Chapter 9

Cost Allocations: Theory and Applications

THE EZ-REST MATTRESS COMPANY sells two types of mattresses, Standard and Deluxe, to university dormitories and hospitals. While both mattresses are the same size, the Deluxe mattress has extra padding and is of higher quality. Demand is high for both mattresses, allowing EZ-Rest to operate at full capacity.

However, Craig Edwards, the chief executive officer (CEO) of EZ-Rest, is not satisfied with the firm's performance. Currently, EZ-Rest sells 18,000 Standard mattresses and 12,000 Deluxe mattresses, for 30,000 total units every year. Craig wonders whether EZ-Rest could make more money by selling more of the Deluxe mattresses. His plan is to keep total sales volume the same, but to sell 20,000 Deluxe mattresses and 10,000 Standard mattresses. Craig believes that the company can achieve this goal within the next three years. Before he makes the necessary changes to the company's operations, Craig asks you to evaluate the merits of this decision.

APPLYING THE DECISION FRAMEWORK

What Is the Problem?	Even though EZ-Rest currently operates at capacity, CEO Craig Edwards wants the company to increase its profit.
What Are the Options?	We will examine two options: (1) Change the product mix to emphasize Deluxe mattresses; (2) Stay with the current product mix.
What Are the Costs and Benefits?	We will use cost allocations to estimate the change in EZ-Rest's profit due to this long-term decision.
Make the Decision!	After estimating the profit associated with EZ-Rest's two options, we will be able to recommend the best option to Craig.

Tanya Constantine/Digital Railroad, Inc.

EZ-Rest is trying to figure the best mix of the two models of mattresses it makes.

LEARNING OBJECTIVES

After studying this chapter, you will be able to:

1. Understand how to use cost allocations to make long-term decisions.
2. Explain how cost allocations affect income under absorption costing relative to variable costing.
3. Describe the role of incentives in the choice of allocation procedures.

In Chapters 4–8, we examined short-term decisions for which the costs associated with capacity resources, such as property, plant, and equipment, were not controllable. Accordingly, our goal was to make the best use of *available* capacity resources by maximizing contribution margin. In this chapter, we shift our attention to longer-term decisions. The key feature distinguishing these decisions is the controllability of capacity costs, or the ability to *change* capacity levels.

We begin this chapter by discussing why firms frequently allocate capacity costs for long-term decisions. We then review the mechanics of cost allocations and allocate EZ-Rest's capacity costs to its two products. Such allocations are a practical and often used method for estimating long-term costs of decision options. Finally, we describe other reasons why firms allocate capacity costs.

CHAPTER CONNECTIONS

In Chapter 10, we focus on activity-based costing, a technique that refines the cost allocation procedures to make allocated costs more suitable for making effective decisions.

Long-Term Decisions and Cost Allocations

LEARNING OBJECTIVE 1

Understand how to use cost allocations to make long-term decisions.

In the previous module, we frequently used contribution margin income statements to address short-term decision problems. Exhibit 9.1 presents EZ-Rest's contribution margin income statement and accompanying unit-level data for the most recent year of operations.

Exhibit 9.1 *EZ-Rest Mattress Company: Income Statement for the Most Recent Year*

	Mattress Type		
	Standard	***Deluxe***	***Total***
Sales volume (in units)	18,000	12,000	30,000
Revenue	$11,700,000	$10,500,000	$22,200,000
Variable costs			
Direct materials	$5,310,000	$4,200,000	$9,510,000
Direct labor	1,350,000	1,800,000	3,150,000
Marketing and sales	432,000	864,000	1,296,000
Contribution margin	$4,608,000	$3,636,000	$8,244,000
Fixed costs			
Manufacturing			$5,040,000
Marketing and sales			1,560,000
Administration			960,000
Profit before taxes			$684,000

Unit-level data	***Standard***	***Deluxe***
Selling price	$650	$875
Direct materials	295	350
Direct labor	75	150
Variable marketing & sales	24	72
Unit contribution margin	$256	$303

EZ-Rest's Deluxe mattress is more comfortable but is also more costly to make than the Standard mattress. (Gregory Kramer/Getty Images)

Craig's proposal is to change the product mix to 10,000 Standard and 20,000 Deluxe mattresses. Using the data in Exhibit 9.1, we estimate the profit from Craig's proposal as:

Contribution margin from Standard mattresses	10,000 × $256/unit	$2,560,000
Contribution margin from Deluxe mattresses	20,000 × $303/unit	$6,060,000
Total contribution margin		$8,620,000
Fixed costs		($7,560,000)
Profit		$1,060,000

This profit is up substantially from the current profit of $684,000. Craig's proposal appears to be a good one, right? Not necessarily!

EZ-Rest's decision to change its product mix over the next three years is not a short-term decision. Shifting emphasis from Standard to Deluxe mattresses would take time and require a replanning of existing capacity resources. EZ-Rest may have to replace equipment, reorganize the factory, and change personnel. These changes would likely alter both the nature and magnitude of EZ-Rest's "fixed" capacity costs.

To evaluate Craig's proposal properly, we need to estimate the change in capacity costs. Treating them as fixed, as we would for a short-term decision, is not appropriate.

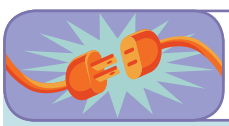
EZ-Rest's long-term decision relates to changing the product mix. Other examples of long-term decisions include adding or dropping products and services, expanding or scaling down operations, and changing target markets. These decisions usually involve altering the level and mix of capacity resources in place. Dropping a product or scaling down operations could idle some existing equipment and machinery. Meanwhile, adding a new product or expanding operations frequently requires additional space, equipment, and staff. Commitments and contractual obligations expire with the passage of time. When excess supply exists in the long term, firms can dispose of unneeded capacity. Similarly, when excess demand exists, firms can acquire extra capacity.

Because capacity costs are controllable over the long term, we need to consider them in our decision-making process. This feature changes our focus from maximizing contribution margin to maximizing profit margin. As we learned in Chapter 4, contribution margin equals revenues less variable costs. **Profit margin** equals contribution margin less allocated capacity costs and, thus, takes into account the change in capacity costs. *While contribution margin is the appropriate measure of value for short-term decisions, profit margin is the appropriate measure for long-term decisions.*

How can we systematically estimate the cost of capacity resources? We discuss two general approaches: direct estimation and cost allocation.

DIRECT ESTIMATION

Direct estimation of capacity costs involves systematically examining each cost account to evaluate whether (and how much) a decision would change a capacity cost. For example, Ram Gupta, EZ-Rest's chief operations officer, estimates that



Connecting to Practice

General Motors Shedding Jobs

In November 2005, General Motors announced plans to cut as many as 30,000 jobs, indicating that it would close operations in nine North American factories. Chairman and Chief Executive Officer Rick Wagoner said the move should help General Motors save as much as $7 billion by the end of 2006.

Commentary: Downsizing staff reduces General Motors' capacity for producing automobiles. A firm might decide to downsize to match capacity with revised beliefs about the demand for the firm's products. Downsizing imposes both explicit and implicit costs. Explicit costs are in the form of paying severance to employees and meeting various contractual obligations. Implicit costs arise because of the cost to the surrounding community from loss of employment and loss of morale among retained employees.

Source: Wall Street Journal, November 22, 2005, p. A3.

Downsizing assembly line capacity is a major decision for an automobile company because it imposes significant costs on the firm, its employees, and the surrounding community. (Al Goldis/©AP/Wide World Photos)

shifting the product mix would increase costs for supervisory staff by $325,000, tools by $206,000 and equipment by $359,000. The sum of these costs, $890,000, would then be the controllable capacity costs for this decision.

With this estimate, Craig's proposal does not appear to be wise. We estimate the profit from Craig's proposal as:

Contribution margin from Standard mattresses	10,000 × $256/unit	$2,560,000
Contribution margin from Deluxe mattresses	20,000 × $303/unit	$6,060,000
Total contribution margin		$8,620,000
Current fixed costs		($7,560,000)
Increase in fixed costs		($890,000)
Profit		$170,000

In many ways, direct estimation is like the account classification method that you learned in Chapter 4. It involves identifying, on an account-by-account basis, which capacity costs would change, and by how much, for each decision option. Direct estimation of changes in capacity costs can be difficult and time-consuming. Moreover, its accuracy depends on the expertise and incentives of the person making the estimates. For these reasons, firms frequently use cost allocations, a simpler but potentially less-accurate approach to estimate controllable capacity costs.

CHAPTER CONNECTIONS

In Chapter 4, we discussed the account classification method. This method allows firms to directly estimate the costs associated with an option by analyzing each cost item separately. While the account classification method can lead to accurate estimates, it is tedious and time consuming, and is subject to the biases and incentives of the decision maker.

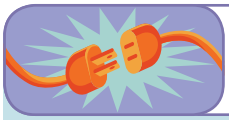
COST ALLOCATIONS

Recall from Chapter 3 that to allocate is to distribute a common cost or benefit among two or more entities. For EZ-Rest, capacity costs (such as the costs of plant and machinery) are the common costs incurred to make the two product lines.

Suppose we decide to allocate EZ-Rest's fixed capacity costs to its two product lines using direct labor dollars (DL$) as the allocation basis. Referring back to Exhibit 9.1, the cost pool is the total fixed costs of $7,560,000, made up of $5,040,000 for manufacturing, $1,560,000 for marketing and sales, and $960,000 for administration. The cost objects are the two product lines (Standard and Deluxe mattresses). The cost driver is direct labor dollars, and the total number of direct labor dollars ($3,150,000) is the denominator volume. With this information, we can perform the two-step cost-allocation procedure for EZ-Rest:

1. Calculate the **allocation rate** by dividing the costs in the cost pool by the denominator volume:

$$\text{Allocation rate} = \frac{\$7,560,000}{\$3,150,000 \text{ DL\$}} = \$2.40 \text{ per DL\$}$$



Connecting to Practice

Product Costing at Nissan

In his study of Nissan Motor Company, Professor Robin Cooper reports that Nissan uses product costs, which include allocated costs, for four primary purposes: (1) For assessing long-term profitability; (2) for selecting the product mix, (3) for identifying nonprofitable variants of models, and (4) for maintaining cost control.

Commentary: The first three uses are classic long-term decisions that we study in this chapter and Chapter 10. We discuss the fourth use in Chapter 12. Nissan also uses an extensive costing system to determine the profitability of products yet to enter production. We discuss such target costing systems in Chapter 13.

Businesses often refer to this rate as the **overhead rate** because capacity costs are also termed **overhead costs**. Some firms refer to this rate as the **burden** because they charge, or burden, each product with this amount.

2. For each product, multiply the cost driver units by the allocation rate:

$$\text{Standard} = \$1{,}350{,}000 \text{ DL\$} \times \$2.40 \text{ per DL\$} = \$3{,}240{,}000$$
$$\text{Deluxe} = \$1{,}800{,}000 \text{ DL\$} \times \$2.40 \text{ per DL\$} = \$4{,}320{,}000$$

In this way, the allocation divides the total fixed costs of $7,560,000 between the two product lines. As you can verify in *Check It! Exercise #1*, the proportion of fixed costs allocated to each mattress line is identical to the proportion of direct labor dollars (the cost driver) in each product line (cost object).

Dividing $3,240,000 by 18,000 Standard mattresses, we determine the allocated cost as $180 per Standard mattress. Similarly, dividing $4,320,000 by 12,000 mattresses gives us an allocated cost of $360 per Deluxe mattress. Alternatively, we could obtain the allocated cost per unit by multiplying the unit labor cost of each type of mattress by the overhead allocation rate of $2.40 per every labor dollar:

$$\text{Standard mattress} = \$75 \text{ DL\$} \times \$2.40 \text{ per DL\$} = \$180 \text{ per mattress}$$
$$\text{Deluxe mattresses} = \$150 \text{ DL\$} \times \$2.40 \text{ per DL\$} = \$360 \text{ per mattress}$$

Check It! Exercise #1

When allocating EZ-Rest's fixed costs of $7,560,000 to mattresses, using direct labor dollars as the allocation basis, verify that the percentage of the cost allocated to each mattress line equals the percentage of direct labor dollars.

	Standard	*Deluxe*	*Total*
Direct labor dollars (DL$)	_____	_____	$3,150,000
Percentage of DL$	_____	_____	100%
Amount allocated	_____	_____	$7,560,000
Percent of cost allocated	_____	_____	100%

Solution at end of chapter.

Notice that with labor cost as the allocation base, the allocated cost per unit for Deluxe mattresses ($360 per mattress) is twice the amount allocated to each unit of the Standard mattress ($180 per mattress).

How do allocations help long-term decisions? Allocations break up capacity costs into pieces attributable to individual products. We then use the product-level estimates to compute expected costs for a new volume of operations or a revised product mix. That is, allocations estimate long-run capacity costs as proportional to the volume of the underlying cost driver. Exhibit 9.2 presents the product-level income statement for EZ-Rest for the projected product mix using the above allocations.

Our new estimate of capacity costs for Standard mattresses multiplies 10,000 units × $75 DL$ per unit × $2.40 allocation per DL$ = $1,800,000. For Deluxe mattresses, the capacity cost estimate is 20,000 units × $150 DL$ per unit × $2.40 allocation per DL$ = $7,200,000. The revised estimate represents a large increase in capacity costs. EZ-Rest's profit actually would decrease from a profit of $684,000 in Exhibit 9.1 to a loss of $380,000—a profit margin decrease of $1,064,000—if Craig changes the product mix.

It is important to understand that the accuracy of our estimates depend crucially on the specific allocation procedure used. *Check It! Exercise #2* emphasizes this observation. This exercise asks you to verify that EZ-Rest's estimated capacity costs would *not* change from its current amount of $7,560,000 if we use sales volume in units as the allocation basis. Why is there no change? The answer is that the change in capacity cost is proportional to the change in the total units of the cost driver. In this exercise, the total number of units sold (the cost driver for this allocation) does not change

Exhibit 9.2 *EZ-Rest Mattress Company: Projected Profit with Modified Product Mix Using Allocations*

	Mattress Type		
	Standard	*Deluxe*	*Total*
Sales volume (in units)	10,000	20,000	30,000
Revenue	$6,500,000	$17,500,000	$24,000,000
Direct materials	2,950,000	7,000,000	9,950,000
Direct labor	750,000	3,000,000	3,750,000
Variable marketing and sales	240,000	1,440,000	1,680,000
Contribution margin	$2,560,000	$6,060,000	$ 8,620,000
Allocated fixed costs	1,800,000	7,200,000	9,000,000
Profit margin	$760,000	($1,140,000)	($380,000)

Check It! Exercise #2

Using the data from Exhibit 9.1, compute the allocation rate per mattress.

Allocation rate = Total fixed costs/Total number of mattresses
= $ _____/mattress.

Using this allocation rate, verify that the projected capacity costs under the new product mix are $7,560,000. That is, *there is no change in estimated capacity costs with the new product mix.* Why is this conclusion likely erroneous?

	Standard	*Deluxe*	*Total*
Sales volume (# of mattresses)	10,000	20,000	30,000
Allocated fixed costs	_____	_____	$7,560,000

Solution at end of chapter.

between the current and proposed product mix. Thus, the total cost will remain the same. (In our calculations above, the cost driver was labor dollars, not units sold.)

REFINING THE ALLOCATION

When we use allocated costs to make decisions, the quality of our decision depends on how well the allocation estimates the capacity cost associated with the various options. Constructing the right allocation procedure is a critical step in obtaining the best estimate of controllable capacity costs. A procedure that is too simple might give inaccurate estimates because it does not capture how different products consume capacity resources. On the other hand, highly sophisticated procedures may be difficult to implement because of the many measurements that may be required. The decision context, ease of collecting and analyzing data, and magnitude of the decision all play a role in determining how detailed an allocation procedure to use.

Let us consider two ways to improve the accuracy of allocation procedures.

Using Multiple-Cost Pools and Cost Drivers

Sarah Andrews, the marketing director at EZ-Rest, points out a potential issue in the allocation procedure we used earlier. Sarah agrees that the capacity costs associated with manufacturing the mattresses are likely to vary in proportion to the direct labor cost of each mattress. After all, greater labor cost means more manufacturing time, which means greater use of the factory's capacity. Thus, she supports the use of direct labor costs to estimate the change in manufacturing overhead costs. However, she sees no connection between direct labor cost and the effort needed to market and sell the mattresses. In her experience, it takes the same amount of time to sell either a Deluxe or a Standard mattress. Moreover, the time taken for general administration, processing, and delivering the order is independent of the kind of mattress ordered. Sarah believes that sales volume is better suited for assigning the fixed marketing and administrative costs to the two product lines.

Sarah's observation highlights that a firm's total capacity cost is the sum of the costs of many resources. Products generally consume different capacity resources in different proportions. A driver that is appropriate for some resources may not be appropriate for other resources. How should we deal with this problem?

The solution is to use multiple-cost pools. For each resource or class of similar resources, we could use a separate cost pool. We then allocate the costs in this pool using an allocation basis that best captures the consumption of the associated resources. For example, when estimating the cost of operating a checking account, Citicorp might use separate cost pools for the costs of operating the ATM network and of processing checks. It could then allocate these costs to individual accounts using the number of ATM transactions and the number of checks as the allocation bases, respectively.

In the case of EZ-Rest, let us break the total fixed costs into two separate pools. The first pool contains manufacturing capacity costs and the second, marketing costs. Using the data from Exhibit 9.1, we classify $5,040,000 of the total fixed costs of $7,560,000 as manufacturing costs and the remaining $2,520,000 as marketing and administration costs. Next, we use direct labor dollars for allocating manufacturing costs, and units sold for allocating marketing and administrative costs.

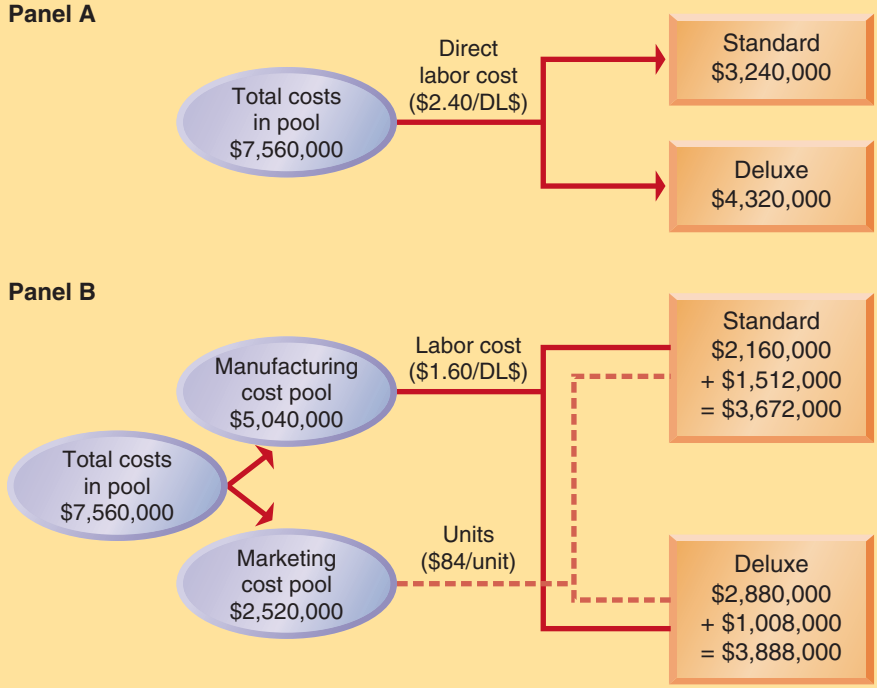
As Exhibit 9.3 shows, after repeating the two cost allocation steps for each cost pool separately, we have $3,672,000 allocated to the Standard mattresses and $3,888,000 allocated to the Deluxe mattresses. Panels A and B in Exhibit 9.4 show the computations for the one- and two-pool systems, respectively.

If using two cost pools is better than using one pool, how about using three cost pools? For instance, why not separately allocate the cost of machines, currently included with manufacturing costs, using machine hours as a third driver? In this case, we would use three cost pools—machining costs, manufacturing costs other than machining costs, and marketing costs—to assess the profit impact of the change in product mix. Such a refinement could make sense if the pattern of machine usage differs from how products use labor.

Exhibit 9.3 *EZ-Rest Mattress Company: Allocation with Two Cost Pools*

	Mattress Type		
	Standard	*Deluxe*	*Total*
Pool 1: Manufacturing costs			
Step 1			
Total fixed manufacturing costs			$5,040,000
Total direct labor $	$1,350,000	$1,800,000	$3,150,000
Rate per direct labor $			$1.60
Step 2			
Allocate costs to product lines			
(= DL $ × rate per DL $)	$2,160,000	$2,880,000	$5,040,000
Pool 2: Marketing and administrative costs			
Step 1			
Total fixed marketing and administration costs			$2,520,000
Total units	18,000	12,000	30,000
Rate per unit			$84.00
Step 2			
Allocate costs to product lines			
(= # of units × rate per unit)	$1,512,000	$1,008,000	$2,520,000
Total allocated cost	$3,672,000	$3,888,000	$7,560,000
Allocated cost per unit			
(= total allocated cost / total units)	$204	$324	

Exhibit 9.4 *Refining Cost Estimation by Using Two- versus One-pool Systems*



In principle, we could divide the total fixed costs of $7,560,000 into as many pools as needed. There is no hard and fast rule that determines how many different cost pools to use. Some firms use only a few cost pools, while other firms such as Siemens use several hundred pools. Firms that use a single rate are often characterized as using a **plantwide rate**, whereas firms that develop many rates, usually one per department, are labeled as employing **departmental rates**.

Excluding Some Capacity Costs

The second refinement to EZ-Rest's system concerns which costs to allocate. Both the one- and two-pool systems assume that EZ-Rest's entire capacity costs of $7,560,000 are controllable. This assumption may be inaccurate in some contexts. After all, some of these costs, such as factory rent and other facility-level costs, could be noncontrollable for the product-mix decision. That is, regardless of the product mix, these costs stay the same. Ideally, we should exclude such noncontrollable costs from the allocation process. We have not done so in the case of EZ-Rest for simplicity; we will revisit this issue in detail in Chapter 10.

PULLING IT ALL TOGETHER

You are now ready to estimate EZ-Rest's income for the proposed product mix using the allocated costs from the two-pool system. Exhibit 9.5 presents the income statement for the proposed product mix. It shows that the estimated capacity costs total $8,520,000, representing an increase of $960,000 from the current level of $7,560,000. With this increase, you project the profit with the new mix at $100,000, which is significantly lower than EZ-Rest's current profit of $684,000. You recommend that Craig consider other avenues for increasing EZ-Rest's profitability.

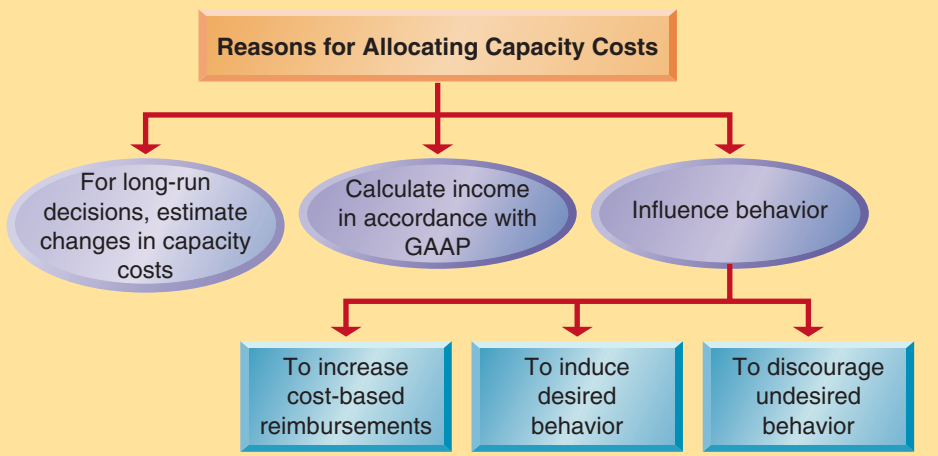
Exhibit 9.5 *EZ-Rest Mattress Company: Income Statement—Proposed Product Mix and Allocated Costs from Two-Pool System*

		Mattress Type		
	Detail	*Standard*	*Deluxe*	*Total*
Sales volume (in units)		10,000	20,000	30,000
Revenue	10,000 × $650;			
	20,000 × $875	$6,500,000	$17,500,000	$24,000,000
Variable costs	10,000 × $394;			
	20,000 × $572	3,940,000	11,440,000	15,380,000
Contribution margin		$2,560,000	$6,060,000	$8,620,000
Estimated fixed costs	10,000 × $75 × $1.60;			
(manufacturing)	20,000 ×$150 × $1.60	1,200,000	4,800,000	6,000,000
Estimated fixed costs	10,000 × $84;			
(Marketing)	20,000 × $84	840,000	1,680,000	2,520,000
Profit before taxes		**$520,000**	**($420,000)**	**$100,000**

APPLYING THE DECISION FRAMEWORK

What Is the Problem?	Even though EZ-Rest currently operates at capacity, CEO Craig Edwards wants the company to increase its profit.
What Are the Options?	We examined two options: (1) Change the product mix to emphasize Deluxe mattresses, (2) Stay with the current product mix.
What Are the Costs and Benefits?	Using the single-pool cost allocation system, we estimate profit will decrease to ($380,000) if EZ-Rest changes its product mix. Using the two-pool cost allocation system, we estimate profit will decrease to $100,000 if EZ-Rest changes its product mix.
Make the Decision!	Because we estimate that changing the product mix to emphasize Deluxe mattresses will actually decrease profit, we recommend that Craig explore alternative ways to increase his company's profitability.

Exhibit 9.6 *Organizations Allocate Capacity Costs for Many Reasons*



As shown in Exhibit 9.6, helping with decisions is just one of the many reasons firms allocate costs. We now turn our attention to three other common applications of cost allocations: (1) Reporting income to external parties such as shareholders and the IRS; (2) justifying costs, including cost-based reimbursements; and (3) influencing behavior.

Cost Allocations for Reporting Income

LEARNING OBJECTIVE 2

Explain how cost allocations affect income under absorption costing relative to variable costing.

Recall from Chapter 3 that firms must prepare income statements and balance sheets in accordance with the Generally Accepted Accounting Principles (GAAP). GAAP requires firms to use **absorption costing**, which separates product costs from period costs, for external reporting purposes.

Under absorption costing, the value of a unit of a product includes all product costs. Thus, the value includes direct manufacturing costs such as materials and direct labor, as well as indirect manufacturing costs, such as machine depreciation and factory rent. Because indirect manufacturing costs are not traceable to individual products, companies must allocate them to prepare income statements for

CHAPTER CONNECTIONS

As you learned in Chapter 3, product costs are the expenditures required to make a product ready for sale. Examples include the costs of direct materials, direct labor, as well as a variable and fixed manufacturing overhead. Period costs include all selling and administration expenses.

external reporting under GAAP. (You also might wish to review the discussion in Chapter 3 concerning the flow of costs in manufacturing firms, and Exhibits 3.7 and 3.12 in particular.) Thus, EZ-Rest calculates $295 (materials) + $75 (labor) + $120 (manufacturing overhead at $1.60 per labor $) = $490 as the inventoriable value for each Standard mattress. The corresponding number is $350 + $150 + $240 = $740 for each Deluxe mattress. Notice that we do not include variable or fixed selling and administration costs when calculating these values.

To understand how absorption costing affects reported income, assume that EZ-Rest continued to *make* 18,000 Standard and 12,000 Deluxe mattresses as in Exhibit 9.1, but *sold* only 17,000 Standard and 11,600 Deluxe mattresses. That is, the firm put 1,000 Standard and 400 Deluxe mattresses into its inventory of finished goods. How does this change affect reported income from $684,000 in Exhibit 9.1?

Let us begin by calculating what the change in income would be under the now familiar contribution margin format. Exhibit 9.7 presents these calculations. Because this format groups variable costs and fixed costs separately, many also refer to the method as either **direct costing** or **variable costing**. As we expect, the reduction in sales volume reduces income from $684,000 in Exhibit 9.1 to $306,800. This reduction is as predicted by the CVP equation (see *Check it! Exercise #3*). Notice that

Exhibit 9.7 *EZ-Rest Mattress Company: Variable Costing Income Statement*

	Mattress Type		
	Standard	***Deluxe***	***Total***
Production volume (in units)	18,000	12,000	30,000
Sales volume (in units)	17,000	11,600	28,600
Revenue	$11,050,000	$10,150,000	$21,200,000
Variable costs			
Direct materials ($295 × 17,000; $350 × 11,600)	$5,015,000	$4,060,000	$9,075,000
Direct labor ($75 × 17,000; $150 × 11,600)	1,275,000	1,740,000	$3,015,000
Marketing and sales ($24 × 17,000; $72 × 11,600)	408,000	835,200	$1,243,200
Contribution margin	$4,352,000	$3,514,800	$7,866,800
Fixed costs			
Manufacturing overhead			$5,040,000
Marketing and sales			1,560,000
Administration			960,000
Profit before taxes			$306,800
Unit-level data for inventory value	***Standard***	***Deluxe***	
Direct materials	295	350	
Direct labor	75	150	
Inventoriable cost per unit	$370	$500	
× # of units in inventory	1,000	400	
Value of inventory (total)	$370,000	$200,000	$570,000

Check It! Exercise #3

Verify that the decline in income from $684,000 in Exhibit 9.1 to $306,800 in Exhibit 9.7, a reduction of $377,200, is as predicted by the CVP equation for EZ-Rest.

First, write down the CVP equation for EZ-Rest:

Profit before taxes = UCM of _____ × # of Standard mattresses
+ UCM of _____ × # of Deluxe mattresses
− fixed costs of _____.

Next, use the equation to calculate the reduction in profit if sales decline by 1,000 units of Standard and 400 units of the Deluxe mattress.

Solution at end of chapter.

Exhibit 9.8 *EZ-Rest Mattress Company: Absorption Costing Income Statement*

	Mattress Type		
	Standard	***Deluxe***	***Total***
Production volume (in units)	18,000	12,000	30,000
Sales volume (in units)	17,000	11,600	28,600
Revenue	$11,050,000	$10,150,000	$21,200,000
Product costs			
Direct materials ($295 × 17,000; $350 × 11,600)	$5,015,000	$4,060,000	$9,075,000
Direct labor ($75 × 17,000; $150 × 11,600)	1,275,000	1,740,000	3,015,000
Manufacturing overhead ($120 × 17,000; $240 × 11,600)	2,040,000	2,784,000	4,824,000
Gross margin	$2,720,000	$1,566,000	$4,286,000
Period costs			
Variable marketing and sales ($24 × 17,000; $72 × 11,600)	$408,000	$835,200	1,243,200
Fixed marketing and sales			1,560,000
Administration			960,000
Profit before taxes			$522,800
Unit-level data for inventory values	***Standard***	***Deluxe***	
Direct materials	295	350	
Direct labor	75	150	
Allocated overhead	120	240	
Inventoriable cost per unit	$490	$740	
× # of units in inventory	1,000 units	400 units	
Value of inventory (total)	$490,000	$296,000	$786,000

the amount of manufacturing overhead cost expensed in the income statement is still $5,040,000—it is unaffected by the change in the number of units sold.

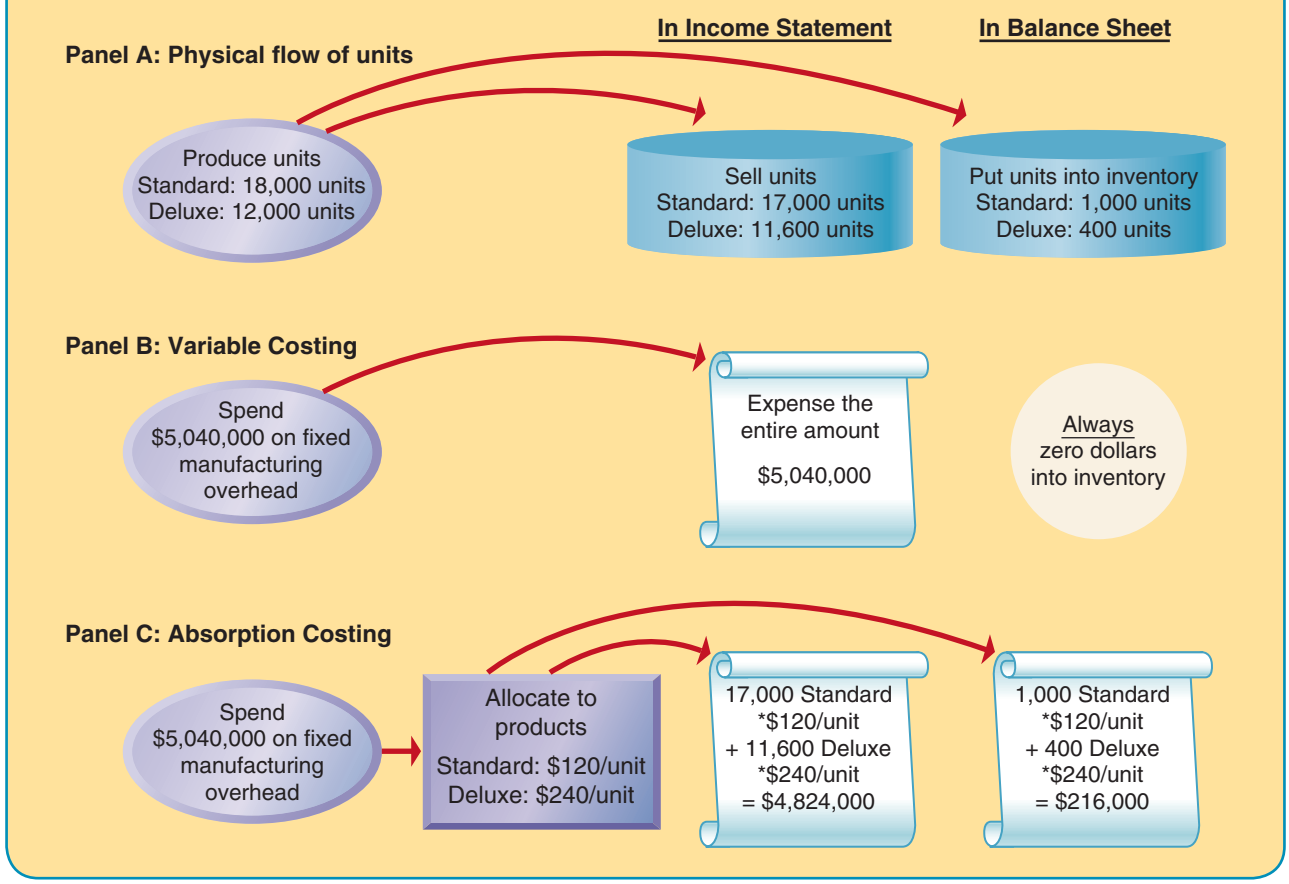
Exhibit 9.8 presents the absorption costing income statement with the revised assumption about units sold. Again, as we expect, reported income declines relative to $684,000, the income when EZ-Rest sold all the units that it made. In this statement, consistent with GAAP, we use the product cost of $490 and $740 per Standard and Deluxe mattress to calculate the cost of goods sold and inventory values.

Notice that the drop in income is much smaller in Exhibit 9.8 than in Exhibit 9.7. Why is this? The answer is that we allocate fixed manufacturing costs to individual products under absorption costing so that we can comply with GAAP and account for overhead as a product cost. Intuitively, absorption costing "burdens" each unit with some fixed manufacturing overhead as it moves through the production process. This allocation results in fixed manufacturing overhead "traveling" with the units.

At the end of an accounting period, in addition to the units we sell, we may have added units to the finished goods account. The cost of goods sold account will include the fixed manufacturing costs of units sold. Similarly, the finished goods inventory account will contain the fixed manufacturing costs of units produced but not sold. Focusing only on the fixed manufacturing costs, we see in Exhibit 9.8 that the cost of goods sold contains $4,824,000 of the $5,040,000 of fixed manufacturing overhead, and the finished goods inventory contains the remainder. In contrast, the contribution margin statement (i.e., variable costing statement) summarized in Exhibit 9.7 expenses all $5,040,000 of manufacturing overhead. This difference of $216,000 in overhead costs contained in the inventory is also the difference in the income reported under the two methods.

Exhibit 9.9 represents the cost flows pictorially. Panel A shows the underlying physical flow of units: EZ-Rest made 18,000 Standard and 12,000 Deluxe mattresses and sold 17,000 and 11,600 units, respectively. As shown in the leftmost circles of panels B and C, EZ-Rest also spent $5,040,000 in fixed manufacturing costs. Panel B shows that, under variable costing, we expense the entire amount to the income statement. However, as shown in panel C, under absorption costing, we first allocate the amount to individual

Exhibit 9.9 *Accounting for Fixed Manufacturing Overhead Is the Only Difference between Variable and Absorption Costing*



units. This means that the overhead associated with units sold appears in the income statement, and the overhead for the units put into inventory appears in the balance sheet. When EZ-Rests adds units to inventory, this accounting for overhead leads to greater reported income, relative to the income reported under variable costing.

The Appendix to this chapter provides an in-depth comparison of variable and absorption costing. For now, it is enough that you know firms must allocate manufacturing overhead to products when valuing inventories. Such allocations result in the overhead cost flowing through the inventory account. Consequently, when inventory levels change, the amount recognized in the income statement for overhead may not correspond to the amount spent. How the firm allocates overhead determines the portion recognized in the income statement and, therefore, reported income.

Incentives and Cost Allocations

LEARNING OBJECTIVE 3

Describe the role of incentives in the choice of allocation procedures.

As you have learned thus far, the amount of cost allocated to a particular cost object depends on what costs we allocate, how we group them into cost pools, and which drivers we choose. Companies often choose allocation procedures in a way that allows them to achieve certain goals. In this section, we provide some examples of how companies use allocations in contract negotiations and as a means of influencing workplace behavior.

USING ALLOCATIONS TO JUSTIFY COSTS AND REIMBURSEMENTS

Many government entities, such as the Department of Defense (DoD), contract to compensate their suppliers on a cost-plus basis. For example, if the supplier's cost is $200 and the agreed-on markup is 10%, the supplier's reimbursement is $220. Suppliers such as Rockwell Collins often prefer such contracts when there is uncertainty about the final cost or project success, as it allows them to share the risk of cost overruns with the government. Absent such contracts, companies may be reluctant to accept the risky and expensive projects such as developing the next generation of combat aircraft.

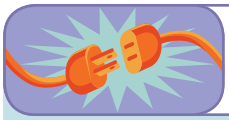
Many organizations also use allocated costs to justify prices. Hospitals such as Massachusetts General use allocated costs when negotiating rates with insurance companies and other payers. A communications company like Qwest uses allocated costs to justify the prices set for regulated services such as residential phone rates. Managers in the Federal Reserve Bank, a government institution, use allocated costs to determine whether they should continue to offer services such as check clearing and wire transfers that large commercial banks also offer.

In such instances, firms have incentives to be strategic in the choice of allocation procedures. Qwest could potentially benefit by choosing a procedure that increases the portion of costs allocated to regulated services. Managers at the Federal Reserve may have an incentive to decrease the cost allocated to competitive services, to "prove" that their services are profitable and that they should continue to offer the service. We use a numerical example to illustrate this incentive next.

An Example

Ryan Supply Systems sells ready-to-eat meals to both the armed forces and the public (e.g., campers and hunters). We have the following information about Ryan's operations:

- The variable cost of a meal supplied to the armed forces is $4. The variable cost of a meal supplied to the public is $5, due to better packaging and the greater variety of meals available.



Connecting to Practice

Detecting Cost Shifting

A recent study of defense contractors shows that the contractors enjoyed higher than normal profits during 1984–1989, which was a period of unusually low competition. The authors examine the hypothesis that these firms were able to generate abnormal profits because they exploited their bargaining power to shift more costs to cost-plus contracts with the defense department.

Commentary: The study looked for evidence of cost shifting by comparing the profits reported by three segments—commercial, defense, and mixed—for a sample of defense contractors. Surprisingly, despite extensive analysis of the firms' financial data, it did not find any evidence that the higher profitability resulted from the alleged cost-shifting behavior. Thus, while cost shifting is a much talked about phenomenon, it might be hard to detect and prove.

Source: Vendrzyk, V., and A. McGowan. "The relation between cost shifting and segment profitability in the defense contracting industry." *The Accounting Review* 2002 77(4): 949–969.

- Annual fixed costs equal $8 million.
- Sales to each the military and the public equal 2 million meals per year. Because of the greater variety of meal packages sold to the public, Ryan estimates that the 2 million meals sold to the public consume 60% of the plant's capacity of 100,000 machine hours; the 2 million meals sold to the military consume the remaining 40%.
- The price of a meal sold to the public is $8; the price to the military allows for a 20% markup on cost.

Because Ryan's reimbursement from the armed forces depends on cost, it must decide how to allocate the fixed costs of $8 million between the military and the public. The military contract allows Ryan to use either the number of meals or machine hours to allocate fixed costs. Which basis should Ryan use to maximize its profit?

Allocations Using Units

Using meals as the allocation basis, we find:

- The allocated fixed cost per meal is $2 (= $8,000,000 fixed costs/4,000,000 meals) for both the armed forces and the public.
- The total cost per meal is $6 for the military contract ($6 = $4 variable cost per meal + the allocated fixed cost of $2 per meal).
- Adding the markup of 20% to this cost, the military pays $7.20 per meal (= $6 × 1.2).

Allocations Using Machine Hours

If Ryan were to choose machine hours as the basis for allocation:

- The allocation rate is $80 per machine hour (= $8,000,000 fixed costs/100,000 machine hours).
- Ryan uses 40% of its 100,000 hours of machine capacity, or 40,000 machine hours, to produce meals for the military. Multiplying this amount by the allocation rate of $80 per machine hour, Ryan allocates $3,200,000 of the fixed costs to the military contract, for an allocated cost of $1.60 per meal (= $3,200,000/2,000,000).

- The total cost per meal is \$5.60 for the military contract (\$5.60 = \$4 variable cost per meal + \$1.60 of allocated fixed cost).
- Adding the markup of 20% to this cost, the military price is \$6.72 (= \$5.60 × 1.2).

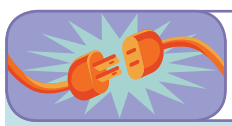
Exhibit 9.10 provides a condensed income statement under the two allocation methods. We find that Ryan increases its profit by \$960,000 merely by changing the basis for its allocation. Using meals instead of machine hours as the allocation basis increases the amount allocated to the military sector from \$3.2 million to \$4 million, an increase of \$800,000. The additional reimbursement combines this \$800,000 and the 20% markup of \$160,000, for a total increase of \$960,000 in profit. The change in the allocation basis does not affect other costs and revenues. Choosing units as the allocation basis merely shifts a greater portion of the fixed costs to the military contract, and increases the associated revenue.

Buyers like government agencies understand firms' incentives to engage in this cost-shifting behavior. As a result, government contracts typically specify how the supplier should determine the allocated cost. These agencies also conduct audits to ensure compliance. Nevertheless, because of the unavoidable ambiguity in allocating common costs, the contracting parties must strike a delicate balance. The contract must devise procedures that allow suppliers to recoup a fair share of their costs while controlling their incentive to manage cost estimates to their advantage.

Check It! Exercise #4

Suppose that the meals sold to the public consume 55% of the plant's capacity of 100,000 machine hours. Verify that Ryan would still prefer to allocate costs based on meals.

Solution at end of chapter.



Connecting to Practice

Taxes and Not-for-Profit Organizations

Under U.S. tax laws, not-for-profit organizations owe income taxes on the profit they make from activities not related to their charitable mission. For example, a university must pay taxes on income it receives from renting out the stadium for a rock concert. But revenue from tuition is not taxable because it relates to the university's educational mission. We usually find many shared costs among the activities that generate related and unrelated business income. The not-for-profit must therefore allocate costs to determine taxable income.

Commentary: Research finds that more than half of the surveyed not-for-profits that reported positive revenue from unrelated businesses also reported taxable income of exactly zero! That is, their costs *exactly* equaled their revenue. It appears that many not-for-profit organizations allocate costs strategically to minimize their taxable income.

Exhibit 9.10 *Ryan Supply Systems: Condensed Income Statements*

	Unit Data (Public/Military)	Public	Military	Total
Sales volume (in units)		2,000,000	2,000,000	
Panel A: Using Units as the Allocation Basis				
Revenue	$8.00 / $7.20	$16,000,000	$14,400,000	$30,400,000
Variable costs	$5.00 / $4.00	10,000,000	8,000,000	18,000,000
Allocated fixed costs	$2.00 / $2.00	4,000,000	4,000,000	8,000,000
Gross Margin		$2,000,000	$2,400,000	$4,400,000
Panel B: Using Machine Hours as the Allocation Basis				
Revenue	$8.00 / $6.72	$16,000,000	$13,440,000	$29,440,000
Variable costs	$5.00 / $4.00	10,000,000	8,000,000	18,000,000
Allocated fixed costs	60% / 40%	4,800,000	3,200,000	8,000,000
Gross margin		$1,200,000	$ 2,240,000	$3,440,000

USING COST ALLOCATIONS TO INFLUENCE BEHAVIOR

Well-designed cost allocation procedures can influence the mix of resources that an organization uses. In particular, cost allocations may dissuade the use of one resource in favor of another resource. Recall that allocated cost equals the number of driver units used multiplied by the cost per driver unit. Therefore, the cost allocated to the manager is proportional to the number of driver units consumed by the manager. By changing the quantity of driver units consumed, managers can change the costs allocated to their units. From a manager's perspective, the allocated cost *behaves* like a variable cost.

Why do managers care about the costs allocated to their individual departments or divisions? After all, the total cost is the same and fixed for the company as a whole. The allocation merely changes the distribution of this fixed cost among units. It might seem that the firm or its managers should not care about how the firm allocates this cost. However, managers' performance evaluations frequently depend on their unit's performance more than overall firm performance. The cost allocated to a division is an integral part of that division's reported profit and performance. Reducing the number of driver units consumed benefits managers by lowering the cost allocated to their units, even though the change may have no effect on the firm as a whole.

Cost allocations therefore provide subtle, yet effective, means to achieve change. It is often difficult for organizations to implement change; people generally resist change. Of course, one way to force people to change is by leaving them with no other option. However, such autocratic approaches usually create resentment and motivational problems. Instead, using carefully chosen allocation methods can induce desired behavior and dissuade undesired behavior. We next look at two examples to show how firms can accomplish this.

Allocations to Induce Desired Behavior

Consider a company that has five divisions, each of which manufactures a different product line. A year ago, the company invested in sophisticated equipment and technology to automate production processes. The company believed that the technology would help improve quality and productivity in every division. Moreover, this technology would help divisions reduce their reliance on direct labor by automating production processes. Surprisingly, the divisions appeared to continue existing practices, adopting the new technology at a slower-than-expected pace.

Faced with the task of motivating its workforce to use the new technology, corporate headquarters reexamines its employee incentives. Employees receive a straight salary and a bonus based on divisional profit. Divisional profit includes an allocation for corporate administrative and overhead costs. Although the allocation results in a substantial charge to each division's profit, the head office does provide numerous support services to the divisions. Currently, the firm allocates administrative costs equally among the five divisions.

As a motivation to use the new technology, the chief financial officer (CFO) suggests changing this allocation procedure and using direct labor hours as the basis for allocating corporate overhead. Thus, the company would allocate the most corporate overhead to the division that uses the most direct labor hours in its production process. That division's profit would accordingly decrease, thereby reducing employee bonuses. The result is a natural incentive for the workforce in the division to opt for new technology and automation to lower the amount of direct labor used. As Exhibit 9.11 shows, the quantity demanded of any resource (vertical axis) decreases as its price (horizontal axis) increases. Allocating overhead costs in proportion to the usage of a resource effectively increases its price, and, therefore, the quantity demanded goes down.

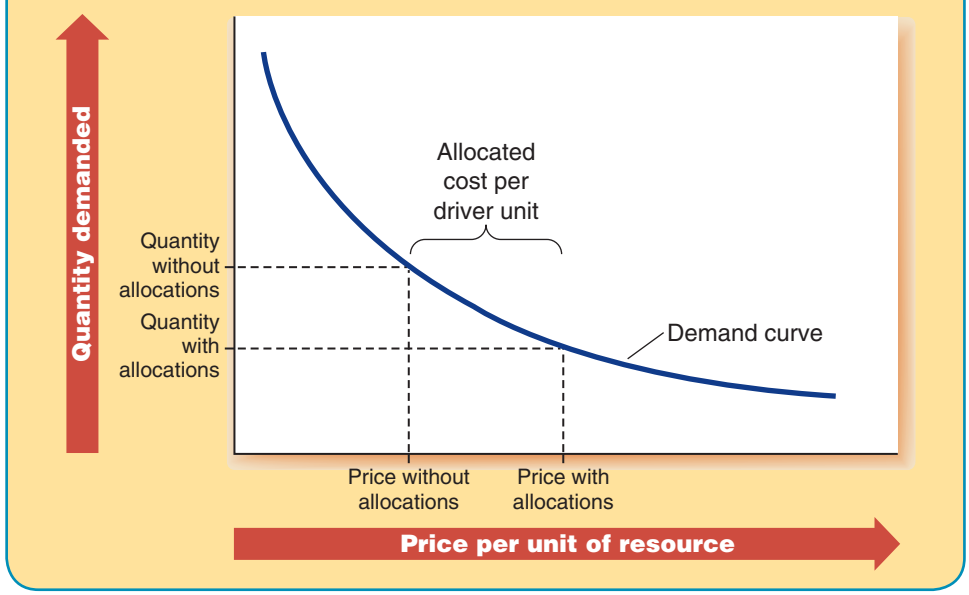
In this example, allocating corporate overhead based on direct labor is arbitrary. Direct labor use may have little to do with corporate overhead costs. However, even arbitrary allocations, if well designed, can serve the purpose of encouraging desired organizational behavior.

Allocations to Induce Efficient Use

By discouraging wasteful use, cost allocations also can induce efficient utilization of resources shared by multiple users. Suppose the Department of Accounting at Prestige University recently hired Brad Gates, a talented computer service specialist, to help with the computing needs of its faculty and staff. The department offered Brad a three-year contract at an annual salary of $60,000.

At the start, Brad seemed to provide a welcome solution to the department's mounting computer hardware and software woes. However, after only a few months, Melanie Brooks, the department chair, began to hear complaints regarding Brad's tardiness and inability to cope. After investigating the issue, Melanie notes that Brad,

Exhibit 9.11 *We Can Use Allocations to Modify Behavior*



in fact, is competent and puts in long hours. However, Brad spends much of his time attending to minor jobs that faculty and staff could easily handle themselves.

Melanie concludes that the faculty and the staff are using Brad's services inefficiently because they view Brad's time as a "free good." As there is no charge for Brad's time, everyone asks for Brad's help, even for minor problems. Being an astute accountant, Melanie decides to charge the faculty and staff an hourly rate for using Brad's services. Assuming 250 working days in a year, and eight working hours in a day, Melanie comes up with an hourly rate of $30 per hour ($60,000/(250 days × 8 hours per day)). Any time a faculty member uses Brad's services, she decides to charge the faculty person's spending account at the rate of $30 per hour.

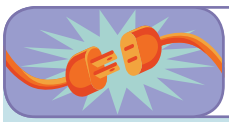
As Melanie expected, the faculty initially react to this decision with some disapproval. Soon, however, everybody seems happy with Brad's performance. The faculty only brings to Brad's attention those problems that need his expertise. Thus, everybody uses Brad's services more efficiently.

What happened? Given the three-year contract, Brad's salary is a fixed and noncontrollable cost. Thus, the $30 per hour rate at which the department allocates this cost is arbitrary. However, this rate creates an opportunity cost for faculty requesting Brad's help. It forces faculty members to evaluate whether it is worth paying for Brad's services at $30 per hour, or whether they should resolve the problem themselves. Because the allocated cost serves as the price for using Brad's services, Melanie can further increase efficiency. That is, she can increase or decrease the demand for Brad's time by changing the hourly rate.

Many universities use such cost allocation procedures to cut unnecessary and wasteful use of expensive resources. Firms such as British Petroleum and Principal Financial Group use similar procedures with respect to administrative, maintenance, IT, and other support services. The use of cost allocations for this purpose serves as a simple and effective way to influence employees' use of resources, especially the expensive ones.

CONTROLLABILITY AND ALTERNATE DEMANDS FOR COST ALLOCATIONS

Thus far, we have described three different demands for cost allocations: estimating long-run capacity costs, determining reported income, and influencing behavior. Let us now consider how these uses differ in terms of the costs to allocate and choice of drivers.



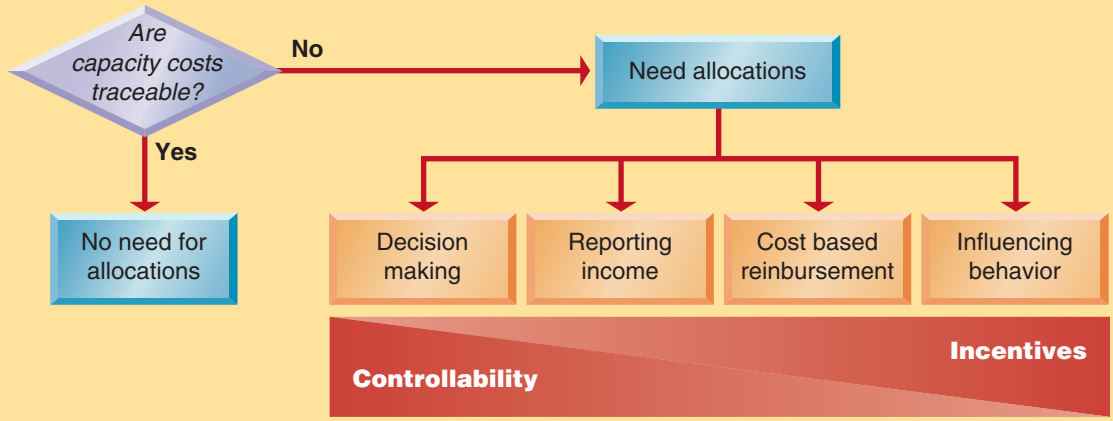
Connecting to Practice

Cost Allocations in Japan

After an extensive study of Japanese firms such as Nissan, Komatsu, and Citizen Watch, Professor Robin Cooper concluded that the product costing systems of these firms follow traditional practices. They also have cost control as their primary focus. That is, they use large cost pools and use drivers such as labor dollars and machine hours.

Commentary: The primary goal of these costing systems is to support cost control during the production process. Firms engage in this practice to motivate their managers to reduce labor content to the maximum extent feasible. These firms do not use this allocation when determining prices, an economic decision. The firms use detailed target costing systems for this purpose. We discuss target costing in Chapter 13.

Exhibit 9.12 *The Reason for Allocating Costs Affects the Choices of Drivers We Use*



Dominant influence in the choice of allocation procedure

At the start of this chapter, our goal was to determine the profit impact of changing EZ-Rest's product mix. For this decision, the need for cost allocations arose from two fundamental principles: (1) *controllability* of capacity costs over the long term resulted in EZ-Rest measuring these costs for appropriate decision making; (2) the lack of *traceability* of capacity costs to individual products led to a demand for allocations.

Controllability is the criterion that determines what costs to measure. In the context of a long-term decision (such as the product-mix choice), the cost of a decision option may include direct and allocated costs across all functional areas including manufacturing, marketing, and administration. Indeed, surveys indicate that numerous companies, including John Deere, Siemens, and Lehigh Steel, allocate capacity costs to estimate product profitability for making product-mix decisions. These firms employ a many-pool system with multiple drivers to estimate how costs would change as the volume of the underlying activities changes.

When allocating costs to value inventory, traceability is the underlying reason why firms allocate rather than directly measure capacity costs. Controllability is less important. In particular, GAAP mandates that we allocate manufacturing overhead to products, even if they are not controllable. Furthermore, firms do not allocate selling and distribution costs to units in inventory even though these costs may be controllable. Firms also tend to employ simple one-pool systems when allocating costs for valuing inventory.

As Exhibit 9.12 shows, the link to controllability is even weaker when using allocations to determine reimbursements or to influence behavior. In these cases, the focus is on what behavior we wish to encourage or deter—controllability is less of an issue.

We must always keep the specific context in mind when seeking to understand, design, and use cost allocation systems. Ideally, firms need to use separate systems for each purpose. Unfortunately, multiple systems increase the potential to confuse users, most firms use one cost allocation for all purposes. Managers therefore must modify available data often to make it suitable for the specific purpose at hand.

SUMMARY

In this chapter, we discussed the how and the why of cost allocations. We learned that organizations use cost allocations for several purposes, including decision making, reporting income to external parties, justifying reimbursements, and influencing behavior. We studied each of these uses as well as the mechanics underlying allocations. While controllability is the driving

force behind the use of allocations for decision making, incentives drive the choice of allocation procedures for the other three uses.

In Chapter 10, we examine in detail the use of cost allocations as decision aids. Our primary focus is activity-based costing (ABC), a technique to help improve our estimates of product profitability. In Chapters 14 and 15, we consider further the external reporting role of allocations, examining job and process costing systems, respectively.

Rapid Review

LEARNING OBJECTIVE 1

Understand how to use cost allocations to make long-term decisions.

- The key feature distinguishing long-term decisions from short-term decisions is the ability to change the level of capacity supplied and, thus, capacity costs. In the long term, we can sell excess capacity or acquire additional capacity. Accordingly, we need to consider the cost of capacity resources when evaluating long-term decisions.
- There are two general approaches to estimating the change in capacity costs: (1) direct estimation and (2) allocations. While potentially accurate, direct estimation is difficult and time-consuming. In addition, its accuracy depends on the expertise and incentives of the person making the estimates. For these reasons, organizations make frequent use of cost allocations. An allocation distributes a common cost or benefit among two or more cost objects (e.g., products, departments).

LEARNING OBJECTIVE 2

Explain how cost allocations affect income under absorption costing relative to variable costing.

- Under variable costing, sales, the unit contribution margin, and fixed costs determine reported income. We do not need to use cost allocations to arrive at net income or inventory values when constructing the contribution margin statement.
- Cost allocations play an important role in determining income reported under Generally Accepted Accounting Principles (GAAP). GAAP specifies that a cost of a unit in inventory should include the direct manufacturing costs of materials and labor as well as the indirect manufacturing costs such as machine depreciation and factory rent. Because these costs are indirect, firms use cost allocations to value inventory and, in turn, determine cost of goods sold and net income. The matching principle, a fundamental precept of GAAP, underlies this use of cost allocations.
- A common criticism of absorption costing is that it provides incentives to produce more than what is necessary to satisfy demand. This incentive arises because a firm can report higher income merely by increasing production.
- Increases or decreases in inventory levels will cause income under variable costing to differ from income under absorption costing. We reconcile this difference as:

  Income reported under variable costing
  + Fixed manufacturing costs in ending inventory
  − Fixed manufacturing costs in beginning inventory
  = Income reported under absorption costing

LEARNING OBJECTIVE 3

Describe the role of incentives in the choice of allocation procedures.

- Numerous organizations use allocated costs to justify prices. In such instances, firms can be strategic by choosing a procedure that increases the portion of costs allocated to the goods and services priced on a cost-plus basis. By merely changing the basis for cost allocation, organizations can sometimes increase their profitability.
- Cost allocations are a way to penalize and, therefore, dissuade the use of one resource in favor of another resource. For example, cost allocations based on labor may encourage managers to automate production processes. In addition, cost allocations can induce the efficient use of resources shared by multiple users by discouraging wasteful use.
- While controllability is central when allocating costs for decision making, it is subordinate to incentives when allocating costs for other uses, such as valuing inventory, justifying costs, and influencing behavior.

Appendix

VARIABLE AND ABSORPTION COSTING

In this appendix, we use an example to provide an in-depth comparison of variable and absorption costing. Consider Bath Technologies, a firm that makes enamel-coated steel bathtubs. Exhibit 9.13 presents Bath's variable costing income statement for the most recent quarter of operations.

We begin by noting that variable costing conforms to the CVP relation you learned in Chapter 5. Thus, we could express Bath's monthly profit before taxes as:

$$\text{Monthly profit before taxes} = (\text{Sales in units} \times \$416) - \$3{,}725{,}000$$

Exhibit 9.13 also shows that Bath accumulated inventory of 200 bathtubs in August; the firm produced 10,000 tubs but only sold 9,800. Bath values this inventory at the variable manufacturing cost of $270 per unit ($120 in direct materials + $150 in direct labor). Variable selling costs are not included in ending inventory values because Bath would not have incurred selling expenses for the unsold units in its inventory.

In essence, sales, the unit contribution margin, and fixed costs determine income reported under variable costing. Whether Bath accumulates inventories (as in

Exhibit 9.13 *Bath Technologies: Variable Costing Income Statement*

	Per unit	July	August	September
Sales volume (in units)		10,000	9,800	10,200
Production volume (in units)		10,000	10,000	10,000
Revenue	$700	$7,000,000	$6,860,000	$7,140,000
Variable costs				
Direct materials	$120	1,200,000	1,176,000	1,224,000
Direct labor	$150	1,500,000	1,470,000	1,530,000
Marketing and sales	$14	140,000	137,200	142,800
Contribution margin	$416	$4,160,000	$4,076,800	$4,243,200
Fixed costs				
Manufacturing		2,550,000	2,550,000	2,550,000
Marketing and administration		1,175,000	1,175,000	1,175,000
Profit before taxes		$435,000	$351,800	$518,200
Inventory:				
Units in ending inventory		0	200	0
Value per unit		$270	$270	$270
Value of ending inventory		$0	$54,000	$0

Check It! Exercise #5

Using Bath's monthly CVP equation, verify its income before taxes for the months of July, August, and September as reported in Exhibit 9.13.

Solution at end of chapter.

August) or depletes inventories (as in September) does not affect reported income. We also note that Bath does not use any cost allocations to arrive at monthly income or inventory values when constructing the variable costing income statement. However, as mentioned in the chapter, this approach is not acceptable under GAAP for external reporting purposes.

Absorption Costing

Absorption costing separates costs that are required to ready goods for sale (product costs) from all other costs (period costs). Exhibit 9.14 recasts Bath's data using the absorption costing approach. Some refer to this format as **full costing** because accounting convention terms a product's inventoriable cost as its full cost.

To comply with GAAP, Bath allocates fixed manufacturing costs to units *produced*. That is, Bath divides its monthly fixed costs ($2,550,000) by its monthly production (10,000 units) to arrive at a fixed manufacturing rate of $255 per unit. Bath adds this allocated cost to variable manufacturing costs ($270), thereby valuing each tub at $525. Thus, Bath computes its COGS as the number of tubs sold × $525. Likewise, it values the inventory of 200 tubs in August at $105,000 (200 tubs × $525 per tub).

Exhibit 9.14 *Bath Technologies: Absorption Costing Income Statement and Inventory Values*

	Revenue/ Cost per unit	July	August	September
Sales volume (in units)		10,000	9,800	10,200
Production volume (in units)		10,000	10,000	10,000
Revenue	$700	$7,000,000	$6,860,000	$7,140,000
Cost of goods sold				
Direct materials	$120	1,200,000	1,176,000	1,224,000
Direct labor	$150	1,500,000	1,470,000	1,530,000
Allocated fixed manufacturing costs	$255	2,550,000	2,499,000	2,601,000
Total cost of goods sold	$525	5,250,000	5,145,000	5,355,000
Gross margin	$175	$1,750,000	$1,715,000	$1,785,000
Period costs				
Variable marketing and sales	$14	140,000	137,200	142,800
Fixed marketing and sales		1,175,000	1,175,000	1,175,000
Profit before taxes		$435,000	$402,800	$467,200
Inventory:				
Units in ending inventory		0	200	0
Inventoriable cost per unit		$525	$525	$525
Value of ending inventory		$0	$105,000	$0

Recall that because manufacturing overhead "travels" with the units, the cost of goods sold account will include the fixed manufacturing costs of units sold. The finished goods inventory account will contain the fixed manufacturing costs of units produced but not sold. Thus, focusing only on the fixed manufacturing costs, we see that the cost of goods sold contains $2,499,000 of the $2,550,000 of fixed manufacturing overhead, and the finished goods inventory contains the remainder of $51,000.

ABSORPTION COSTING AND THE MATCHING PRINCIPLE

The matching principle, a fundamental tenet of GAAP, requires firms to recognize costs in the same period in which the associated revenue occurs. GAAP specifies that fixed manufacturing costs are part of the cost of producing a unit and requires that companies record the product cost as an expense only in the period in which they make the sale and recognize the associated revenue. Absorption costing accomplishes this goal by allocating fixed manufacturing costs to units in inventory. When the sale eventually takes place, fixed manufacturing costs are included in cost of goods sold for that accounting period.

INCENTIVES TO OVERPRODUCE UNDER ABSORPTION COSTING

A common criticism of absorption costing is that it provides incentives to produce more than what is necessary to satisfy demand. This incentive arises because a firm can report a higher income merely by increasing production. To illustrate, assume that Bath increases production from 10,000 to 15,000 tubs during July, but sales remain at 10,000 units. In this case, the new allocation rate is $170 per unit ($2,550,000/15,000 units). Why? The additional production decreases the overhead rate from $255 per unit ($2,550,000/10,000 units) to $170 per unit. Because this change in allocation rate does not change either revenue or variable costs, the gross margin per unit increases by $85 per unit, from $175 per unit to $260 per unit. As a result, income increases by 10,000 units × $85 per unit = $850,000, to $1,285,000.

This increase is illusory. The firm now has 5,000 units in inventory, whereas previously it had none. Inventory contains $850,000 (5,000 units × $170 per unit) of July's fixed overhead costs. This "hiding" of the overhead cost in inventory is the source for the additional "profit" in July. This cost will become part of cost of goods sold in some future period, when Bath sells these 5,000 units.

Why might managers seek to boost current income in this manner? Managers may be overly optimistic about the future. They might view the inventory buildup as a way to use currently available capacity to meet future demand. Managers also might want to increase reported income if they receive bonuses based on the income that they report.

Reconciling Variable and Absorption Costing Income

Over the lifetime of the firm, both variable and absorption costing will lead to the same total income, as the firm begins and ends with zero inventories. However, within a shorter period, any increase or decrease in inventory levels will cause the two incomes to differ. We can reconcile this difference as follows:

Income reported under variable costing
+ Fixed manufacturing costs in ending inventory
− Fixed manufacturing costs in beginning inventory
= Income reported under absorption costing

Check It! Exercise #6

Complete the following table to reconcile the income numbers reported under variable costing and absorption costing. Recall that the fixed manufacturing cost per unit = $255

	July	*August*	*September*
Units in beginning inventory	0	_____	_____
Units in ending inventory	_____	_____	0
Income reported under variable costing	$435,000	$351,800	$518,200
+ Fixed manufacturing costs in ending inventory	_____	_____	_____
− Fixed manufacturing costs in beginning inventory	_____	_____	_____
= Income reported under absorption costing	$435,000	$402,800	$467,200

Solution at end of chapter.

In our example, Bath reports income of $435,000 for July under both variable and absorption costing because production equaled sales and the firm had zero units in beginning inventory. There was no change in inventory levels. Therefore, income reported under absorption costing equaled income reported under variable costing.

Referring to Exhibits 9.13 and 9.14 for the month of August, we find that income under absorption costing is $51,000 higher than income under variable costing ($402,800 − $351,800). Note that this difference in income corresponds to the difference in ending inventory values—ending inventory under absorption costing is $105,000, whereas it is only $54,000 under variable costing. The $51,000 represents the fixed manufacturing costs in ending inventory under absorption costing (200 unsold bathtubs × $255 fixed manufacturing cost per bathtub).

In September, income reported under absorption costing is $51,000 *less* than income reported under variable costing because Bath *sold* its inventory of 200 tubs. Accordingly, the income statement for September includes the costs attached to these units. Under variable costing, these costs include direct materials and direct labor. Under absorption costing, however, the cost also includes the $51,000 in fixed manufacturing costs allocated to the ending inventory of 200 units in August. These costs become a part of the COGS for September when Bath sells the units it inventoried in August. Thus, September income decreases by the same $51,000.

Answers to Check It! Exercises

Exercise #1: Direct labor dollars (DL$) = $1,350,000 and $1,800,000; Percentage of DL$ = 42.86% and 57.14%; Amount allocated = $3,240,000 and $4,320,000; Percent of cost allocated = 42.86% and 57.14%.

Exercise #2: Allocation rate = $7,560,000/30,000 = $252 per mattress; Allocated fixed costs = $2,520,000 ($252 × 10,000) and $5,040,000 ($252 × 20,000). The total does not change

because we have 30,000 units both under the current and projected mix. Furthermore, when we choose units as the allocation basis, the fixed overhead estimate is proportional to total units. This estimate is likely to be erroneous because manufacturing capacity costs are not likely to be related to units sold—that is, Standard and Deluxe mattresses consume varying amounts of resources. As discussed in the text, the Deluxe mattresses use much more labor time, which, in turn, leads to greater use of the factory's capacity.

Exercise #3: Unit contribution margin is $256 per Standard mattress and is $303 per Deluxe mattress. We can calculate these values as $4,352,000/17,000 Standard mattresses and $3,514,800/11,600 Deluxe mattress. Thus, the contribution lost because of the lower sales volume (relative to the volume in Exhibit 9.1) is (1,000 Standard × $256) + (400 Deluxe × $303 per mattress) = $377,200.

Exercise #4: The allocation rate is $80 per machine hour. Thus, $4,400,000 would be allocated to public meals (= 0.55 × $8,000,000), and $3,600,000 would be allocated to the military contract (= 0.45 × $8,000,000). The gross margin for public meals is therefore $1,600,000 (= $16,000,000 − $10,000,000 − $4,400,000). The gross margin for the military is $2,320,000 (= [$8,000,000 + $3,600,000] × 0.20). The total gross margin = $1,600,000 + $2,320,000 = $3,920,000, which is still lower than the $4,400,000 total gross margin using meals as the allocation basis.

Exercise #5: July: (10,000 × $416) − $3,725,000 = $435,000; August: (9,800 × $416) − $3,725,000 = $351,800; September: (10,200 × $416) − $3,725,000 = $518,200.

Exercise #6: July: 0, $0, $0, 435,000 + $0 − $0 = $435,000; August: 0, 200, $351,800 + $51,000 − $0 = $402,800; September: 200, 0, $518,200 + $0 − $51,000 = $467,200.

SELF-STUDY PROBLEMS

Susan Brown, a talented engineer, holds the patent on a device that helps cap oil wells. Susan runs a small firm that makes and sells this product, which we refer to as the "cap." Susan has provided you with the following data regarding her operations:

Sales volume	1,500 units per month
Selling price	$350 per unit
Direct materials costs	$120 per unit
Labor hours consumed	3 hours per unit
Variable marketing and selling costs	$25 per unit

Susan pays her labor $20 per hour. She also incurs fixed manufacturing costs of $135,000 per month and fixed marketing and administrative costs of $30,000 per month. Finally, Susan currently is operating at full capacity, which she defines in terms of labor hours.

a. *One of Susan's customers approaches her to make a new component. This component has materials cost of $200 per unit and would consume 2 hours of labor per unit. In addition, it would cost Susan $10 per unit in variable marketing and selling costs. The customer needs 450 units urgently and knows that Susan's factory has the needed equipment. The customer's regular supplier had a fire in its factory and cannot supply the units this month. For this short-term decision, what is the minimum price that Susan should charge per unit for this new component so that her monthly profit does not decrease?*

In this situation, Susan faces a short-term decision with excess demand (as we studied in Chapter 6). The decision is short term because it pertains to a one-time special order. The situation is one of excess demand as Susan currently is operating at full capacity and the special order would put her over the top. Because Susan cannot expand her capacity in the short term, contribution margin is the relevant concept.

In the following table, we compute the incremental costs for this decision.

Item	*Detail*	*Cost*
Direct materials cost for new component	450 units × $200 per unit	$90,000
Direct labor cost for new component	450 units × 2 hours per unit × $20 per hour	$18,000
Variable marketing and sales costs for new component	450 units × $10 per unit	$4,500
Lost contribution margin from selling 300 fewer caps	300 caps × $145 per cap*	$43,500
Total incremental costs		$156,000

* Unit contribution margin for current caps = $350 − $120 − (3 labor hours × $20 per hour) − $25 = $145. Because the new component would consume 900 labor hours (= 450 units × 2 hours per unit), Susan would have to give up production of 300 caps (= 900 hours/3 hours per cap).

Our analysis reveals that the minimum price for the new component is $156,000 for the order of 450 components, or $156,000/450 = $346.67 per component.

b. *Suppose Susan's customer has approached her with the intention of switching suppliers rather than filling a temporary need. The customer would give Susan time to acquire the additional capacity resources required to handle the increase in monthly production volume. Thus, rather than having to sacrifice regular business, Susan can acquire the needed capacity to handle both her regular business and the additional business. Susan believes that her fixed manufacturing costs relate to direct labor cost, while her fixed marketing and administration costs relate to sales volume in units. For this long-term decision, what is the minimum price that Susan could charge per unit for the new component without decreasing her profit?*

Susan now faces a long-term decision as she is contemplating a long-lasting change to her product line. Thus, we can no longer use contribution margin to determine all controllable costs and benefits, which now include the opportunity cost of capacity. The problem indicates that labor cost is the appropriate driver for fixed manufacturing costs, and sales volume in units is the appropriate driver for fixed marketing and administration costs. Using the data from current operations, we have:

Item	*Fixed Manufacturing Costs*	*Fixed Marketing Costs*
Amount in cost pool	$135,000	$30,000
Cost driver	Labor cost	Units sold
Denominator volume	$90,000*	1,500 units
Allocation rate	$1.50 per labor $ (= $135,000/$90,000)	$20 per unit (=$30,000/1,500 units)

* $90,000 = 1,500 units × 3 labor hours per unit × $20 per labor hour

Using this data, we could project the increase in fixed manufacturing and fixed marketing and administration costs required if Susan produces the new component. Including the variable costs, we calculate the controllable cost of producing the new component as:

Item	*Detail*	*Cost*
Direct materials cost	Given	$200
Direct labor cost	2 hours per unit × $20 per hour	40
Variable marketing cost	Given	10
Allocated fixed manufacturing costs	$40 labor per unit × $1.50 per labor $	60
Allocated fixed marketing costs	$20 per unit	20
Total controllable costs per unit		$330

Thus, over the long-term, Susan's minimum price for the new component is $330 per unit. Notice that this price is lower than the price we computed in part (a). Rather than having to ration capacity as she did in the short term, Susan has the option of acquiring additional capacity in the long term. This ability to adjust capacity expands Susan's options and, in this example, reduces the price per unit for the new component.

c. *(Appendix) For parts (c), (d), and (e), ignore data pertaining to the new component. Assume that for the most recent month, Susan produced 1,500 caps but only sold 1,350 caps. Determine her monthly income and the value of her ending inventory as reported under variable costing. Assume Susan had zero units in beginning inventory.*

The following table provides Susan's monthly income and the value of her ending inventory under variable costing. This statement is in the contribution margin format as it groups fixed and variable costs.

Sales volume (in units)		1,350
Production volume (in units)		1,500
Revenue	$350 per unit	$472,500
Variable costs		
Direct materials	$120 per unit	$162,000
Direct labor	$60 per unit	81,000
Marketing and sales	$25 per unit	33,750
Contribution margin		$195,750
Fixed costs		
Manufacturing		135,000
Marketing and administration		30,000
Profit before taxes		$30,750
Inventory:		
Units in ending inventory		150
Value per unit	$120 dm + $60 dl	$180
Value of ending inventory		$27,000

d. *(Appendix) As in part (c), assume that for the most recent month Susan produced 1,500 caps but only sold 1,350 caps. Determine her monthly income and the value of her ending inventory if she prepared financial statements in accordance with Generally Accepted Accounting Principles (GAAP) as under absorption costing. To comply with GAAP, Susan allocates fixed manufacturing costs to units produced. Assume that Susan uses units produced to allocate manufacturing overhead to products and that Susan had zero units in beginning inventory.*

Under absorption costing, the method specified by GAAP, Susan needs to allocate fixed manufacturing costs to units produced. These costs then "travel" with the units via the inventory account to cost of goods sold. Susan incurs fixed manufacturing costs of $135,000 per month. Her allocation rate is therefore $90 per unit = $135,000/1,500 units. In turn, Susan's inventoriable cost per unit is $270 = $120 for materials + $60 for labor + $90 for allocated manufacturing overhead.

With this information, the following table provides the income reported under absorption costing. This statement is in the gross margin format as it groups manufacturing costs and non-manufacturing costs.

Sales volume (in units)		1,350
Production volume (in units)		1,500
Revenue	$350 per unit	$472,500
Cost of goods sold		
Direct materials	$120 per unit	$162,000
Direct labor	$60 per unit	$81,000
Allocated fixed costs	$90 per unit	$121,500
Gross margin		$108,000
Period costs		
Variable marketing and sales	$25 per unit	$33,750
Fixed marketing and administration		$30,000
Profit before taxes		$44,250
Inventory:		
Units in ending inventory		150
Value per unit	$120 + $60 + $90	$270
Value of ending inventory		$40,500

e. *(Appendix) Reconcile the incomes reported under variable costing and absorption costing. Explain your logic.*

The income reported under the two methods differs owing to the differing treatment of fixed manufacturing costs. Under variable costing, we expense all of the fixed manufacturing

costs in the income statement. Under absorption costing, we allocate this cost to units produced. We expense the cost only when we sell the units. Thus, any discrepancy between the number of units produced and sold would lead to some fixed manufacturing cost being added to or taken out of the inventory accounts. This amount also appears as a difference in the incomes reported under the methods.

Using the formula from the text, we have:

Income reported under variable costing	from part (c)	\$30,750
+ Fixed manufacturing costs in ending inventory	(1,500 − 1,350) units × \$90 per unit	\$13,500
− Fixed manufacturing costs in beginning inventory	given	\$0
= Income reported under absorption costing	from part (d)	\$44,250

Notice that the difference in incomes reported under the variable and absorption costing methods corresponds to the differences in ending inventory values (i.e., \$40,500 − \$27,000 = \$13,500).

Glossary

Absorption costing A method whereby a product's inventoriable cost includes direct manufacturing costs, such as materials and direct labor, as well as indirect manufacturing costs such as machine depreciation and factory. Generally Accepted Accounting Principles (GAAP) requires absorption costing.

Allocation rate Equals the costs in the cost pool divided by the allocation (denominator) volume.

Burden Term frequently used to refer to "allocation rate."

Departmental rates The use of many rates, usually one per department, for allocating capacity (overhead) costs to products.

Direct costing Term frequently used to refer to "variable costing."

Full costing Term frequently used to refer to "absorption costing."

Overhead costs Term frequently used to refer to "capacity costs."

Overhead rate Term frequently used to refer to "allocation rate."

Plantwide rate The use of one rate for the entire company when allocating capacity costs (overhead) to products.

Profit margin Contribution margin less allocated capacity costs.

Variable costing A method that separates variable costs from fixed costs. Under this method, the cost of a unit of product in inventory includes only variable manufacturing costs, such as direct materials, direct labor, and variable manufacturing overhead.

Review Questions

9.1 LO1. What is the appropriate measure of value for long-term decisions?

9.2 LO1. What is the difference between a contribution margin and a profit margin?

9.3 LO1. What are the two approaches for estimating the controllable cost of capacity resources over the long term?

9.4 LO1. Describe the direct estimation method for estimating controllable capacity costs. List one advantage and one disadvantage of this approach.

9.5 LO1. In addition to decision making, what are the other common uses of cost allocations?

9.6 LO2. Which of the two methods, variable costing or absorption costing, is allowed under GAAP?

9.7 LO2. What costs does the value of a unit of product include under absorption costing?

9.8 LO2. Under variable costing, how does sales volume affect the amount of fixed manufacturing overhead expensed in the income statement?

9.9 LO2. Under absorption costing, how does sales volume affect the amount of fixed manufacturing overhead expensed in the income statement?

9.10 LO2. When will income reported under variable costing be the same as income reported under absorption costing?

9.11 LO3. Why might the Department of Defense pay some of its suppliers on a cost-plus basis?

9.12 LO3. Why might a firm be strategic in the choice of allocation procedures to determine reimbursable costs?

9.13 LO3. How could a firm induce desirable behavior or dissuade undesirable behavior by changing its cost allocation procedures?

9.14 LO3. What are the two main influences that guide the choice of a cost allocation procedure?

9.15 Appendix. What is the formula for reconciling income reported under variable costing with income reported under absorption costing?

Discussion Questions

9.16 LO1. Many firms dedicate separate production facilities to each of their product lines. What are some of the advantages and disadvantages of this approach from the perspective of allocating costs for decision making?

9.17 LO1. Suppose a firm currently makes three products using the same capacity resources and that one of the products has a negative profit margin. Identify two reasons why the firm may wish to continue making the unprofitable product.

9.18 LO1. We define "long term" as the time needed to change capacity resources. What do you think constitutes the "long term" for the following industries: (a) Automobiles, (b) Toys, (c) Computers, and (d) Construction Equipment?

9.19 LO1 (Advanced). When using allocated costs for decision making, we assume that capacity costs will change in proportion to changes in the cost driver. How can a company validate this assumption when it chooses cost drivers? (*Hint*: Consider the techniques we used in Chapter 4 to determine the link between activity volume and variable costs.)

9.20 LO2 (Advanced). Do you believe GAAP should allow variable costing for external reporting? Why or why not?

9.21 LO2. GAAP usually excludes research and development costs from its definition of inventoriable costs. Why do you believe GAAP mandates such a treatment?

9.22 LO2. "Depreciation is nothing but an allocation of the purchase price over different accounting periods." Do you agree with this statement? If so, identify the elements of cost allocations (cost pool, cost objects, cost driver, denominator volume) implicit in the computation of depreciation. If not, identify differences between cost allocations and depreciation.

9.23 LO2. Assume a firm's overall inventory has increased during the period. Is it possible for income under variable costing to exceed income under absorption costing? (*Hint:* think about multiproduct firms or changing prices and inventory layers).

9.24 LO3. Cost uncertainty creates more opportunities to exaggerate costs. Yet, cost reimbursement is more prevalent in situations with high cost uncertainty. How might we reconcile these contradictory tensions?

9.25 LO3. The IRS exempts qualified charities from income taxes, provided the income relates to their charitable activities. The provision exists because many charities conduct activities deemed unrelated to their core charitable mission. For example, a museum may earn income on its cafeteria sales or by renting out its lobby for a corporate reception. Such unrelated business income is taxable. Determining the portion of income that is taxable often involves extensive cost allocations. How might a charity be strategic in its choice of allocation methods? (*Hint*: An academic study found that nearly 30% of sampled charities reported *exactly* $0 as their unrelated business income.)

9.26 LO3. Suppose a firm produces two products, both of which are sold in competitive markets. Are there any incentives to be strategic when allocating costs between these two products?

9.27 LO3. Firms that allocate costs based on head count motivate their managers to reduce the number of employees. What kind of dysfunctional and profit-destroying (from the firm's perspective) behavior might such allocations engender?

9.28 LO3. Suppose a firm allocates costs to its individual product lines using labor cost as the allocation basis. Further assume that each product line's manager is evaluated based on the line's reported profit. How might this allocation affect a manager's short-term decision to make or buy individual components?

9.29 LO3. Even when a decision is short term, the use of allocated costs in managerial performance evaluation implicitly makes the manager behave as if the decision were a long-term decision. Do you agree with this statement?

9.30 LO3. Governments often use tax policy to induce desired behavior (e.g., allow mortgage interest to be deducted) or to dissuade undesired behavior (e.g., "sin taxes" on cigarettes). Can you give two additional examples of how tax policy influences behavior? Discuss the similarities and differences between the use of tax policies and cost allocations to modify behavior.

EXERCISES

9.31 Contractor pricing, qualitative (LO1). Service providers such as plumbers and electricians often charge $60 per hour even in rural areas where a factory job that pays perhaps $20–$25 per hour would be considered a "good job." Furthermore, factory workers often have training that equals that of most plumbers and electricians.

Required:

Explain the seeming discrepancy in the prices for labor services. Please note that many plumbers and electricians operate small businesses.

9.32 Increase in volume of business and cost projections (LO1). David Sharma sells masks, textiles, and other goods imported from Africa. David usually marks up his purchases by 300% (that is, if he pays $10 for an item, he lists it at $40). His annual sales range from $1,400,000 to $1,700,000, with sales for the current year expected to be $1,500,000. He also incurs fixed costs related to the rental for his store, travel, and other items. Such fixed costs generally amount to $900,000 per year.

Required:

a. Suppose David anticipates sales of $1,700,000 next year. Calculate his expected profit for the current year and for next year, assuming that he does not change his pricing strategy. Use the contribution margin format.

b. Suppose David anticipates sales of $2,800,000 next year because he expects African art to come into "fashion." Calculate expected profit. The new level of fixed costs is $1,600,000.

c. Why is it reasonable to think of fixed costs as being controllable when computing the answer for part (b) but not for part (a)? How might David reasonably estimate the "fixed" costs if he expects sales of $2,800,000 next year?

9.33 Increase in volume of business and cost projections (LO1). Acme Manufacturing Company has approached Hercules Health club with a plan to provide discounted memberships to its employees. In particular, Acme will start a match program (i.e., Acme will pay a part of the club fees charged to its employees) to motivate its employees to join the fitness club. In return, Acme wants Hercules to give a 25% discount—that is, the fee to Acme employees would be $60 per person instead of the normal charge of $80 per person per month.

You learn that Hercules currently has 1,000 members and incurs variable costs of $35 per member per month and fixed costs of $40,000 per month. Tom and Lynda tell you that the club can accommodate the 200 members that would be added if they accepted Acme's proposal. However, they also tell you that more than 200 additional members would strain the club's capacity.

Required:

a. What is the additional contribution margin if Hercules were to accept Acme's proposal?

b. Is the answer in part (a) the correct way to evaluate Acme's proposal?

c. How might allocations help Tom and Lynda improve their decision making? Justify with suitable supporting calculations.

9.34 Absorption costing, income, and inventory effects of alternative allocation bases (LO2). Charlie Stumpf manufactures and sells high-quality, handmade wooden toys. Charlie began the current year with zero inventories. During the year, Charlie produced toys that consumed $24,000 in materials and $30,000 in labor. At year-end, Charlie estimated that his inventory comprised toys that had $5,000 of materials content and $7,500 of labor content. Based on his actual fixed manufacturing overhead costs, Charlie added overhead to products at the rate of 100% of labor cost.

Required:

a. What is the value of Charlie's ending inventory under absorption costing?

b. Repeat requirement (a) assuming that Charlie allocates overhead to products using material cost, rather than labor cost, as the allocation basis.

c. Which of the two allocation bases, labor cost or materials cost, will cause Charlie to report higher income for the year? Why?

9.35 Allocations under absorption costing, GAAP inventory valuation (LO2). Precision Bearings manufactures several kinds of roller bearings. This past year, Precision spent $11,750,000 on fixed manufacturing costs, $1,762,500 on fixed selling and administrative costs, and $23,500,000 for direct labor. Precision produced 5,875,000 bearings and sold 5,500,000 bearings during the year.

The following table provides the direct materials and labor costs for three of Precision's bearings:

	Model 6203	*Model 6210*	*Model 30207*
Materials cost	$1.00	$1.75	$3.00
Labor cost	$3.00	$4.00	$7.00

Required:

a. Assume that Precision allocates fixed costs using the number of units produced as the allocation basis. Under absorption costing, what is the inventoriable cost per unit of each of the three bearings?

b. Assume that Precision allocates fixed costs using direct labor costs as the allocation basis. Under absorption costing, what is the inventoriable cost per unit of each of the three bearings?

c. Compare the answers to parts (a) and (b). Comment on any differences in inventoriable cost.

9.36 Variable costing versus absorption costing, Income Reconciliation (LO2). Horizon Manufacturing provides you with the following information for the most recent month of operations:

Units in beginning inventory	0
Units produced	2,000
Units sold	1,600
Selling price	$50 per unit
Fixed manufacturing costs	$24,000
Fixed selling and administrative costs	$10,000
Variable manufacturing costs	$16 per unit
Variable selling and administrative costs	$6 per unit

Required:

a. What is Horizon's reported income and cost of ending inventory under variable costing?

b. What is Horizon's reported income and cost of ending inventory under absorption costing? Assume Horizon allocates cost using units produced.

c. Reconcile the difference between Horizon's income under variable costing and absorption costing.

9.37 Variable costing versus absorption costing (LO2). Creative makes tiles in batches of 1,000 tiles each, the standard "unit" in the industry. Each batch consumes $70 in materials and $140 in labor costs. Manufacturing overhead amounts to $1,500,000 and is allocated equally among the batches produced during the year. Creative had no inventories at the beginning of the most recent year. During the most recent year, Creative made 15,000 batches. The firm sold 13,500 batches for an average price of $450 each. Creative incurred variable marketing costs of $50 per batch and fixed marketing costs of $625,000 for the year.

Required:

a. Prepare a contribution margin statement for Creative Tiles for the most recent year. In addition, compute the value of the Creative Tiles' ending inventory under variable costing.

b. Prepare a gross margin statement for Creative Tiles for the most recent year. Also compute the value of the Creative Tiles' ending inventory under absorption costing.

c. Reconcile the income reported under variable costing and absorption costing. Briefly explain the reason for the difference.

9.38 Allocations for taxes (LO3). Located in Madras, India, Shah Company manufactures and sells leather garments in India and in Europe. For the most recent year of operations, Shah sold 20,000 garments each in Europe and India. Each garment sold in India consumes 4 hours of labor, while each garment sold in Europe consumes 7 hours of labor. Shah currently allocates fixed manufacturing overhead costs, which amount to $660,000 per year, using the number of garments produced for the allocation basis.

Shah's income-tax rate in Europe is 40% and 30% in India. Assume that each jurisdiction (Europe, India) taxes only income reported in that jurisdiction.

Required:

Compute the net savings in taxes paid if Shah were to allocate overhead costs using labor hours rather than garments as the allocation basis.

9.39 Change in product mix (LO1). Bradshaw Industries makes two varieties—Standard and Deluxe—of its one product. The following data are available:

	Standard	*Deluxe*
Number of units	250,000	50,000
Labor hours per unit	2	4
Price per unit	$14	$18
Variable costs	$8	$9
Contribution margin	$6	$9

You also know that Bradshaw incurs common fixed costs of $1,400,000.

Suppose Bradshaw is considering changing its product mix to sell equal amounts of its Standard and Deluxe products. Total sales would remain at 300,000 units. This change would be implemented over the next two to three years.

Required:

a. Why should Bradshaw consider the common fixed costs as being controllable for this decision?

b. Allocating common fixed costs as per the number of units, calculate Bradshaw's expected profit with the new product mix.

c. Repeat part (b) except use the number of direct labor hours to allocate costs to the two products.

d. Which of the two estimates, in part (b) or part (c), do you feel is a superior estimate of profit with the new mix? Why?

9.40 Allocations under absorption costing, GAAP inventory valuation, two departments (LO2). The Boston Box Company has two departments, fabrication and assembly. Boston uses machine hours to allocate overhead costs in the fabrication department and labor hours to allocate overhead costs in the assembly department. Pertinent data for each department follows:

Item	*Fabrication*	*Assembly*
Overhead costs	$66,000	$39,000
Labor hours	4,000	6,000
Machine hours	12,000	6,500

Required:

a. One of Boston Box's products has direct materials costs of $50 per unit and direct labor costs of $42 per unit. This product uses one machine hour in the fabrication department and two labor hours in the assembly department. Finally, the product incurs $6 in variable selling costs and $5 in allocated fixed marketing costs per unit. Determine the inventoriable cost of this product under absorption costing.

b. Briefly discuss whether the inventoriable cost, as computed under absorption costing, is the appropriate cost estimate to use when determining a product's long-term profitability.

9.41 Allocations and inventory valuation, incentives (LO2, LO3). Atsuko Ito makes custom skates that sell for $750 a pair. Atsuko began the most recent year with zero inventory. She produced 3,500 pairs of skates during the year and sold 3,300 of them. Atsuko

figures that the skates in inventory at year end have materials worth $50,000 and labor of $62,500. Atsuko also informs you that she spent $700,000 on materials, $1,050,000 on labor, $525,000 on manufacturing overhead, and $250,000 on selling and administrative costs during the year.

Required:

a. Using labor dollars to allocate manufacturing overhead costs, determine the value of Atsuko's ending inventory under GAAP.

b. Using the ending inventory value derived in requirement (a), determine Atsuko's reported income for the year.

c. Suppose it is near the end of the fiscal year. Because of the lead-time required, Atsuko has received all of the orders relating to the current year. Revenues from any new orders would be booked in the financial statements for the following year. Discuss one way in which Atsuko could temporarily boost her current year's reported income.

9.42 Inventory valuation, variable overhead, multiple cost pools (LO2). Xenon Corporation makes a number of industrial products. Xenon estimates annual factory overhead at $1,500,000, materials cost at $600,000, and labor cost at $1,000,000. In addition, Xenon considers one-third of its overhead to be variable, as these costs pertain to items such as supplies, oils, and lubricants. Xenon uses direct labor cost to allocate manufacturing overhead to products. One of Xenon's products, a pump, requires $12 in materials and $30 in labor. Each pump sells for $90.

Required:

a. Determine the contribution margin per pump. Assume that pumps do not incur any variable selling and administrative costs.

b. Determine the gross margin per pump.

c. Suppose Xenon analyzes its fixed overhead and determines that $240,000 relates to materials and the remainder relates to labor-related expenses. Xenon allocates materials-related fixed overhead using materials cost as the allocation basis and labor-related fixed overhead using labor cost as the allocation basis. As before, Xenon allocates variable overhead using labor cost as the allocation basis. Determine the gross margin per pump.

d. Why is the gross margin in (c) higher than the gross margin in (b)?

9.43 Allocation for reimbursement, arbitrary nature of some allocations (LO3). Shibin expects to receive his Ph.D. soon from a highly-regarded program. Seeking to hire him for their faculty, the accounting group at State University in New York City invited Shibin to interview. After finalizing dates, Shibin purchased a round-trip airline ticket for $400. Just after he purchased the ticket, Shibin received a call from Prestige University, a private university, also in New York City. The accounting faculty at Prestige had heard that Shibin was coming to State University and wanted to interview him for a position at Prestige as well. They were willing to conduct their interview the day after the interview at State. Shibin, of course, was ecstatic with the chance to interview at two well-regarded institutions.

Shibin called his travel agent to change his ticket. The travel agent informed Shibin that while the price would stay the same, as per airline rules, the change in plans would trigger a penalty of $100.

Required:

How should Shibin allocate the total cost of the airfare (i.e., $500) between the two schools? What is the purpose of this allocation? What factors should he consider as he chooses among alternate splits? (Assume that the split will have no effect on the probability of his getting an offer from either school.)

9.44 Cost allocations and reimbursement (LO3). Pamela Bourjaily is a consultant. Two of Pam's current projects have considerable overlap, meaning that the same background research benefits both projects. The first project, from Apollo Corporation, pays cost plus 50%. The second project, from Troy Brothers, pays cost plus 30%. Apollo is a long-time customer while Troy is a future prospect, which is part of the reason for the price break.

Pam estimates that she has spent $6,000 on travel, books, and databases for work that is common to both projects. She also provides the following additional data.

	Apollo	*Troy*
Budgeted hours	40	40
Pam's sales for the year to the client	$100,000	$25,000
Client's annual sales	$50 million	$200 million

Required:

a. Calculate the cost allocated to the two clients using budgeted hours as the allocation basis. Repeat the exercise using Pam's sales to the clients as the allocation basis and the clients' annual sales as the allocation basis.

b. Advise Pam on the appropriate choice of an allocation basis.

PROBLEMS

9.45 Short vs. long-term considerations in pricing (LO1, qualitative). "My boss simply doesn't get it. We are operating at 60% of capacity, and this situation is not likely to improve for at least six months. I just convinced a regular client to double her order. But, I had to cut the price below cost to get the order. Even with the price cut, we are making a good contribution. Therefore, this is a good deal. But the VP has nixed the deal insisting that all orders must cover full costs, including allocated fixed costs." This is Brian Baxter's rant, after learning that his latest deal has fallen through.

Brian is a star salesman for an equipment manufacturing company that is subject to a six-year business cycle. That is, the firm usually experiences three years of high demand followed by three years of low demand. The firm is currently on the down cycle. An upswing is expected in 6 to 12-months.

Required:

a. How could Brian justify taking an order that generates positive contribution margin but a negative profit margin?

b. What arguments could the VP for sales advance to justify her decision to nix the sale?

9.46 Direct estimation vs. allocated costs (LO1). Catlow Corporation is trying to estimate the costs associated with increased volume of operations. The firm currently has a capacity for 10,000 machine hours, spread over five machines. That is, each machine provides 2,000 hours of capacity. It is not feasible to buy machines with smaller capacity (e.g., to buy a machine with 480 hours or capacity, or rent a machine on a half-time basis).

Currently, the firm makes two products, Alpha and Beta. Alpha, with a volume of 2,900 units, takes two machine hours per unit. Beta, with a volume of 1,400 units, consumes three machine hours per unit. Each machine hour costs has a variable overhead rate of $20 per machine hour (for power, oils, lubricants and other consumable items), and $30 as an allocation for fixed costs (e.g., machine depreciation).

Catlow is considering expanding the volume of its operations to produce 3,400 units of Alpha and 2,000 units of Beta.

Required:

a. Using the cost per machine hour to estimate capacity costs, calculate the total cost of machining time for the two products.

b. How could you refine the estimate in part (a) above? What conclusions do you draw about the relative costs and benefits of direct estimation of capacity costs versus using allocated costs to estimate them?

9.47 Change in product mix (LO1). Sunder Corp. makes two main products in its factory in Birmingham, Alabama. Because of intense competition for standardized products,

particularly from overseas firms, Sunder is considering switching its emphasis to custom-made products.

The following data are available:

Item	Standard Products	Custom Products
Average price per unit	$130 per unit	$175 per unit
Contribution margin ratio	50%	60%
Profit margin per unit	$25	$65
Machine hours per unit	2	4
Number of units	75,000	25,000

Required:

a. Calculate the variable cost and the allocated fixed cost per unit of the standard and the custom product. Comment on the validity of the implied allocation mechanism.

b. Calculate the profit margin for the two products, assuming that Sunder allocates costs to products using machine hours as the allocation basis.

c. Sunder believes that, with suitable marketing, it can change its product mix to be 50,000 units each of the Standard and Custom products. Using fixed costs allocated on the number of units to project the change in capacity costs, estimate Sunder's profit with the proposed product mix.

d. Repeat part (c) except allocate capacity costs using machine hours.

9.48 Change in customer segments (LO1). N&N Sanitation offers waste management services for residential and commercial clients. The following select operating data are available:

	Residential	*Commercial*	*Total*
Number of customers	500	100	600
Number of pickups per week	500	500	1,000
Revenue	$800,000	$1,200,000	$2,000,000
Variable costs	$140,000	$240,000	$380,000
Traceable fixed costs	$150,000	$225,000	$375,000
Common fixed costs	NA	NA	$1,100,000

Believing its commercial customers to be more profitable, N&N is thinking of moving its business more toward the business segment. Management would like to see a mix of 200 residential and 300 commercial clients in three years' time.

Required:

a. Estimate the change in profit arising from the change in product mix. For now, assume that traceable and fixed common costs do not change from current levels.

b. Suppose N&N believes that, in the long run, fixed costs would change in proportion to sales revenue. Calculate the expected profit with the new customer mix. Allocate common fixed costs in proportion to the revenue from the two segments when performing this exercise.

c. Repeat the exercise in part (b), except allocate common fixed costs to segments and in proportion to the number of pickups from each segment. That is, assume that pickups are the cost driver for traceable and common fixed costs.

d. Which of the three estimates, for parts (a) through (c), is likely to be a good estimate of N&N's profits three years hence if it changes its customer mix as indicated?

9.49 Product introduction decisions, qualitative (LO1). "I spend half my time trying to figure out these accounting reports," said Paul Hribar in total frustration. He was trying to figure out whether to introduce a new product and was referring to the latest "Product Cost Estimate" he had received from accounting. He thinks the report is wrong. He argues that "No one will be hired or fired in accounting if I add or do not add this product. But I am being charged for the accounting department's costs and am expected to recover it in the product price. How can this make sense?"

Product Cost Sheet (Estimate)	Model Number: KX –245/R2	
Number of units		50,000
Estimated unit price		$80.00
Materials cost	$13.00	
Labor cost (1 hour @ $22/labor hour)	$22.00	
Variable factory overhead (@$7 per machine hour)	$10.50	
Materials handling (10% of materials cost)	$1.30	
Other factory costs (150% of labor cost)	$33.00	
Total factory cost		$79.80
Gross margin		$0.20
Variable selling costs	$6.45	
Fixed selling costs (5% of price)	$4.00	
Total selling costs		10.45
Net profit		($10.25)

Required:

Explain why the product cost report contains allocations for manufacturing and SG&A overhead.

9.50 Direct estimation vs. using allocated costs (LO1). The following data pertain to the budgeted overhead for Waymire, Inc., which makes wires and coils.

Item	*Amount*
Materials handling and inventory	$2,400,000
Supervision	460,000
Payroll	640,000
Factory administration	1,600,000
Machine depreciation	3,450,000
Machine operations	1,410,000
Sales offices	840,000
Travel and other customer development	1,200,000
Selling administration	1,500,000
Total capacity costs	$13,500,000

Waymire, Inc., has asked for your help in estimating capacity costs if it implements an ambitious plan to rationalize its product portfolio. The change would also increase the amount of automation in the plant. If implemented, the change would dramatically alter Waymire's activity profile. Waymire provides you with the following additional information concerning activity levels before and after the change in product portfolio.

Item	*Current Amount (prior to change)*	*Expected Amount (after the change)*
Materials cost	$48,000,000	$52,000,000
Labor hours	135,000 hours	121,500
Machine hours	81,000 hours	132,300
Revenue	$162,000,000	$175,000,000

Required:

a. Waymire currently uses labor hours to allocate all capacity costs (including SGA costs) to products. Using the allocation rate per unit of this driver, estimate the capacity cost after the change in operations.

b. Repeat the exercise with machine hours and revenue as the sole drivers.

c. Could you construct a better estimate using a combination of these four drivers to model the change in activity levels?

d. How does the refinement in part (c)bring the analysis closer to direct estimation of capacity costs? Comment on the relative merits and demerits of direct estimation and using allocations to estimate capacity costs.

9.51 Choice of cost drivers, behavior modification (LO1, LO3). "I simply don't understand this! I went from a winner to a loser in one month because some bozo in accounting changed his spreadsheet," griped LuAnne Leffler, a sales representative for DisplayCo, a firm that sells display stands to stores.

LuAnne and other sales representatives call on prospective clients to update them regarding new products and prices, to assess customer needs, and to take orders. LuAnne was the top salesperson last year, generating $5 million of DisplayCo's total annual revenue of $60 million. Much of LuAnne's success stemmed from her close relationship with a major client that generated $3 million in annual revenue. LuAnne likes this client a great deal even though the client's average order was smaller than DisplayCos's overall average revenue per order of $8,000.

DisplayCo compensates its sales representatives based on their "margin," computed as sales revenue *less* manufacturing and marketing costs. Under the current system, total manufacturing and marketing costs are allocated on the basis of revenue. For the most recent year, total manufacturing costs equaled 80% of revenue and total marketing costs amounted to 13.50% of revenue.

Recently, DisplayCo's accountant decided to allocate marketing costs by the number of sales orders rather than revenue. The accountant based the marketing allocation rate on last year's total marketing costs and sales orders. Manufacturing costs continue to be allocated at 80% of revenue. LuAnne's reaction is to the new allocation procedure. Under the new system, she has slipped to second place for the most recent month, even though Betty Barnett, the first-place salesperson, recorded monthly sales of only $350,000 from 35 orders when LuAnne had raked in $400,000 from 60 orders.

Required:

a. For the most recent month, compute both LuAnne's and Betty's margin under the allocation system in place before the accountant revised the basis for allocating marketing costs.

b. Compute both LuAnne's and Betty's margin for the most recent month under the accountant's revised allocation system.

c. Which system, the old system or the accountant's revised version, do you believe better captures the profit from a customer? How can you further improve the allocation of marketing costs to customers when assessing the margin generated by individual salespersons?

d. How could a manager use information regarding the margin generated by each sales representative to motivate and reward her sales force?

9.52 Choice of drivers, qualitative (LO1, LO3). Governments and other regulators often finance roads via tolls and other fees paid by motorists. One can view the charge to a motorist as an allocation for the cost of building and maintaining the toll way. Some examples include the New Jersey Turnpike and the "Coastal Highway," a controlled access, high-speed road link between major cities in Tamil Nadu in India.

Required:

Evaluate the costs and benefits of the following four pricing schemes.

1. A flat charge per vehicle, charged when the vehicle enters the toll way.

2. A flat charge per category of vehicle. That is, there is a different charge for a car, a small truck, and an 18-wheeler.

3. A graduated charge based on the vehicle's actual weight, paid when the vehicle enters the toll way.

4. A graduated charge based on vehicle weight and distance traveled on the road. This fee requires a tollbooth at both the entrances to and the exits from the toll way.

9.53 Allocation mechanics, choice of allocation basis, qualitative (LO1, LO3). Municipalities often allocate the cost of new infrastructure such as sewer lines to property owners who benefit from the improvements. Such improvements often take place when a city expands its services to newly annexed areas. The choice of an allocation basis is often contentious as the cost is significant (often in the thousands of dollars per house) and the benefit is hard to quantify.

Required:

a. Evaluate the following three possibilities as to their suitability for allocating the cost of improving the sewer lines to property owners.

1. Equally across all homeowners.

2. Based on linear feet of road front for the property.

3. Based on property value.

b. Discuss how, if at all, your relative ranking of the allocation bases would change if the improvement were to install sidewalks instead of laying a sewer line.

9.54 Different allocations for different purposes (LO1, LO3, Advanced). Maggie Chen, the owner of the Yin Yang Yogurt Shop, is very pleased with how her business has grown over the past two years. She now has five branches in various suburbs in addition to her flagship store. Maggie has asked for your suggestions regarding the wisdom of allocating the following central office costs to the branches. Each branch has its own store manager and staff.

Payroll Processing. The firm administers payroll from its main office. However, each branch manager handles the hiring and firing of employees (mostly hourly workers). The number of people on the payroll drives the expense for payroll processing and, of course, the payroll itself. In addition, there is one-time paperwork every time a new employee is hired or an existing employee is let go.

Advertising. The firm runs ads in the local newspaper, as well as radio spots on the morning talk shows. Maggie believes that sales would drop 15%, across the board, if she were to discontinue the advertising.

Purchasing and Inventory Handling. All purchasing is done centrally. The firm replenishes branch inventory from a central warehouse each morning. The amount delivered depends on the branch manager's estimate of demand. Branch managers differ in their ability to forecast demand. Some branches have a greater tendency to run out of a flavor and ask for an additional delivery in the afternoon.

Required:

Help Maggie decide if she should allocate any of the listed cost items to branches. Distinguish between using the allocation for the purpose of managerial performance evaluation and using the allocation for the purpose of evaluating branch profitability.

9.55 Cost allocations in real estate, qualitative (LO1, LO3, Advanced). The Great Lakes Company specializes in real estate. Great Lakes purchases large tracts of land in a city's outlying areas. The company improves the land by putting in roads, sewer systems, and so on, and then subdivides the improved property into parcels sold to individual homeowners and homebuilders. To make the property more attractive, Great Lakes always designates some land as green-space (i.e., parks and other recreational areas). It also reserves land for an elementary school, a community center, and other "public-use" property. Finally, Great Lakes reserves about 5% of the property for retail use (i.e., for neighborhood stores). From start to finish, a typical deal consumes anywhere from three to seven years.

In a recent transaction, Great Lakes spent $1.6 million to buy 160 acres of property near a fast-growing city. It then spent an additional $1.4 million to develop the property. In line with its usual practice, the firm reserved 20 acres for green space, 4 acres for an elementary school, 3 acres for a church, and 3 acres for a community center. In addition, roads and out-lots (i.e., unusable parcels) consumed 5 acres. Thus, the firm could sell 125 acres to homeowners, to homebuilders, and as retail space.

Required:

a. Discuss two reasons why Great Lakes may wish to allocate its costs to individual parcels of land.

b. List at least two bases Great Lakes could use to allocate its costs to the individual parcels of land.

c. Considering the differences among buyers (school district, church, home builder, retailer), list at least three criteria that Great Lakes would employ to choose the allocation basis. Explain.

9.56 Variable costing versus absorption costing, income reconciliation (LO2, Advanced). For April, Quick Test Enterprises prepared, in accordance with Generally Accepted Accounting Principles (GAAP), the following income statement using absorption costing.

Quick Test Enterprises *Gross Margin Statement—April*		
Sales volume (in units)	1,500	
	Total	*Per Unit*
Revenue	$150,000	$100
Cost of goods sold	105,000	70
Gross margin	$45,000	$30
Selling, general, and administrative (SG&A) expenses	18,000	12
Profit before taxes	$27,000	$18

Quick Test uses a FIFO (i.e., First-In-First-Out) inventory cost flow assumption to compute cost of goods sold and the value of ending inventory. At the *beginning* of April (i.e., at the end of March), Quick test had 750 units in inventory with a total cost of $45,000. Of the $45,000, $11,250 represents allocated fixed manufacturing overhead costs.

Quick Test produced 1,250 units during April. The variable manufacturing cost per unit produced during April was $50. In addition, fixed selling, general, and administrative expenses for April were $12,000.

Required:

a. Compute the value of Quick Test's inventory at the end of April under variable costing.

b. How much did Quick Test actually spend on fixed manufacturing overhead costs during April?

c. Prepare Quick Test's variable costing income statement for April.

d. Reconcile the difference between Quick Test's April income under variable costing and April income under absorption costing.

9.57 Control role for allocations, (LO3, qualitative). Southeast University's Business College created the Horn Technology Center to centralize all of the computing services within the college. The center coordinates computer purchases for faculty, staff, classrooms, and the computer labs. The center also selects software and administers it. In addition to word processing and spreadsheet programs, the center's staff maintains large and complex research databases. They design, build, and maintain the college's extensive website. Finally, the Center provides help on special projects such as developing a Web-based questionnaire or database.

Because it considers itself part of the college, the center does not charge any of its "internal customers" for work done. The Center's budget comes from the college and comprises staff salaries and equipment such as servers. (The Center bills out, at cost, any computing equipment purchased for a specific user.)

The Center's director recently approached the dean for approval to charge faculty and departments a flat rate of $50 per hour for any work on special projects. She argued that the Center is handling too many requests for special projects. The dean is puzzled because, a few years ago, the director herself had proposed the idea of special projects as a way to fill in the unevenness in the Center's workload. It was widely understood that these projects would be completed when time became available. Thus, the projects were using a temporarily idle resource, with no increase in the college's overall cash outflow.

When he put these arguments to the Center's director, she argued that the volume of special projects had increased by an order of magnitude over the years, as faculty and staff gained expertise in using the World Wide Web. She also mentioned that it was personally embarrassing to miss promised delivery dates several times in a row. She believed that the charge is a compromise between charging faculty for the full rate (outside consultants may charge up to $100 per hour) and giving them a value-added service for "free."

Required:

Evaluate the arguments for and against allocating the Center's cost to faculty and departments. Assume that the Center's overall expenditure will not change whether or not they continue to do the special projects. (The charge of $50 per hour merely moves money from one account to another and does not alter the total outflow for the college.)

9.58 Allocations for eliciting demand, qualitative (LO1, LO3, Advanced). Matt Mouw is in charge of providing computing and other information technology services to his firm. Matt's firm has four distinct product lines, each operated as a stand-alone business. Profit is the primary criterion for evaluating product-line managers, and the entire firm has a competitive culture that takes pride in meeting tight targets. Support department managers, such as Matt, are expected to allocate their costs to their internal customers and break even.

Matt has identified a new software product that would help all four product lines improve their data storage, analysis, and reporting. The product would bring considerable standardization to Matt's department as well and allow him to provide more effective and efficient customer service. The product will cost $750,000 plus a license fee for each user. The managers of product lines A and B, the two largest products, have expressed considerable interest in installing the system. The existing software package has become obsolete, and the divisions see the new software as increasing their competitive edge. The manager of product line C indicates that a number of other initiatives are underway. She will be able to indicate interest, or lack thereof, only after a period of six months or so. The manager of product line D wants to wait for another year because his division is too small to take a gamble. He wants to see how things go with the "big boys" before committing the human and other resources needed to roll out the new system.

Required:

a. What is the purpose of allocating the cost of the new software product to the users? In particular, should the firm allocate the acquisition cost to the four product lines?

b. Assume that the firm has decided to allocate the software cost. List two different ways the firm could allocate the software cost to the product divisions. What are the costs and benefits of each method?

c. Suppose that the software cost was allocated to Divisions A and B alone because they are the only immediate users. Six months later, Division C wants to implement the software as well. The division manager for C argues that the acquisition cost is now sunk, meaning that none of it should be allocated to her division. Evaluate the merits of this argument.

9.59 Alternate allocation basis, homeowner's association (LO1, LO3). The City of Pleasantville created The Peninsula as a model subdivision. In contrast to traditional subdivisions, The Peninsula mingled condominiums, town homes, and single-family homes. The City designed the project so that many key amenities (a bank, the post office, shops, and so on) are within an easy walk from any residence. The development is located in a river's oxbow and almost constitutes a stand-alone entity. Indeed, the City believed this feature to be critical in developing a sense of neighborhood and in creating a vibrant, self-sufficient community. With all of these features, the City realized high demand for the properties, and within a few years, The Peninsula was fully occupied.

The current dilemma concerns the homeowner's association. Until The Peninsula became sustainable, the City used monies from a federal grant to maintain many of the amenities such as the pond, parks, hiking trails, shelters, and landscaping. A homeowner's association was formed to discharge these duties. The association learns that the City spent $150,000 last year on these amenities. Thus, the homeowner's association needs to find a way to raise $150,000 from the homeowners and the retail establishments.

Required:

Evaluate the following methods of raising the $150,000. Identify at least one positive feature and one negative feature associated with each allocation basis.

1. Value of property.

2. Head count, based on the number of persons living at each residence.

3. Equal division, counting each residence and store as one unit.

4. Fee-based, as far as practicable, with the remainder being allocated.

9.60 Allocations and reimbursement, ethics (LO3). Because he is a senior executive, Jean-Pierre's firm allows him to travel business class, particularly for international travel. The firm wants its executives to be well rested and ready for business when they reach their destination. Jean-Pierre seeks your advice regarding the appropriate amount to allocate toward reimbursable expenses.

a. Jean-Pierre recently took a trip for which the business class airfare is $5,000. The airline offered a deal whereby Jean-Pierre could obtain a second business class ticket for the price of a coach ticket, which is $1,800. Jean-Pierre used the offer to have his wife travel with him.

b. Consider the setting in (a) above. Assume the airline offers a "companions fly free" program, which Jean-Pierre frequently uses to take his wife with him. However, the program requires companions to have the same travel itinerary. Jean-Pierre's wife wanted to spend an extra day at the foreign locale. Consequently, Jean-Pierre stayed a day longer than he would have stayed if he had traveled alone. The hotel costs $450 per night, and Jean-Pierre can (and usually does) charge his firm up to $200 per day for meals.

c. Consider the setting in (a) above. Assume the airline is willing to swap one business class ticket for two tickets in coach class. Jean-Pierre and his wife took advantage of the offer. Jean-Pierre extended his stay by another day, and enjoyed a wonderful weekend getaway.

Required:

Discuss the appropriate course of action for each of the three settings.

9.61 Allocations and behavior modification (LO3). Allocations influence behavior because they serve as a "tax" on the cost driver. Thus, users are induced to decrease the quantity of driver units consumed. The following depict situations in which allocated costs can potentially affect behavior.

1. You are a division manager, and a large part of your bonus derives from your division's reported profit. Your firm allocates corporate office expenses to divisions based on the number of employees in each division.

2. You are part of a team designing a new circuit board. Your firm allocates materials-handling costs to products using the number of components used as the driver.

3. You are part of a team designing a new circuit board. Your firm allocates materials-handling costs to products using the number of unique components (i.e., the number of components used by this product alone) as the driver.

4. You are a product manager. Your firm allocates all manufacturing overhead to products using materials cost as the driver.

5. You are a product manager. Your firm allocates all manufacturing overhead to products using labor costs as the cost driver.

Required:

a. For each of the preceding situations, describe the kinds of actions you might take to reduce the amount of overhead allocated to you. Do these actions necessarily increase the firm's overall profitability?

b. What might be the firm's logic in using the specified drivers in each instance. That is, what do you perceive to be the costs and benefits of each allocation mechanism?

9.62 Cost allocations and behavior (LO3). "I can't believe what just happened back there," Julie exclaimed to her friend, Becky, as they were returning to their apartment after a dinner at an upscale restaurant to celebrate their passing the bar exam. Julie, Becky, and four other friends had gone through law school together, studied together for the bar exam, and were all excited at clearing the final hurdle before they could practice law. The meal was excellent, the conversation upbeat and scintillating, and the wine flowed freely.

Julie's complaint related to her share of the cost. When the final check (which made Julie gulp in shock) arrived, someone proposed an equal split. The proposal was quickly seconded. Although some looked uncomfortable, no one objected. The bill was settled and the friends dispersed.

Julie felt that the scheme was unfair. She had consumed only soda and the cost for the liquor represented at least half of the total bill. However, she felt awkward about

complaining and spoiling an otherwise excellent evening. She expressed her discomfort only when she and Becky were returning to their apartment.

Becky sympathized with Julie. As a vegetarian, Becky could not consume many of the appetizers and had to settle for an inexpensive pasta while the others splurged on lobster and other expensive delicacies. The two friends felt that they wound up paying for the other four friends' meals.

Required:

a. What is the objective of allocating the cost of the bill among the six friends? What considerations come into play when choosing an allocation mechanism?

b. In addition to equally splitting the cost among all diners, list at least two other methods that the friends could have used to allocate the cost among themselves. What are the costs and benefits of each method?

c. Assume that none of the friends were teetotalers and none were vegetarian. Suppose the friends had agreed, at the start of the meal, to split the cost equally. Would you expect the total bill to differ if the friends had agreed, at the start, to track individual orders for drinks and entrees? Why or why not?

MINI-CASES

9.63 Allocations for estimating capacity costs (LO1). Color Graphics (CG) specializes in printing glossy magazines. CG currently has orders for four magazines, with each magazine being issued on its own cycle. With the four magazines, CG's capacity is 100% utilized from Thursday through Sunday, every week. The press run 14 hours for each of these days, and CG's management believes that it is counterproductive to run the machines any longer than 14 hours (i.e., two shifts) in a day. However, CG has considerable excess capacity from Mondays through Wednesdays.

CG prices at an average rate of $0.07 per page. Variable costs amount to $0.02 per page. CG groups its fixed costs into two main pools—Machinery and Support staff. The four-color printing machines cost $4 million two years ago, and are expected to last another two years at the current rate of usage. Currently, CG uses each machine for approximately 3,000 hours per year, meaning that an average machine has a useful life of 12,000 hours, printing 20,000 pages per hour. Support staff and other indirect costs amount to an additional $2 million per year.

a. CG's marketing manager wants to bid for a catalog. The job will consume 20 hours and contain 400,000 pages. The customer has some flexibility regarding delivery dates, meaning that CG could print the job during weekdays. This is a one-time job as the store's regular printer had an unexpected machine malfunction. What is the minimum price that CG can charge for this job, without lowering their profit?

b. Suppose CG enters the catalog market. The marketing manager argues that the catalogs are merely using up extra capacity. Even including machining costs, she argues that any price over $0.0325 a page is "pure profit." She wants to move aggressively and price the product at $0.06 a page, which is substantially below the current price of $0.07 a page. Evaluate the merits of this argument, being sure to show how the marketing manager might have arrived at her estimate.

c. The firm's accountant argues that the catalogs are consuming capacity and must be charged for it. He expects machine usage to increase from 3,000 hours to 4,000 hours per year if the firm pursues the catalog business. In addition, while existing personnel can handle some of the work associated with printing catalogs, more people need to be hired, increasing the cost of support staff by $250,000. He believes that CG should take the **total** support staff cost and allocate it to both magazines and catalogs using machine hours as the allocation basis. Calculate the cost per page for the catalogs per the accountant's proposal. Determine the price per page, if the firm adds a 10% markup and rounds to the nearest 1/100 of a penny. Evaluate the merits of the accountant's argument.

d. The marketing manager sees some logic in the accountant's argument, although she is not happy with the implied cost for printing catalogs. However, she also sees

a positive aspect. She wants to reduce the price per page for printing magazines because now the cost to print magazines has decreased. She wants to use the lower cost to justify a price concession that would relieve her of some the intense price pressure in the market place. Evaluate the merits of this argument.

9.64 Variable versus absorption costing (LO2). "I don't understand how I can go from a profit to a loss when I sell more units." This comment aptly sums Emily Johnson's frustration with her accounting statements. Emily owns and operates a small firm that sells prefabricated sheds used for storing lawn equipment. Her business is seasonal, exhibiting wide swings in sales and production.

Emily's one product sells for $1,000 per unit. Variable manufacturing costs are $200 per unit, with fixed manufacturing costs amounting to $750,000 per month. Emily's monthly marketing costs are given by the equation $100,000 + ($25 × units sold). Each month, Emily allocates costs to units based on actual expenses and production.

Emily began March and ended April with zero inventories. She sold 1,000 units in March and 1,250 units in April. Emily produced 1,500 units in March.

Required:

a. Prepare Emily's income statement for March and April under absorption costing. In addition, determine the cost of Emily's March ending inventory under absorption costing.

b. Prepare Emily's income statements for both March and April under variable costing.

c. Reconcile the difference between variable costing net income and absorption costing net income.

d. Comment on the reconciliation, and indicate why Emily's total profit over the two months is the same under both methods. Also indicate why Emily's absorption costing income decreases from March to April even though she sold more units in April than in March?

9.65 Allocations and reimbursements, ethics (LO3). Sue Malloy works as a project manager for C3 Systems, a firm that designs sophisticated circuit boards. The firm's boards are used in communications satellites and other civilian uses. C3's circuit boards also form the guts of cryptography equipment used by governmental security agencies.

Sue's primary responsibility is to work on a board that potentially could open up a new civilian market for C3 systems. The firm developed the technology used in this board primarily for an application in the armed forces. Deep into the development, Sue realized the complementary civilian application. Sue is wondering how best to allocate the cost of her time as well as that of key research personnel between the government project and the civilian application. She knows that the government contract would reimburse C3 for its development expenses at cost plus a 10% markup. Both the government and C3 systems had agreed that development costs could amount to $8 to $10 million. Clearly, there is no explicit recovery of development expense in the civilian application.

Sue and her team have spent $7 million to date, and anticipate spending another $3 million if they develop both the civilian and the military application. They will spend only an extra $2 million on development if the firm abandons the civilian application.

Once the product goes into production, the civilian product will have $18 million of materials cost and $12 million of labor cost. The military product will have $15 million each of materials and labor cost, for a total of $30 million. The common manufacturing overhead, for both of the products, will be $6 million. This overhead comprises $2 million in materials-related overhead and $4 million in labor-related overhead. Sue expects the civilian application to produce revenues of $40 million. The firm will negotiate a fixed price contract with the government. These fixed prices are set such that the firm obtains a 10% markup on expected product cost.

Required:

a. List two different allocations Sue could use to allocate the development cost between the military and the civilian applications. What are the comparative merits of the two schemes that you suggest?

b. Consider the cost of manufacturing the two products. What is the overhead cost that would be allocated to the military line if (1) all overhead is allocated to products based on labor cost, (2) all overhead is allocated to products based on materials cost, and (3) if materials-related overhead is allocated based on materials cost and

labor-related overhead is allocated based on labor cost? Which of the three mechanisms do you recommend? Why?

c. Suppose Sue decides to allocate $8.5 million of development cost (= $7 million spent already plus half of the next $3 million to be spent) to the government contract. Do you believe this choice conforms to the norms for ethical behavior?

9.66 Cost Allocations and induced behavior, ethics (LO3). Bjorn and Karl work as product managers for a medium-sized manufacturing firm in Cologne, Germany. Both are evaluated on their respective product's reported profit and are given considerable autonomy in terms of production methods, distribution, and pricing.

Their firm has adopted a strategy of automating the production process as much as possible. Yet, as it has done for many years, the firm continues to allocate all overhead to individual products based on the number of labor hours consumed by each product.

During drinks one evening, Bjorn and Karl started talking shop. Bjorn complained that the allocation mechanism penalizes his product line because of its high labor content. Karl laughed and said, "There is an easy way to fix that problem! Start buying more components from suppliers instead of making them yourself."

Required:

a. Evaluate the merits of the firm's choice to continue allocating overhead based on labor hours, although the strategy is to foster automation. What is the impact on the accuracy of reported product cost? What countervailing benefits, if any, does the allocation mechanism provide?

b. How does Karl's recommended strategy reduce the amount of overhead allocated to Bjorn's product line?

c. Suppose Bjorn follows Karl's advice. Will the firm's overall expenditure on overhead costs increase, decrease, or stay about the same? What about the firm's total costs, which includes the cost of materials and labor?

d. Does Karl's recommended course of action fall within the norms for ethical behavior? Why or why not?