was to be paid to the musical group. This is but one way the musical group could be paid. Possible payment schedules that might be considered include:

- ◆ **Schedule 1.** \$1,000 fixed fee
- ◆ **Schedule 2.** \$1 per person attending + \$500 fixed fee
- ◆ **Schedule 3.** \$2 per person attending

Under schedules 2 and 3, the dollar amount of the payment to the musical group is not known until after the event.

The effects of these three payment schedules on unit costs and total costs for five attendance levels are as follows:

Number of Persons Attending	Schedule 1: \$1,000 Fixed		Schedule 2: \$1 per Person + \$500 Fixed		Schedule 3: \$2 per Person	
	Total Cost	Unit Cost	Total Cost	Unit Cost	Total Cost	Unit Cost
50	\$1,000	\$20	\$ 550	\$11	\$ 100	\$2
100	1,000	10	600	6	200	2
250	1,000	4	750	3	500	2
500	1,000	2	1,000	2	1,000	2
1,000	1,000	1	1,500	1.50	2,000	2

The unit cost under schedule 1 is computed by dividing the fixed cost of \$1,000 by the attendance level. For schedule 2, the unit cost is computed by first determining the total cost for each attendance level and then dividing that amount by that attendance level. Thus, for 250 people, schedule 2 has a total cost of \$750 ($\$500 + 250 \times \1), which gives a unit cost of \$3 per person. Schedule 3 has a unit cost of \$2 per person for any attendance level, because the musical group is to be paid \$2 per person with no fixed payment.

All three payment schedules would yield the same unit cost of \$2 per person only if 500 people attend. The unit cost is not \$2 per person under schedule 1 or schedule 2 for any attendance level except 500 people. Thus, it would be incorrect to use the \$2 per person amount in schedule 1 or 2 to predict what the total costs would be for 1,000 people. Consider what occurs if 250 people attend and the group is paid a fixed fee of \$1,000. The unit cost is then \$4 per person. *While unit costs are often useful, they must be interpreted with extreme caution if they include fixed costs per unit.* When

estimating total cost, think of variable costs as an amount per unit and fixed costs as a lump sum total amount.

The key relationships between total costs and unit costs are summarized in Panel A of Exhibit 2-6. Panel B illustrates these relationships for schedule 3 where the university social club pays the musical group on a variable basis (cost of \$2 per person). Panel C illustrates schedule 1 where the musical group is paid a fixed amount (cost of \$1,000).

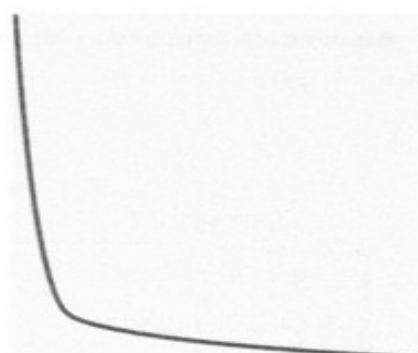
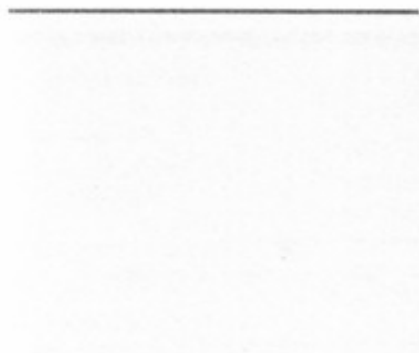
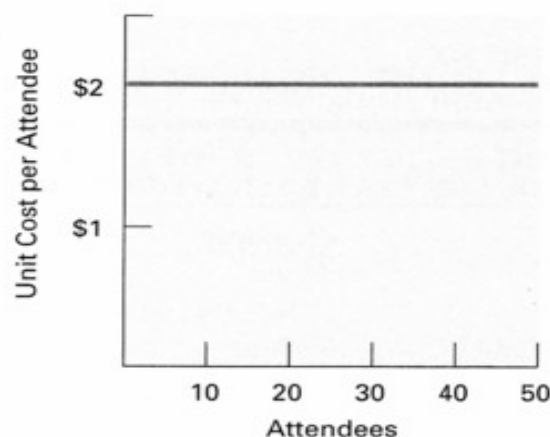
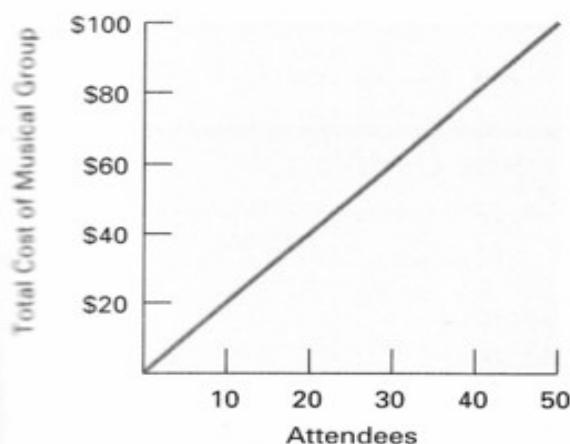
EXHIBIT 2-6

Behaviour of Total Costs and Unit Costs When the Level of the Cost Driver Changes with Illustration of Alternate Payment Schedules for Musical Group

PANEL A: SUMMARY OF KEY RELATIONSHIPS

Cost Behaviour Pattern	Total Costs	Unit Costs
When item is a variable cost	Total costs change with changes in level of cost driver.	Units costs remain the same with changes in level of cost driver.
When item is a fixed cost	Total costs remain the same with changes in level of cost driver.	Unit costs change with changes in level of cost driver.

PANEL B: PAYMENT IS \$2 PER ATTENDEE



2-16 Total costs and unit costs. A student association has hired a musical group for a graduation party. The cost will be a fixed amount of \$4,000.

REQUIRED

1. Suppose 500 people attend the party. What will be the total cost of the musical group? The unit cost per person?
2. Suppose 2,000 people attend. What will be the total cost of the musical group? The unit cost per person?
3. For prediction of total costs, should the manager of the party use the unit cost in requirement 1? The unit cost in requirement 2? What is the major lesson of this problem?

2-17 Total costs and unit costs. Nathan Brown is a well-known motivational speaker. The St. George Speaker's Bureau wants Brown to be the sole speaker at an all-day seminar. Brown's agent offers St. George the choice of three possible fee arrangements:

- ◆ **Schedule 1.** \$8,000 fee
- ◆ **Schedule 2.** \$20 per person + \$2,000 fixed fee
- ◆ **Schedule 3.** \$50 per person

Each attendee will be charged a \$200 fee for the all-day seminar.

REQUIRED

1. What is St. George's fixed cost and variable cost for hiring Brown under each alternative schedule?
2. For each schedule, compute the total cost and unit cost per seminar attendee if (a) 50 attend, (b) 200 attend, and (c) 500 attend. Comment on the results.

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2-19 Cost drivers and the value chain. A Johnson & Johnson analyst is preparing a presentation on cost drivers at its pharmaceutical drug subsidiary. Unfortunately, both the list of its business function areas and the accompanying list of representative cost drivers are accidentally randomized. The two lists now on the computer screen are as follows:

BUSINESS FUNCTION AREA	REPRESENTATIVE COST DRIVER
A. Production	1. Minutes of television advertising time on <i>60 Minutes</i>
B. Research and development	2. Number of calls to toll-free customer phone line
C. Marketing	3. Hours Tylenol packing line in operation
D. Distribution	4. Number of packages shipped
E. Design of products/processes	5. Hours spent designing tamper-proof bottles
F. Customer service	6. Number of patents filed with government agency

REQUIRED

1. Match each business function area with its representative cost driver.
2. Give a second example of a cost driver for each of the business functions of Johnson & Johnson's pharmaceutical drug subsidiary.

- 2-20 Cost drivers and the value chain.** A Toyota analyst is preparing a presentation on cost drivers. Unfortunately, both the list of its business function areas and the accompanying list of representative cost drivers are accidentally randomized. The two lists now on the computer screen are as follows:

BUSINESS FUNCTION AREA	REPRESENTATIVE COST DRIVER
A. Design of products/processes	1. Number of cars recalled for defective parts
B. Customer service	2. Number of machine assembly hours
C. Marketing	3. Number of research scientists
D. Research and development	4. Hours of computer-aided design (CAD) work
E. Distribution	5. Number of sales personnel
F. Production	6. Weight of cars shipped

REQUIRED

1. Match each business function area with its representative cost driver.
2. Give a second example of a cost driver for each of the business function areas of Toyota.

- 2-21 Variable costs and fixed costs.** Consolidated Minerals (CM) owns the rights to extract minerals from beach sands on Fraser Island. CM has costs in three areas:

- a. Payment to a mining subcontractor who charges \$80 per tonne of beach sand mined and returned to the beach (after being processed on the mainland to extract three minerals—ilmenite, rutile, and zircon).
- b. Payment of a government mining and environmental tax of \$50 per tonne of beach sand mined.
- c. Payment to a barge operator. This operator charges \$150,000 per month to transport each batch of beach sand—up to 100 tonnes per batch per day to the mainland and then return to Fraser Island (i.e., 0–100 tonnes per day = \$150,000 per month; 101–200 tonnes = \$300,000, and so on). Each barge operates 25 days per month. The \$150,000 monthly charge must be paid even if less than 100 tonnes are transported on any day and even if Consolidated Minerals requires fewer than 25 days of barge transportation in that month.

CM is currently mining 180 tonnes of beach minerals per day for 25 days per month.

REQUIRED

1. What is the variable cost per tonne of beach sand mined? What is the fixed cost to CM per month?
2. Plot one graph of the variable costs and another graph of the fixed costs of CM. Your plots should be similar to Exhibits 2-4 and 2-5. Is the concept of relevant range applicable to your plots?
3. What is the unit cost per tonne of beach sand mined (a) if 180 tonnes are mined each day and (b) if 220 tonnes are mined each day? Explain the difference in the unit-cost figures.

2-22 Classification of costs, service sector. Consumer Focus is a marketing research firm that organizes focus groups for consumer product companies. Each focus group has eight individuals who are paid \$50 per session to provide comments on new products. These focus groups meet in hotels and are led by a trained independent marketing specialist hired by Consumer Focus. Each specialist is paid a fixed retainer to conduct a minimum number of sessions and a per-session fee of \$2,000. A Consumer Focus staff member attends each session to ensure that all the logistical aspects run smoothly.

REQUIRED

Classify each of the following cost items as:

- Direct or indirect (D or I) costs with respect to each individual focus group.
- Variable or fixed (V or F) costs with respect to how the total costs of Consumer Focus change as the number of focus groups changes. (If in doubt, select the cost type on the basis of whether the total costs will change substantially if a large number of groups are conducted.)

You will have two answers (D or I; V or F) for each of the following items:

Cost Item	D or I	V or F
A. Payment to individuals in each focus group to provide comments on new products		
B. Annual subscription of Consumer Focus to <i>Consumer Reports</i> magazine		
C. Phone calls made by Consumer Focus staff member to confirm individuals will attend a focus group session (records of individual calls are not kept)		
D. Retainer paid to focus group leader to conduct 20 focus groups per year on new medical products		
E. Hotel meals provided to participants in each focus group		
F. Lease payment by Consumer Focus for corporate office		
G. Cost of tapes used to record comments made by individuals in a focus group session (these tapes are sent to the company whose products are being tested)		
H. Gasoline costs of Consumer Focus staff for company-owned vehicles (staff members submit monthly bills with no kilometrage breakdowns)		

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