

Chapter 2

Lecture Notes

- 1 { **Chapter theme:** This chapter explains how managers need to rely on different cost classifications for different purposes. The four main purposes emphasized in this chapter include **assigning costs to cost objects, preparing external financial reports, predicting cost behavior, and decision making.**

I. Summary of the types of cost classifications

- 2 { A. This slide summarizes the types of cost classifications that will be discussed in this chapter, namely cost classifications for **assigning costs to cost objects, financial reporting, predicting cost behavior, and making business decisions.**

II. Cost classifications for assigning costs to cost objects

- 3 { *Learning Objective 2-1: Understand cost classifications used for assigning costs to cost objects: direct costs and indirect costs.*

- 4 { A. **Cost object** – Anything for which cost data are desired including products, customers, jobs, organizational subunits, etc. For purposes of assigning costs to cost objects costs are classified two ways:
- i. **Direct costs** – Costs that can be easily and conveniently traced to a specified cost object.
 - ii. **Indirect costs** – Costs that cannot be easily and conveniently traced to a specified cost object.

- 4 { 1. **Common costs** – Indirect costs incurred to support a number of cost objects. These costs cannot be traced to any individual cost object.

III. **Cost classifications for manufacturing companies**
Manufacturing companies separate their costs into two broad categories—manufacturing and nonmanufacturing costs.

5 { *Learning Objective 2-2: Identify and give examples of each of the three basic manufacturing cost categories.*

6 { **A. Classifications of manufacturing costs**

7 { i. **Direct materials** – Raw materials that become an integral part of the finished product and whose costs can be conveniently traced to it.

8 { ii. **Direct labor** – Labor costs that can be easily traced to individual units of product (also called touch labor).

9 { iii. **Manufacturing overhead** – Includes all manufacturing costs except direct materials and direct labor. These costs cannot be easily traced to specific units produced (also called indirect manufacturing cost, factory overhead, and factory burden).
1. Includes **indirect materials** that are part of the finished product, but that cannot be easily traced to it.

- 9 {
- 2. Includes **indirect labor costs** that cannot be conveniently traced to the creation of products.
 - 3. Other examples of manufacturing overhead include: maintenance and repairs on production equipment, heat and light, property taxes, depreciation and insurance on manufacturing facilities, etc.

B. Classifications of nonmanufacturing costs (also called selling and administrative costs).

- 10 {
- i. **Selling costs** – Includes all costs necessary to secure customer orders and get the finished product into the hands of the customer. Selling costs can be either direct or indirect costs.
 - ii. **Administrative costs** – Includes all costs associated with the general management of an organization. Administrative costs can be either direct or indirect costs.

11 { *Learning Objective 2-3: Understand cost classifications used to prepare financial statements: product costs and period costs.*

- 12 {
- C. Cost classifications for preparing financial statements**
- i. **Product costs** – Includes all the costs that are involved in acquiring or making a product. More specifically, it includes direct materials, direct labor, and manufacturing overhead.

- 12 {
- 1. Product costs are expensed in the income statement when the products are sold.
 - ii. **Period costs** – Includes all selling and administrative costs.
 - 1. These costs are expensed in the income statement in the period incurred.

13-14 { *Quick Check – product versus period costs*

D. Prime costs and conversion costs

- 15 {
- i. **Prime cost** – Direct materials cost plus direct labor cost.
 - ii. **Conversion cost** – Direct labor cost plus manufacturing overhead costs.

IV. Cost classifications for predicting cost behavior

16 { *Learning Objective 2-4: Understand cost classifications used to predict cost behavior: variable costs, fixed costs, and mixed costs.*

17 { A. **Cost behavior** refers to how a cost will react to changes in the level of activity. The most commonly used classifications of cost behavior are variable, fixed, and mixed costs:

- 18-19 {
- i. **Variable cost** – A cost that varies, in total, in direct proportion to changes in the level of activity. However, variable cost per unit is constant.

- 20 { 1. An **activity base** (also called a cost driver) is a measure of what causes the incurrence of variable costs. As the level of the activity base increases, the total variable cost increases proportionally.
- 21-22 { ii. **Fixed cost** – A cost that remains constant, in total, regardless of changes in the level of the activity. However, if expressed on a per unit basis, the average fixed cost per unit varies inversely with changes in activity.
- 23 { 1. **Committed fixed costs** represent investments with a multi-year planning horizon that cannot be easily adjusted in the short term.
2. **Discretionary fixed costs** usually arise from annual decisions by management and they can be easily reduced in the short term.

Helpful Hint: To illustrate fixed costs, ask students for the cost of a large pizza. Then ask: What would be the cost per student if two students buy a pizza? What if four students buy a pizza? This makes it clear why average fixed costs change on a per unit basis. To illustrate variable costs, add that a beverage costs \$1 and each student eating the pizza has one beverage. So, if two people were eating the pizza, the total beverage bill would come to \$2; if four people, \$4. The cost per beverage remains the same, but the total cost depends on the number of people ordering a beverage.

- 24 {
- iii. **The linearity assumption and the relevant range** – Accountants usually assume that costs are strictly linear; however, economists point out that many costs are actually curvilinear. Nonetheless, within a narrow band of activity known as the relevant range, a curvilinear cost can be **satisfactorily approximated** by a straight line.
 - 1. The **relevant range** is that range of activity within which the assumptions made about cost behavior are valid.
- 25 {
- iv. The relevant range of activity **pertains to fixed cost as well as variable costs**.
 - 1. For example, assume office space is available at a rental rate of **\$30,000** per year in increments of **1,000** square feet.
 - 2. Fixed costs would increase in a step fashion at a rate of \$30,000 for each additional 1,000 square feet.
- 26 {
- v. The relevant range for a fixed cost is the range of activity over which the graph of the cost is flat.
- 27 {
- vi. It is helpful to think about variable and fixed cost behavior in a **2x2 matrix**.
- 28-29 { *Quick Check – variable vs. fixed costs*

- 30 {
- vii. **Mixed cost** – A cost that contains both variable and fixed elements.
 - 1. For example, utility bills often contain fixed and variable cost components.
 - a. The fixed portion of the utility bill is constant regardless of kilowatt hours consumed. This cost represents the minimum cost that is incurred to have the service ready and available for use.
 - b. The variable portion of the bill varies in direct proportion to the consumption of kilowatt hours.
- 31 {
- ii. An equation can be used to express the relationship between mixed costs and the level of the activity. This equation can be used to calculate what the total mixed cost would be for any level of activity.
 - 1. The equation is $Y = a + bX$
 - a. Y = The total mixed cost.
 - b. a = The total fixed cost (the vertical intercept of the line).
 - c. b = The variable cost per unit of activity (the slope of the line).
 - d. X = The level of activity.
- 32 {
- iii. For example, if your fixed monthly utility charge is \$40, your variable cost is \$0.03 per kilowatt hour, and your monthly activity level was 2,000 kilowatt hours, this equation can be used to calculate your total utility cost of \$100.

III. The analysis of mixed costs

- 33 { a. Account analysis and the engineering approach
- i. In **account analysis**, each account under consideration is classified as variable or fixed based on the analyst's prior knowledge about how costs behave.
 - 1. This approach is limited in value in the sense that it glosses over the fact that some accounts may have both fixed and variable components.
 - ii. The **engineering approach** classifies costs based upon an industrial engineer's evaluation of production methods, material specifications, labor requirements, equipment usage, power consumption, and so on.
 - 1. This approach is particularly useful when no past experience is available concerning activity and costs.

b. Diagnosing cost behavior with a scattergraph plot

34 { *Learning Objective 2-5: Analyze a mixed cost using a scattergraph plot and the high-low method.*

- 35 { i. Before analyzing a mixed cost you should plot the data on a scattergraph. For illustrative purposes, assume the following information, which would be plotted as follows:

36

1. The maintenance cost, which is known as the dependent variable, is plotted on the Y (vertical) axis.
 2. The activity (hours of maintenance), which is known as the independent variable, is plotted on the X (horizontal) axis.
- ii. After plotting the data, examine the dots on the scattergraph to see if they are linear, such that a straight line can be drawn that approximates the relation between cost and activity.
1. If the dots are not linear, do not analyze the data any further. Instead, search for another independent variable that bears a stronger linear relationship with the dependent variable.
 2. In this example, the dots are linear so we can proceed to the high-low method.

37

c. The **high-low method**

- i. This method can be used to analyze mixed costs if a scattergraph plot reveals a linear relationship between the X and Y variables. Let's continue with our data from the scattergraph plot.
- ii. The first step is to choose the data points pertaining to the highest and lowest activity levels (high = 850 units; low = 450 units).
 1. Notice, this method relies on two data points to estimate the fixed and variable portions of a mixed cost.

37	iii. The second step is to determine the total costs associated with the two chosen points (high = \$9,800; low = \$7,400). <i>Helpful Hint: Emphasize that the high and low points are identified by the level of activity and not by the level of the cost.</i> iv. The third step is to calculate the change in cost between the two data points (\$2,400) and divide it by the change in activity level between the two data points (400 units). 1. The quotient represents an estimate of variable cost per unit of activity (\$6.00 per unit).
38	v. The fourth step is to take the total cost at either activity level (in this case, \$9,800) and deduct the variable cost component (\$5,100). The residual represents the estimate of total fixed costs (\$4,700). 1. The variable cost component (\$5,100) is determined by multiplying the level of activity (850 units) by the estimated variable cost per unit of the activity (\$6.00 per unit).
39	vi. The fifth step is to construct an equation that can be used to estimate the total cost at any activity level ($Y = \\$4,700 + \\$6.00X$).
40-43	<i>Quick Check – the high-low method</i>

- 44 { d. The **least-squares regression method**
- i. This method can be used to analyze mixed costs if a scattergraph plot reveals an approximately linear relationship between the X and Y variables.
 - ii. This method uses **all of the data points** to estimate the fixed and variable cost components of a mixed cost. This method is superior to the high-low method that uses only two data points to estimate the fixed and variable cost components of a mixed cost.
 - iii. The basic goal of this method is to fit a straight line to the data that **minimizes the sum of the squared errors**. The regression errors are the vertical deviations from the data points to the regression line.
- 45 { iv. The formulas that are used for least-squares regression are complex. Fortunately, computers can perform the calculations quickly. The observed values of the X and Y variables are entered into the computer and the software does the rest.
- 1. The output from the regression analysis can be used to create an equation that enables you to estimate total costs at any activity level.
- 46 { v. The high-low and least-squares regression methods provide **different estimates** of the fixed and variable cost components of a mixed cost. This is to be expected because each method uses

46 { differing amounts of the data points to provide estimates. Least-squares regression provides the most accurate estimates because it uses all of the data points.

IV. **Traditional and contribution format income statements**

47 { *Learning Objective 2-6: Prepare income statements for a merchandising company using the traditional and contribution formats.*

48 { a. The traditional and contribution formats differ as follows:

- i. The traditional approach separates product costs as required for external reporting purposes from selling and administrative expenses. It does not focus on cost behavior.
- ii. The contribution approach separates costs into fixed and variable categories. Sales – variable costs = contribution margin. The contribution margin – fixed costs = net operating income.

49 { iii. The contribution approach is used as an internal planning and decision-making tool. For example, this approach is useful for:

- 1. Cost-volume-profit analysis (Chapter 3).
- 2. Budgeting (Chapter 9).
- 3. Segmented reporting of profit data (Chapter 5).
- 4. Special decisions such as pricing and make or buy analysis (Chapter 7).

Helpful Hint: The income statement from the annual report of a well-known local manufacturing firm can be used to illustrate the functional income statement. Ask if the various expense categories on the income statement contain both fixed and variable costs. Also ask how to estimate the increase in profit that would result from a 4% increase in sales using the functional statement. There is no way to do this with reasonable accuracy, since there is no way to tell on a functional income statement what costs would increase.

V. Cost classifications for decision making

50 { *Learning Objective 2-7: Understand cost classifications used in making decisions: differential costs, opportunity costs, and sunk costs.*

51 { A. It is important to realize that every decision involves a choice between at least two alternatives. The goal of making decisions is to identify those costs that are either **relevant** or **irrelevant** to the decision. To make decisions, it is essential to have a grasp on three concepts:

52 { i. **Differential costs** (or **incremental costs**) – A difference in cost between any two alternatives (a difference in revenue between two alternatives is called **differential revenue**).

1. Differential costs can be either fixed or variable.

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ii. **Opportunity cost** – The potential benefit that is given up when one alternative is selected over another.

1. These costs are not usually entered into the accounting records of an organization, but must be explicitly considered in all decisions.

Helpful Hint: Ask students what opportunity costs they incur by attending class. Their opportunity cost is the value to them of the activity they would be doing otherwise (e.g., working, sleeping, partying, studying, etc.)

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iii. **Sunk cost** – A cost that has already been incurred and that cannot be changed now or in the future.

Helpful Hint: Ask students: “Suppose you had purchased gold for \$400 an ounce, but now it is selling for \$250 an ounce. Should you wait for the gold to reach \$400 an ounce before selling it?” Many students will say “yes” even though the \$400 purchase is a sunk cost.

55-60

Quick Check – relevant costs

Chapter 3 Lecture Notes

- 1 { Chapter theme: Cost-volume-profit (CVP) analysis helps managers understand the interrelationships among **cost, volume, and profit** by focusing their attention on the interactions among the **prices** of products, **volume** of activity, **per unit variable costs**, **total fixed costs**, and **mix** of products sold. It is a vital tool used in many business decisions such as deciding what products to manufacture or sell, what pricing policy to follow, what marketing strategy to employ, and what type of productive facilities to acquire.

I. Assumptions of CVP analysis

- 2 { A. **Four key assumptions** underlie CVP analysis:
- i. Selling price is **constant**.
 - ii. Costs are **linear** and can be accurately divided into variable and fixed elements. The variable element is **constant** per unit, and the fixed element is **constant** in total over the entire relevant range.
 - iii. In multiproduct companies, the sales mix is **constant**.
 - iv. In manufacturing companies, inventories **do not change**. The number of units produced equals the number of units sold.

Helpful Hint: Point out that nothing is sacred about these assumptions. When violations of these assumptions are significant, managers can and do

modify the basic CVP model. Spreadsheets allow practical models that incorporate more realistic assumptions. For example, nonlinear cost functions with step fixed costs can be modeled using “If...Then” functions.

II. The basics of cost-volume-profit (CVP) analysis

- 3 { *Learning Objective 3-1: Explain how changes in activity affect contribution margin and net operating income.*
- 4 { A. **The contribution income statement** is helpful to managers in judging the impact on profits of changes in selling price, cost, or volume. For example, let's look at a hypothetical contribution income statement for Racing Bicycle Company (RBC). Notice:
- i. The **emphasis is on cost behavior**. Variable costs are separate from fixed costs.
 - ii. The **contribution margin** is defined as the amount remaining from sales revenue after variable expenses have been deducted.
- 5 { iii. Contribution margin is used first to cover **fixed expenses**. Any remaining contribution margin contributes to **net operating income**.

- 6

{

iv. Sales, variable expenses, and contribution margin can also be expressed on a **per unit basis**. Thus:

 - 1. For each additional unit RBC sells, \$200 more in contribution margin will help to cover fixed expenses and provide a profit.
- 7

{

- 2. Notice, each month RBC must generate at least \$80,000 in total contribution margin to **break-even (which is the level of sales at which profit is zero)**.
- 8

{

- 3. Therefore, if RBC sells **400 units** a month, it will be operating at the **break-even point**.
- 9

{

- 4. If RBC sells one more bike (**401 bikes**), net operating income will increase by **\$200**.
- 10

{

v. You do not need to prepare an income statement to estimate profits at a particular sales volume. Simply multiply the number of units sold above break-even by the contribution margin per unit.

 - 1. For example, if RBC sells **430 bikes**, its net operating income will be **\$6,000**.
- 11

{

B. CVP relationships in equation form (for those who prefer an algebraic approach to solving problems in the chapter)

 - i. The contribution format income statement can be expressed in equation form as shown on this slide.
- 12

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- 1. This equation can be used to show the profit RBC earns if it sells **401 bikes**. Notice, the answer of **\$200** mirrors our earlier solution.

13 { ii. When a company has only **one product** we can further refine this equation as shown on this slide.

14 { 1. This equation can also be used to show the \$200 profit RBC earns if it sells **401 bikes**.

15 { iii. The profit equation can also be expressed in terms **unit contribution margin** as shown on this slide.

16 { 1. This equation can also be used to compute RBC's \$200 profit if it sells **401 bikes**.

17 { *Learning Objective 3-2: Prepare and interpret a cost-volume-profit (CVP) graph and a profit graph.*

18 { **C. CVP relationships in graphic form**
i. The relationships among revenue, cost, profit, and volume can be expressed graphically by preparing a cost-volume-profit (CVP) graph. To illustrate, we will use contribution income statements for RBC at 0, 200, 400, and 600 units sold.

Helpful Hint: Mention to students that the graphic form of CVP analysis may be preferable to them if they are uncomfortable with algebraic equations.

19 { ii. In a CVP graph, **unit volume** is represented on the **horizontal (X) axis** and **dollars** on the **vertical (Y) axis**. A CVP graph can be prepared in **three steps**.

20 { 1. Draw a line parallel to the volume axis to represent total fixed expenses.

21 { 2. Choose some sales volume (e.g., 400 units) and plot the point representing total

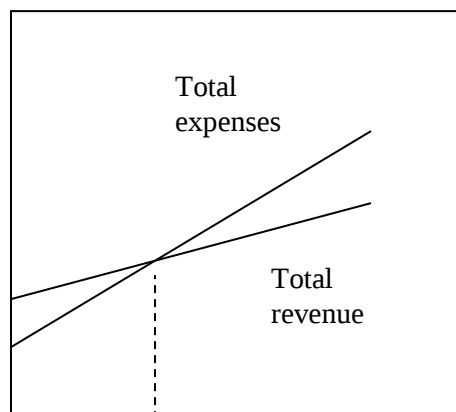
21 { expenses (e.g., fixed and variable) at that sales volume. Draw a line through the data point back to where the fixed expenses line intersects the dollar axis.

22 { 3. Choose some sales volume (e.g., 400 units) and plot the point representing total sales dollars at the chosen activity level. Draw a line through the data point back to the origin.

23 { **iii. Interpreting the CVP graph.**

1. The **break-even point** is where the total revenue and total expense lines intersect.
2. The **profit or loss** at any given sales level is measured by the vertical distance between the total revenue and the total expense lines.

Helpful Hint: Ask students what the CVP graph would look like for a public agency like a county hospital receiving a fixed budget each year and collecting fees less than its variable costs. It would look like this:



This is the reverse of the usual situation. If such an organization has volume above the break-even point, it will experience financial difficulties.

- 24 { iv. An even simpler form of the CVP graph is called the **profit graph**. The profit graph is based on the equation shown on this slide.
- 25 { 1. To plot the graph, compute the profit at two different sales volumes, plot the points, and then connect them with a straight line. This slide contains the profit graph for RBC.
Notice:
a. The sales volumes plotted on this graph are **300** and **500** bikes.
b. The breakeven point is **400** bikes.

D. Contribution margin ratio (CM ratio)

- 26 { *Learning Objective 3-3: Use the contribution margin ratio (CM ratio) to compute changes in contribution margin and net operating income resulting from changes in sales volume.*
- 27 { i. The CM ratio is calculated by dividing the **total** contribution margin by **total** sales.
1. For RBC, the CM ratio is 40%. Thus, each \$1.00 increase in sales results in a total contribution margin increase of 40¢.
- 28 { ii. The CM ratio can also be calculated by dividing the contribution margin **per unit** by the selling price **per unit**.
- 29 { 1. For RBC the CM ratio is 40%.
2. If RBC increases sales from 400 to 500 bikes, the increase in contribution margin (**\$20,000**) can be calculated by multiplying

- 29 { the increase in sales (**\$50,000**) by the CM ratio (**40%**).
- 30-31 { *Quick Check – contribution margin ratio*
- 32 {
iii. The relation between profit and the CM ratio can also be expressed in terms of the equation shown on this slide.

1. For example, we can use this equation to calculate RBC's profit of **\$20,000** at a volume of **500 bikes**.

E. Applications of CVP concepts

- 33 { *Learning Objective 3-4: Show the effects on net operating income of changes in variable costs, fixed costs, selling price, and volume.*

Helpful Hint: The five examples that are forthcoming should indicate to students the range of uses of CVP analysis. In addition to assisting management in determining the level of sales that is needed to break-even or generate a certain dollar amount of profit, the examples illustrate how the results of alternative decisions can be quickly determined.

- 34 {
i. The **variable expense ratio**

1. Before proceeding with five examples that demonstrate various applications of CVP concepts, we need to define the variable expense ratio as **the ratio of variable expenses to sales**.

ii. Change in fixed cost and sales volume

- 35 { 1. What is the profit impact if RBC can increase unit sales from 500 to 540 by increasing the monthly advertising budget by \$10,000?
- 36 { a. Preparing a contribution income statement reveals a **\$2,000 decrease** in profits.
- 37 { b. A shortcut solution using **incremental analysis** also reveals a \$2,000 decrease in profits.

iii. Change in variable costs and sales volume.

- 38 { 1. What is the profit impact if RBC can use higher quality raw materials, thus increasing variable costs per unit by \$10, to generate an increase in unit sales from 500 to 580?
- 39 { a. The contribution income statement reveals a **\$10,200 increase** in profits.

iv. Change in fixed cost, sales price, and sales volume.

- 40 { 1. What is the profit impact if RBC: (1) cuts its selling price \$20 per unit, (2) increases its advertising budget by \$15,000 per month, and (3) increases unit sales from 500 to 650 units per month?
- 41 { a. The contribution income statement reveals a **\$2,000 increase** in profits.

- 42 { v. **Change in variable cost, fixed cost, and sales volume.**
- 43 { 1. What is the profit impact if RBC: (1) pays a \$15 sales commission per bike sold instead of paying salespersons flat salaries that currently total \$6,000 per month, and (2) increases unit sales from 500 to 575 bikes?
- 44 { a. The contribution income statement reveals a **\$12,375 increase** in profits.
- 45 { vi. **Change in regular sales price.**
- 46 { 1. If RBC has an opportunity to sell 150 bikes to a wholesaler without disturbing sales to other customers or fixed expenses, what price should it quote to the wholesaler if it wants to increase monthly profits by \$3,000?
- 47 { a. The price quote should be **\$320 per bike.**

III. Break-even analysis

- 46 { *Learning Objective 3-5: Determine the break-even point.*
- 47 { i. The equation and formula methods can be used to determine the unit sales and dollar sales needed to achieve a **target profit of zero**. For example, let's revisit the information from RBC:
- 48 { 1. Suppose RBC wants to know how many bikes must be sold to break-even (i.e. earn a target profit of \$0). The equation shown on

this slide can be used to answer this question.

- 49 { a. The **equation method** reveals that **400 bikes** must be sold to breakeven.
- 50 { b. The **formula method** can also be used to determine that **400 bikes** must be sold to breakeven.
- 51 { 2. Suppose RBC wants to compute the sales dollars required to break-even (i.e. earn a target profit of \$0). The equation shown here can be used to answer this question.
- 52 { a. The **equation method** reveals that sales of **\$200,000** will enable the company to break-even.
- 53 { b. The **formula method** can also be used to determine that sales of **\$200,000** will enable the company to break-even.

54-57 { *Quick Check – break-even calculations*

58 { **B. Target profit analysis**

{ *Learning Objective 3-6: Determine the level of sales needed to achieve a desired target profit.*

59 { C. We can compute the number of **units** that must be sold to attain a target profit using either the **equation method** or the **formula method**.

60 { i. The **equation method** is summarized on this slide. Our goal is to solve for the unknown “Q” which represents the quantity of units that must be sold to attain the target profit. For example:

- 61 {
1. Suppose RBC wants to know how many bikes must be sold to earn a target profit of \$100,000.
 - a. The **equation method** can be used to determine that **900 bikes** must be sold to earn the desired target profit.

- 62 {
- ii. The **formula method** is summarized on this slide. It can also be used to compute the quantity of **units** that must be sold to attain a target profit. For example:

- 63 {
1. Suppose RBC wants to know how many bikes must be sold to earn a target profit of \$100,000.
 - a. The **formula method** can be used to determine that **900 bikes** must be sold to earn the desired target profit.

- 64 {
- D. We can also compute the target profit in terms **sales dollars** using either the **equation method** or the **formula method**.

- 65 {
- i. The **equation method** is summarized on this slide. Our goal is to solve for the unknown “Sales,” which represents the dollar amount of sales that must be sold to attain the target profit. For example:
 1. Suppose RBC wants to compute the sales dollars required to earn a **target profit of \$100,000**.
 - a. The **equation method** can be used to determine that sales must be **\$450,000** to earn the desired target profit.

- 66 { ii. The **formula method** is summarized on this slide. It can also be used to compute the dollar sales needed to attain a target profit. For example:
1. Suppose RBC wants to compute the dollar sales required to earn a **target profit of \$100,000**.
- a. The **formula method** can be used to determine that sales must be **\$450,000** to earn the desired target profit.
- 67-70 { *Quick Check – target profit calculations*
- E. **The margin of safety**
- 71 { *Learning Objective 3-7: Compute the margin of safety and explain its significance.*
- 72 { i. The margin of safety in dollars is the **excess of budgeted (or actual) sales over the break-even volume of sales**. For example:
- 73 { 1. If we assume that RBC has actual sales of \$250,000, given that we have already determined the break-even sales to be \$200,000, the **margin of safety is \$50,000**.
- 74 { 2. The margin of safety can be expressed as a percent of sales. For example:
- a. RBC's **margin of safety is 20% of sales**.
- 75 { 3. The margin of safety can be expressed in terms of the number of units sold. For example:
- a. RBC's **margin of safety is 100 bikes**.

76-77 { *Quick Check – margin of safety calculations*

III. CVP considerations in choosing a cost structure

A. Cost structure and profit stability

- 78 {
- i. **Cost structure** refers to the relative proportion of fixed and variable costs in an organization. Managers often have some latitude in determining their organization's cost structure.
- 79 {
- ii. There are **advantages and disadvantages** to high fixed cost (or low variable cost) and low fixed cost (or high variable cost) structures.
 - 1. An advantage of a high fixed cost structure is that income will be higher in good years compared to companies with a lower proportion of fixed costs.
 - 2. A disadvantage of a high fixed cost structure is that income will be lower in bad years compared to companies with a lower proportion of fixed costs.
 - 3. Companies with low fixed cost structures enjoy greater stability in income across good and bad years.
- 80 {
- Learning Objective 3-8: Compute the degree of operating leverage at a particular level of sales and explain how it can be used to predict changes in net operating income.*

B. Operating leverage

- 81 {
 - i. Operating leverage is a measure of **how sensitive net operating income is to percentage changes in sales.**
 - ii. The degree of operating leverage is a measure, at any given level of sales, of how a percentage change in sales volume will affect profits. It is computed as shown on this slide.
- 82 {
 - iii. To illustrate, let's revisit the contribution income statement for RBC:
 - 1. RBC's degree of operating leverage is **5 (\$100,000/\$20,000).**
 - 2. With an operating leverage of 5, if RBC increases its sales by 10%, net operating income would increase by 50%.
 - 83 {
 - 84 {
 - a. The 50% increase can be verified by preparing a contribution approach income statement.
- 85-89 {

Quick Check – operating leverage calculations

Helpful Hint: Emphasize that the degree of operating leverage is not a constant like unit variable cost or unit contribution margin that a manager can apply with confidence in a variety of situations. The degree of operating leverage depends on the level of sales and must be recomputed each time the sales level changes. Also, note that operating leverage is greatest at sales levels near the break-even point and it decreases as sales and profits rise.

IV. Structuring sales commissions

90 { A. Companies generally compensate salespeople by paying them either a commission based on sales or a salary plus a sales commission. **Commissions based on sales dollars can lead to lower profits in a company.** Consider the following illustration:

91 { i. Pipeline Unlimited produces two types of surfboards, the XR7 and the Turbo. The XR7 sells for \$100 and generates a contribution margin per unit of \$25. The Turbo sells for \$150 and earns a contribution margin per unit of \$18.

92 { ii. Salespeople compensated based on sales commission will push hard to sell the Turbo even-though the XR7 earns a higher contribution margin per unit.
iii. To eliminate this type of conflict, **commissions can be based on contribution margin** rather than on selling price alone.

V. The concept of sales mix

93 { *Learning Objective 3-9: Compute the break-even point for a multiproduct company and explain the effects of shifts in the sales mix on contribution margin and the break-even point.*

- 94 { A. The term **sales mix** refers to the relative proportions in which a company's products are sold. Since different products have different selling prices, variable costs, and contribution margins, when a company sells more than one product, break-even analysis becomes more complex as the following example illustrates:

*Helpful Hint: Mention that these calculations typically assume a constant sales mix. The rationale for this assumption can be explained as follows. To use simple break-even and target profit formulas, we must assume the firm has a single product. So we do just that – even for multi-product companies. The trick is to assume the company is really selling baskets of products and each basket **always contains the various products in the same proportions.***

- 95 { i. Assume the RBC sells bikes and carts. The bikes comprise 45% of the company's total sales revenue and the carts comprise the remaining 55%. **The contribution margin ratio for both products combined is 48.2%.**

- 96 { ii. The break-even point in sales would be **\$352,697**. The bikes would account for 45% of this amount, or **\$158,714**. The carts would account for 55% of the break-even sales, or **\$193,983**.

1. Notice a slight rounding error of \$176.

Chapter 6

Lecture Notes

- 1 { Chapter theme: This chapter introduces students to **activity-based costing (ABC)** which is a tool that has been embraced by a wide variety of **service**, **manufacturing**, and **non-profit organizations**.

I. Activity-based costing: key definition

- 2 { A. ABC is a costing method that is designed to provide managers with cost information for strategic and other decisions that potentially affect **capacity**, and therefore, “fixed” as well as variable costs. It is ordinarily used as a **supplement** to, rather than as a replacement for, the company’s usual costing system.

II. How costs are treated under activity-based costing

A. ABC **differs** from traditional cost accounting in three ways:

- 3 { *Learning Objective 6-1: Understand activity-based costing and how it differs from a traditional costing system.*

- 4 {
i. **Nonmanufacturing as well as manufacturing costs** may be assigned to products, but only on a cause-and-effect basis.
1. For example, ABC systems can assign sales commissions, shipping costs, and warranty repair costs to specific products.

- 5 {
- ii. Some manufacturing costs may be **excluded** from product costs.
 - 1. This is because ABC only assigns a cost to a product if decisions concerning that product will cause changes in the cost.
 - 2. ABC excludes **two types of costs** from product costs:
 - a. Organization-sustaining costs (which will be formally defined later).
 - b. The costs of unused or idle capacity.

Helpful Hint: Emphasize that ABC systems that are used to support internal decision making do not need to conform to GAAP. Therefore, while GAAP requires treating selling and administrative expenses as period expenses and it requires assigning all manufacturing costs to products, ABC systems can assign selling and administrative expenses to products and they can exclude manufacturing costs from product costs where appropriate.

- 6 {
- iii. **Numerous overhead cost pools** are used, each of which is allocated to products and other cost objects using its own unique measure of activity.
 - 1. ABC cost pools are created to correspond to the **activities** performed in an organization that cause the consumption of overhead resources. Therefore, the total number of ABC cost pools will definitely exceed one (as in the plantwide approach) and it is likely to exceed the number of departments within a company (as in the departmental

- 6 { approach) since more than one activity is often performed within each department.
2. Each ABC cost pool has its own **unique measure of activity**. On the contrary, traditional cost systems usually rely on **direct labor hours** and/or **machine hours** to allocate all overhead costs to products.
- 7 { a. Direct labor and machine hours work correctly when changes in the quantity of the base are correlated with changes in the overhead costs being assigned using the base.
- b. Relying exclusively on these bases to assign overhead costs to products has come under increased scrutiny since, on an economy-wide basis, direct labor and overhead costs have been moving in **opposite directions** and the variety of products produced by companies has increased.

B. Key definitions/concepts

- 8 { i. An **activity** is any event that causes the consumption of overhead resources.
- ii. An **activity cost pool** is a “bucket” in which costs are accumulated that relate to a single activity measure in an ABC system.
- 9 { iii. An **activity measure** is an allocation base in an activity-based costing system. The term **cost driver** is also used to refer to an activity measure. The two most common types of activity measures are:

10

1. **Transaction drivers** are simple counts of the number of times an activity occurs such as the number of bills sent out to customers.
2. **Duration drivers** measure the amount of time required to perform an activity such as the time spent preparing individual bills for customers.

Helpful Hint: Introduce the cost-benefit concept by explaining that transaction drivers are more prevalent in practice than duration drivers because the data is much easier to obtain. The additional accuracy provided by duration drivers often times does not pass the cost-benefit test.

11

- iv. Traditional cost systems rely exclusively on allocation bases that are **driven by the volume of production**. ABC defines five levels of activity that largely **do not relate to the volume of units produced**.

12

1. **Unit-level activities** are performed each time a unit is produced.
 - a. For example, providing power to run processing equipment would be a unit-level activity.
2. **Batch-level activities** are performed each time a batch is handled or processed, regardless of how many units are in the batch.
 - a. For example, setting up equipment and shipping customer orders are batch-level activities.
3. **Product-level activities** relate to specific products and must be carried out regardless

- 12 { of how many batches are run or units are produced or sold.
- a. For example, designing or advertising a product would be product-level activities.
4. **Customer-level activities** relate to specific customers and are not tied to any specific product.
- a. For example, sales calls and catalog mailings would be customer-level activities.
5. **Organization-sustaining activities** are carried out regardless of which customers are served, which products are produced, how many batches are run, or how many units are made.
- a. For example, heating a factory and cleaning executive offices are organization-sustaining activities.

III. Designing an activity-based costing (ABC) system

- 13 { A. **Characteristics of a successful ABC implementation:**
- i. There should be strong **top management support**.
1. Without leadership from top management, some managers may not be motivated to embrace the need to change.

13

- ii. Top managers should ensure that ABC data are **linked to how people are evaluated and rewarded.**
 - 1. If employees continue to be evaluated and rewarded using traditional (non-ABC) cost data, they will quickly get the message that ABC is not important and they will abandon it.
- iii. A **cross-functional team** should be created to design and implement the ABC system.
 - 1. Cross-functional employees possess intimate knowledge of operations that is necessary for designing an effective ABC system.
 - 2. Tapping the knowledge of cross-functional managers lessens their resistance to ABC because they feel included in the implementation process.

14

B. The five steps for implementing ABC

- i. Baxter Battery—background information
 - 1. The company makes two types of automobile batteries—**SureStart (a standard battery) and LongLife (a deluxe, higher quality battery).**
 - 2. The company has reported its first loss ever of **\$2,000,000** as shown on the income statement.

15 { ii. **Step 1: define activities, activity cost pools, and activity measures** (The activities are often identified and defined by interviewing the employees that work in the respective overhead departments. The lengthy list of activities that emerges from this process is usually reduced to a handful by combining similar activities.)

16 { 1. Baxter Battery selected the **five activity cost pools** and corresponding activity measures as shown.

a. The definition for each of the activity cost pools is as shown.

17 { *Learning Objective 6-2: Assign costs to cost pools using a first-stage allocation.*

18 { iii. **Step 2: assign overhead costs to activity cost pools (this is also called first-stage allocation)**

1. Baxter's annual overhead costs (both manufacturing and nonmanufacturing) that it intends to assign to its activity cost pools are as shown. Notice:

a. The total costs for the Production Department (**\$14,000,000**) equal the total manufacturing overhead costs shown in the income statement.

b. The total costs for the General Administrative and Marketing Departments (**\$8,000,000**) equal the marketing and general administrative expenses shown in Baxter's income statement.

19

c. Three costs included in Baxter's income statement—**direct materials, direct labor, and shipping**—are excluded from this slide because Baxter's existing cost system can directly trace these costs to products or customer orders.

20

2. Baxter's cross-functional interviews resulted in resource allocations as shown. Notice for example:

a. The indirect factory workers allocated **30%** of their time to the customer orders activity, **30%** of their time to the design changes activity, **20%** of their time to the order size activity, **10%** of their time to customer relations, and **10%** of their time to the "other" activity.

b. The lease costs are allocated entirely to the "other" activity. Since Baxter has a single facility that it does not plan to contract or expand, the lease costs are treated as organization-sustaining costs.

21

3. Once the percentage allocations have been determined, it is a simple matter to assign costs to activity cost pools.

a. For example, the indirect factory wages assigned to the customer orders activity (**\$1,800,000**) was computed by multiplying the total amount of indirect factory wages (**\$6,000,000**) by the percentage of time that indirect factory workers spent on this activity (**30%**).

- 22 {
- b. As another example, the factory equipment depreciation assigned to the customer orders activity (**\$700,000**) was computed by multiplying the total amount of factory equipment depreciation (**\$3,500,000**) by the percentage of time that the factory equipment was used to support this activity (**20%**).
- 23 {
- c. The complete grid of first-stage allocations would be as shown.

24 { *Learning Objective 6-3: Compute activity rates for cost pools.*

iv. **Step 3: calculate activity rates**

- 25 {
1. The Baxter Battery ABC team determined activity levels for each activity as shown. This information enabled the team to compute ABC rates for each activity by dividing the total cost in each activity cost pool by the respective quantity of the activity measure.
- 26 {
- a. The activity rate for each cost pool is as shown. For example, the customer orders activity cost pool has an activity rate of **\$452 per order**. Importantly, this is an **average** figure.
- b. Notice, the “other” cost pool does not have an activity rate. This is because these **organization-sustaining costs will not be assigned to products or customers**.

- 27 { 2. Before proceeding, let us get a visual perspective of the Baxter Battery ABC system.
- 28 { a. The direct materials, direct labor, and shipping costs are **directly traceable** to products or customer orders.
- 29 { b. The first-stage allocation process assigned the remaining overhead costs to **five activity cost pools**.
- c. Then, **activity measures** were identified, **activity levels** were determined, and **activity rates** were computed for each activity. These rates will be used in the next step to assign overhead costs to cost objects.

v. **Step 4: assign overhead costs to cost objects**
(this is also called **second stage allocation**)

30 { *Learning Objective 6-4: Assign costs to a cost object using a second-stage allocation.*

- 31 { 1. **Assigning overhead to products**
- a. The data needed to assign overhead costs to Baxter Battery's two products—SureStart and LongLife—are as shown. Notice:
- (1). **4,000** customer orders were placed for SureStart and **6,000** customer orders were placed for LongLife.
- (2). All **4,000** product designs related to LongLife

- 31 { (3). SureStart consumed **480,000** machine-hours and LongLife consumed **320,000** machine-hours.
- 32 { b. The overhead cost assignments to SureStart and LongLife are as shown.
Notice:
(1). The total overhead costs assigned to SureStart and LongLife are **\$4,928,000** and **\$7,832,000**, respectively.
c. The total overhead costs assigned to products (**\$12,760,000**) plus the total overhead costs not assigned to products (**\$9,240,000**) equal the total overhead cost of **\$22,000,000** from earlier slides.
- 33 { 2. **Assigning overhead to customers**
a. The data needed to assign overhead costs to one of Baxter's customers—**Acme Auto Parts** is as shown.
- 34 { b. The total overhead cost assigned to Acme Auto Parts (**\$12,916**) is calculated as shown.
- 35 { *Learning Objective 6-5: Use activity-based costing to compute product and customer margins.*

vi. **Step 5: prepare management reports**

1. Product margin calculations

- 36 {
- a. The first step in computing product margins is to gather each product's **sales and direct cost data** which are assumed to be as shown.
- 37 {
- b. The second step is to incorporate the previously computed **activity-based cost assignments** pertaining to each product.
- 38 {
- c. The third step is to compute product margins (**\$8,372,000 for SureStarts and a loss of \$1,132,000 for LongLifes**) by deducting each product's direct and indirect costs from its sales.
- 39 {
- d. The product margins can be **reconciled** with the company's net operating income as shown.

2. Customer margin calculation

- 40 {
- a. The first step in computing Acme Auto Parts' customer margin is to gather its **sales and direct cost data** which are assumed to be as shown.
- 41 {
- b. The second step is to incorporate Acme Auto's previously computed **activity-based cost assignments**.
- 42 {
- c. The third step is to compute Acme Auto's customer margin (**\$384**) by deducting all its direct and indirect costs from its sales.

IV. Comparison of traditional and ABC product costs

A. Product margins computed using the traditional cost system

- 43 { i. The first step is to gather each product's sales and direct cost data as shown.
- 44 { ii. The second step is to compute the **plantwide overhead rate**. Notice:
1. The numerator is the **\$14,000,000 of manufacturing overhead** shown earlier on the company's income statement.
 2. The denominator is the **800,000 machine hours** used for the order size activity from the ABC system.
 3. The plantwide overhead rate is **\$17.50 per machine-hour**.
- 45 { iii. The third step is to allocate manufacturing overhead to each product. Notice:
1. 480,000 machine-hours were worked on SureStarts, so **\$8,400,000** ($480,000 \text{ hours} \times \17.50) of manufacturing overhead is assigned to this product. LongLifes are assigning the remaining **\$5,600,000** ($320,000 \times \17.50) of manufacturing overhead.
- 46 { iv. The fourth step is to compute the product margins—**\$6,900,000 for SureStarts and \$2,100,000 for LongLifes**.

- 46 {
1. Notice selling and administrative expenses are **not allocated** to products because they are assumed to be period expenses.
 2. The overall net loss of **\$2,000,000** reconciles with the income statement shown earlier.

B. The differences between ABC and traditional product costs

- 47 {
- i. The changes in product margins caused by switching from the traditional cost system to the activity-based costing system are as shown. Notice:
 1. The traditional cost system **overcosts** the SureStarts and consequently reports an artificially low product margin for this product.
 2. Conversely, the traditional cost system **undercosts** the LongLives and consequently reports an artificially high product margin for this product.

- 48 {
- ii. There are **three reasons** why the reported product margins for the two costing systems differ from one another.
 1. The traditional cost system allocates **all manufacturing overhead to products**. The ABC system only assigns manufacturing overhead costs **consumed** by products to those products. More specifically:
 - a. The ABC system does not assign the manufacturing overhead costs consumed by the **customer relations**

- 48 { activity to products because these costs are caused by customers, not specific products.
- b. The ABC system does not assign the manufacturing overhead costs included in the “**other**” activity to products because these organization-sustaining and unused capacity costs are not caused by products.
- 49 { 2. The traditional cost system allocates all manufacturing overhead costs using a **volume-related allocation base** (machine-hours). The ABC system uses volume-related and **non-volume related allocation bases** to assign manufacturing overhead to products. More specifically:
- a. The traditional cost system allocates **60%** of all manufacturing overhead to SureStarts and **40%** to LongLives.
- b. The ABC system assigns **40%** and **60%** of customer orders activity cost (a batch-level cost) to SureStarts and LongLives, respectively.
- c. The ABC system assigns **0%** and **100%** of product design activity cost (a product-level cost) to SureStarts and LongLives, respectively.
- 50 { 3. The traditional cost system **disregards selling and administrative expenses** because they are assumed to be period expenses. The ABC system directly traces shipping costs to products and includes nonmanufacturing overhead costs caused by products in the activity cost pools that are assigned to products.

Helpful Hint: A simple example can be used to illustrate the impact of ABC systems on product costs when batch-level costs are involved. Suppose two products are each run in one batch a year and the cost of setting up a batch is \$100 for either product. Other data follow:

	<u>A</u>	<u>B</u>	<u>Total</u>
Units	80	20	
DLH/ unit..	<u>x 1</u>	<u>x 1</u>	
Total DLHs	<u>80</u>	<u>20</u>	<u>100</u>

The two batches a year cost a total of \$200 to set up. If DLHs are used to allocate the setup costs, the overhead rate would be \$2 per DLH or \$2 per unit for either product A or product B. However, in an ABC system, \$100 will be allocated to product A and \$100 to product B. Consequently, the batch setup costs would be \$1.25 per unit for product A and \$5.00 per unit for product B. ABC systems tend to reduce the per-unit costs of high-volume products and increase the per-unit costs of low-volume products, but the impact is more dramatic on the low-volume products.

V. Targeting process improvements

A. Key definitions/concepts

- 51 {
- i. **Activity-based management** is used in conjunction with ABC to identify areas that would benefit from process improvement. It involves focusing on activities to eliminate waste, decrease processing time, and reduce defects.
 - ii. The **activity rates** computed in ABC can also provide valuable clues concerning where there is waste and the opportunity for improvement.
 - 1. **Benchmarking** can be used to compare an organization's activity rates with standards of performance that are external to the organization.

VI. Activity-based costing and external reports

- 52 {
- A. There are **four reasons** why most companies **do not use ABC for external reporting purposes**.
 - i. External reports are **less detailed** than internal reports in the sense that individual product costs are not reported. External reports only disclose cost of goods sold and ending inventory. Therefore, if some products are undercosted and others are overcosted, the errors tend to cancel each other out when the product costs are added together.

52

- ii. It is often very **difficult to change** a company's accounting system because it is deeply embedded within complex computer programs that have evolved over many years.
- iii. An ABC system, such as the one described in the chapter, **does not conform to generally accepted accounting principles (GAAP)**.
 - 1. It excluded some organization-sustaining manufacturing costs, some unused capacity costs, and it included some nonmanufacturing costs in its product cost calculations. These cost system design attributes do not comply with GAAP.
- iv. **Auditors are likely to be uncomfortable** with cost allocations that are based on interviews with the company's personnel. This type of **subjective data** can be easily manipulated by management.

VII. The limitations of activity-based costing

53

- A. There are **five limitations of ABC**
 - i. Implementing an ABC system **requires substantial resources**. The benefits of increased cost accuracy may not outweigh the implementation costs.

- ii. ABC systems produce numbers, such as product margins, that are at odds with the numbers produced by traditional cost systems. Managers are not accustomed to managing their operations using these numbers; hence, **ABC inevitably faces resistance**. This underscores the importance of having top management support for and cross-functional involvement with the ABC implementation.
- iii. In practice, **most managers insist on fully allocating all costs to products**. The ABC system described in the main portion of this chapter does not conform to this preference.
- iv. ABC systems do not automatically identify the **relevant costs** for particular decisions; therefore, ABC data can be easily misinterpreted and must be used with care when making decisions. Costs assigned to products, customers, and other cost objects are only **potentially relevant**.
- v. Most organizations use ABC as a **supplement to rather than a replacement for** their existing cost system. Maintaining two cost systems is costlier than maintaining just one system and it may cause confusion about which set of numbers is to be relied on.

Chapter 7

Lecture Notes

- 1 { Chapter theme: Making decisions is one of the basic functions of a manager. To be successful in decision making, managers must be able to perform differential analysis, which focuses on identifying the costs and benefits that differ between alternatives. The purpose of this chapter is to develop these skills by illustrating their use in a wide range of decision-making situations.

I. Cost concepts for decision making

- 2 { *Learning Objective 7-1: Identify relevant and irrelevant costs and benefits in a decision.*

A. Identifying relevant costs and benefits

- 3 { i. Costs that differ between alternatives are called **relevant costs**. Benefits that differ between alternatives are **relevant benefits**.
- 4 { 1. An **avoidable cost** is a cost that can be eliminated in whole or in part by choosing one alternative over another. **Avoidable costs are relevant costs. Unavoidable costs are irrelevant costs.**
- ii. **Two broad categories** of costs are **never relevant** in any decision:
1. A **sunk cost** is a cost that has already been incurred and cannot be avoided regardless of what a manager decides to do.

- 4 { 2. A future cost that **does not differ** between alternatives is **never** relevant in a decision.
- 5 { iii. Keys to successful decision-making:
1. Focus only on relevant costs (also called avoidable costs, differential costs, or incremental costs) and relevant benefits (also called differential benefits or incremental benefits).
 2. Ignore everything else including sunk costs and future costs and benefits that do not differ between the alternatives.
- 6 { iv. **Different costs for different purposes**
1. Costs that are relevant in one decision situation **may not be relevant** in another context. Thus, in each decision situation, the manager must examine the data at hand and isolate the relevant costs.

B. An example of identifying relevant costs and benefits

- 7 { i. Assume the following information with respect to Cynthia, a Boston student who is considering visiting her friend in New York. Cynthia is trying to decide whether it would be less expensive to **drive** or take the **train** to New York.

- 7 {
- 8 {
- 9 {
- 10 {
- 11 {
- 12 {
1. She has assembled the following information with respect to her automobile.
 2. She has also gathered the additional information as shown to aid in her decision.
 3. Which costs are relevant to her decision?
 - a. The cost of the car is **irrelevant** to the decision because it is a sunk cost.
 - b. The annual cost of auto insurance is **irrelevant** because it does not differ between alternatives.
 - c. The cost of the gasoline is **relevant** because it is avoidable if she takes the train.
 - d. The cost of maintenance and repairs is **relevant** because in the long-run these costs depend upon miles driven.
 - e. The parking fee at school is **irrelevant** because it is not a differential cost.
 - f. The decline in resale value is **relevant** due to the additional miles driven.
 - g. The round trip train fare is **relevant** because it is avoidable if she drives her car.
 - h. Relaxing on the train is **relevant**, but difficult to quantify.
 - i. The kennel cost is **irrelevant** because it is not a differential cost.
 - j. The cost of parking in New York is **relevant** because it is avoidable if she takes the train.
 - k. The benefits of having a car in New York and the problem of finding a parking space are both **relevant**, but difficult to quantify.

- 13 { 4. From a financial standpoint, **Cynthia would be better off taking the train.**

C. Reconciling the total and differential approaches

- 14 { i. Assume the following information for a company considering a new labor-saving machine that rents for **\$3,000 per year**.
Notice:
1. The total approach requires constructing **two contribution format income statements** – one for each alternative.
2. The difference between the two income statements of **\$12,000** equals the differential benefits shown at the bottom of the right-hand column.
- 15 { 3. The most efficient means of analyzing this decision is to use the **differential approach** to isolate the relevant costs and benefits as shown.
- 16 { ii. Using the differential approach is desirable for **two reasons**:
1. Only rarely will enough information be available to prepare detailed income statements for both alternatives.
2. Mingling irrelevant costs with relevant costs may cause confusion and distract attention away from the information that is really critical.

II. Adding and dropping product lines and other segments

17 { *Learning Objective 7-2: Prepare an analysis showing whether a product line or other business segment should be added or dropped.*

18 { A. One of the most important decisions managers make is whether to **add or drop a business segment**.
Ultimately, a decision to drop an old segment or add a new one is going to hinge primarily on the impact the decision will have on **net operating income**. To assess this impact it is necessary to carefully analyze the costs.

B. Lovell Company – an example

19 { i. Assume that Lovell Company's digital watch line has not reported a profit for several years; accordingly, Lovell is considering **discontinuing** this product line.

20 { 1. To determine how dropping this line will affect the profits of the company, Lovell will compare **the contribution margin that would be lost to the costs that would be avoided** if the line was to be dropped.

21 { ii. Assume a **segmented income statement** for the digital watches line is as shown. Also, assume the following:

22 { 1. An investigation has revealed that the fixed general factory overhead and fixed general administrative expenses **will not be affected** by dropping the digital watch line.

- 23 { 2. The equipment used to manufacture digital watches has **no resale value or alternative use**.
- 24 { iii. A contribution margin approach reveals that the contribution margin lost (\$300,000) exceeds the fixed costs avoided (\$260,000) by **\$40,000**. Therefore, Lovell should **retain** the digital watch segment.
- 25 { iv. Comparative income statements can also be prepared to help make the decision.
- 26 { 1. These income statements show that if the digital watch line is dropped, the company loses **\$300,000** in contribution margin.
- 27 { 2. The general factory overhead (**\$60,000**) would be the same under both alternatives, so it is **irrelevant**.
- 28 { 3. The salary of the product line manager (**\$90,000**) would disappear, so it is **relevant** to the decision.
- 29 { 4. The depreciation (**\$50,000**) is a sunk cost. Also, remember that the equipment has no resale value or alternative use, so the equipment and the depreciation expense associated with it are **irrelevant** to the decision.
- 30 { 5. The complete comparative income statements reveal that Lovell would earn **\$40,000** of additional profit by retaining the digital watch line.

- 31 { v. Lovell's allocated fixed costs can **distort** the keep/drop decision.
- 32 { 1. Lovell's managers may ask "why keep the digital watch segment when its segmented income statement shows a **\$100,000 loss**?"
- 33 { 2. The answer lies in the way **common fixed costs** are allocated to products.
- 33 { a. Including unavoidable common fixed costs in the segmented income statement makes the digital watch product line **appear** to be unprofitable, when in fact dropping the product line would **decrease** the company's overall net operating income.

III. The make or buy decision

- 34 { *Learning Objective 7-3: Prepare a make or buy analysis.*

A. Key terms and strategic aspects

- 35 { i. When a company is involved in more than one activity in the entire **value chain**, it is vertically integrated.
- 35 { 1. A decision to carry out one of the activities in the value chain **internally**, rather than to buy **externally** from a supplier, is called a **make or buy decision**.

Helpful Hint: Some critics charge that managers have habitually based make or buy decisions on per unit data without determining which costs are relevant and which

are not. Since the per unit costs typically include allocated common fixed costs, they overstate the costs of producing internally. This creates a bias in favor of outsourcing production.

- 36 {
- ii. **Vertical integration** provides certain **advantages**:
 - 1. An integrated company may be able to ensure a **smoother flow of parts and materials** for production than a nonintegrated company.
 - 2. Some companies feel that they can **control quality better** by producing their own parts and materials.
 - 3. Integrated companies **realize profits** from the parts and materials that they choose to make instead of buy.
- 37 {
- iii. The primary **disadvantage** of vertical integration is that a company may fail to take advantage of suppliers who can create an **economies of scale advantage** by pooling demand from numerous companies.
 - 1. While the economies of scale factor can be appealing, a company must be careful to retain control over activities that are **essential to maintaining its competitive position**.

B. Essex Company – an example

- 38 { i. Assume that Essex Company manufactures part 4A with a unit product cost as shown.
- 39 { 1. Also, assume the following information as shown with respect to part 4A. Given these additional assumptions, **should Essex make or buy part 4A?**
- 40 { ii. The avoidable costs associated with making part 4A include direct materials (**\$180,000**), direct labor (**\$100,000**), variable overhead (**\$20,000**), and the supervisor's salary (**\$40,000**). Notice:
- 41 { 1. The **depreciation** of special equipment represents a sunk cost. Furthermore, the equipment has no resale value, thus the special equipment and its associated depreciation expense are **irrelevant** to the decision.
- 42 { 2. The **general factory overhead** represents future costs that will be incurred regardless of whether Essex makes or buys part 4A; hence, it is also **irrelevant** to the decision.
- 43 { iii. The total avoidable costs of **\$340,000** are less than the **\$500,000** cost of buying the part, thereby suggesting that Essex should **continue to make the part**.

- 44 { C. Opportunity cost
- i. An opportunity cost is the benefit that is **foregone** as a result of pursuing a course of action. While these costs **do not represent actual cash outlays**, they are relevant when making decisions.
 - ii. In the Essex Company example that we just completed, if Essex had an alternative use for the capacity that it used to make part 4A, there would have been an opportunity cost to factor into the analysis.
- 44 {
- 1. The opportunity cost would have been equal to the **segment margin that could have been derived from the best alternative use of the space**.

IV. Special orders

- 45 { *Learning objective 7-4: Prepare an analysis showing whether a special order should be accepted.*

- 46 { A. Key terms and concepts
- i. A **special order** is a one-time order that is not part of a company's normal operations.
 - ii. When analyzing a special order, only the **incremental costs and benefits** are relevant. Since the existing fixed manufacturing overhead costs would not be affected by the order, they are not relevant.

- 47 { **B. Jet Inc. – an example**
- i. Assume the following information with respect to a special order opportunity for Jet Inc. **Should Jet accept the offer?**
- 48 { ii. A contribution format income statement for Jet Inc.'s normal sales of **5,000 units** is as shown.
- 49 { iii. If Jet accepts the special order, the incremental revenue of **\$30,000** will exceed the incremental costs of **\$24,000** by **\$6,000**. This suggests that Jet should **accept** the order. Notice:
1. This answer assumes that the fixed costs are **unavoidable** and that variable marketing costs **must be incurred** on the special order.
- 50-52 { *Quick Check – special order decision making*

V. Utilization of a constrained resource

53 { *Learning Objective 7-5: Determine the most profitable use of a constrained resource.*

A. Key terms and concepts

- 54 { i. When a limited resource of some type restricts the company's ability to satisfy demand, the company is said to have a **constraint**. The machine or process that is limiting overall output is called the **bottleneck**—it is the constraint.

Helpful Hint: A production process can be thought of as a chain; each link in the chain represents a step in the process. A chain is only as strong as its weakest link. Likewise, the capacity of a production process is determined by its weakest link, which is the constraint. To increase the strength of a chain, its weakest link must be strengthened. To increase the output of the entire process, the output of the constraint must be increased. Strengthening the stronger links has no effect on the strength of the entire chain. The moral is to identify the constraint and concentrate management attention on effectively increasing its capacity.

- 55 {
- ii. Fixed costs are usually unaffected in these situations, so the product mix that maximizes the company's **total contribution margin** should ordinarily be selected.
 - iii. A company should not necessarily promote those products that have the highest **unit** contribution margins. Rather, total contribution margin will be maximized by promoting those products or accepting those orders that provide **the highest contribution margin in relation to the constraining resource**.

B. Ensign Company – an example

- 56 {
- i. Assume that Ensign Company produces **two products** and selected data are as shown. In addition assume that:

57

1. **Machine A1 is the constraint.**
2. There is **excess capacity** on all other machines.
3. Machine A1 has a capacity of **2,400 minutes per week.**
4. Ensign is trying to decide if it should focus its efforts on product 1 or 2.

58-61

Quick Check – constrained resource calculations

62

- ii. As suggested by the answer to the Quick Check question, Ensign should emphasize **product 2** because it generates a **contribution margin of \$30 per minute of the constrained resource** relative to **\$24 per minute for product 1.**

63

- iii. Ensign can maximize its contribution margin by **first producing product 2** to meet customer demand and then using **any remaining capacity to produce product 1.** The calculations would be performed as follows:

64

1. Satisfying the weekly demand of **2,200 units** for product 2 would consume **1,100 minutes** of available capacity on machine A1.

65

2. This implies that **1,300 constraint minutes would still be available** to satisfy demand for product 1.

66

3. Since each unit of product 1 requires one minute of A1 machine time, Ensign could produce **1,300 units of product 1** with its remaining capacity.

67 { 4. This mix of production (e.g., 2,200 units of product 2 and 1,300 units of product 1) would yield a **total contribution margin of \$64,200.**

68 { *Learning Objective 7-6: Determine the value of obtaining more of the constrained resource.*

69 { iv. How much should Ensign be willing to pay for an additional minute of A1 machine time?

70 { 1. Because the additional machine time would be used to make more units of Product 1, Ensign should be willing to pay up to \$24 per minute. This amount equals the contribution margin per minute of machine time that would be earned producing more units of Product 1.

71-76 { *Quick Check – constrained resource calculations*

77 { **C. Managing constraints**

i. It is often possible for a manager to increase the capacity of a bottleneck, which is called **relaxing (or elevating) the constraint**, in numerous ways such as:

- 77 {
1. Working **overtime** on the bottleneck.
 2. **Subcontracting** some of the processing that would be done at the bottleneck.
 3. **Investing in additional machines** at the bottleneck.

- 77 {
- 4. **Shifting workers** from non-bottleneck processes to the bottleneck.
 - 5. **Focusing business process improvement efforts** on the bottleneck.
 - 6. **Reducing defective units** processed through the bottleneck.
- ii. If a company has more than one potential constraint, the proper “mix” of products can be found using a quantitative method known as **linear programming**, which is covered in quantitative methods and operations management courses.

VI. Joint product costs and the contribution approach

- 78 { *Learning Objective 7-7: Prepare an analysis showing whether joint products should be sold at the split-off point or processed further.*

A. Key terms/concepts

- 79 {
- i. In some industries, a number of end products are produced from a single raw material input. When two or more products are produced from a common input these products are known as **joint products**. The **split-off point** is the point in the manufacturing process at which the joint products can be recognized as separate products.

80 { 1. For example, in the **petroleum refining industry** a large number of products are extracted from crude oil, including gasoline, jet fuel, home heating oil, lubricants, asphalt, and various organic chemicals.

81 { ii. The term **joint cost** is used to describe costs incurred up to the split-off point. Joint costs are common costs incurred to simultaneously produce a variety of end products.

82 { 1. Joint costs are traditionally allocated among different products at the split-off point. A typical approach is to allocate joint costs according to the **relative sales value** of the end products.
2. Although allocation is needed for some purposes such as balance sheet inventory valuation, allocations of this kind are **very dangerous** for decision making.

B. Sell or process further decisions

83 { i. Joint costs are **irrelevant** in decisions regarding what to do with a product from the split-off point forward. Therefore, these costs should **not be allocated** to end products for decision-making purposes.
ii. With respect to sell or process further decisions, it is profitable to continue processing a joint product after the split-off point **so long as the incremental revenue from such processing exceeds the**

83 { **incremental processing costs incurred after the split-off point.**

C. Sell or process further decisions – an example

84 { i. Assume the facts as shown with respect to Sawmill, Inc.

85 { 1. Sawmill has two joint products – **lumber and sawdust**. Selected financial information is shown for each joint product.

86 { 2. The **incremental revenue** from further processing of the lumber and sawdust is **\$130** and **\$10**, respectively.

87 { 3. The **profit (loss)** from further processing is **\$80** for the lumber and **(\$10)** for the sawdust.

88 { 4. The lumber **should be processed further** and the sawdust **should be sold at the split-off point**.

D. Activity-based costing and relevant costs

89 { 1. Activity-based costing can be used to help identify **potentially** relevant costs for decision-making purposes. However, managers should exercise caution against reading more into this “traceability” than really exists. People often assume that if a cost is traceable to a segment, then the cost is automatically avoidable, which is **untrue**. Before making a decision, managers must decide which of the potentially relevant costs are **actually** avoidable.

Chapter 8

Lecture Notes

- 1 { Chapter theme: The term **capital budgeting** is used to describe how managers plan significant cash outlays on projects that have long-term implications such as the purchase of new equipment and the introduction of new products. This chapter describes four methods for making these types of investment decisions—the **payback method**, the **net present value method**, the **internal rate of return method**, and the **simple rate of return method**.

I. Capital budgeting – an overview

- 2 { A. Typical capital budgeting decisions
- i. Capital budgeting analysis can be used for any decision that involves an outlay now in order to obtain some future return. Typical capital budgeting decisions include:
 - 1. **Cost reduction decisions.** Should new equipment be purchased to reduce costs?
 - 2. **Expansion decisions.** Should a new plant or warehouse be purchased to increase capacity and sales?
 - 3. **Equipment selection decisions.** Which of several available machines should be purchased?
 - 4. **Lease or buy decisions.** Should new equipment be leased or purchased?
 - 5. **Equipment replacement decisions.** Should old equipment be replaced now or later?

B. Types of capital budgeting decisions

- 3 {
- i. There are **two main types** of capital budgeting decisions:
 - 1. **Screening decisions** relate to whether a proposed project passes a preset hurdle.
 - a. For example, a company may have a policy of accepting projects only if they promise a return of 20% on the investment.
 - 2. **Preference decisions** relate to selecting among several competing courses of action.
 - a. For example, a company may be considering several different machines to replace an existing machine on the assembly line.

C. Cash flows versus net operating income

- 4 {
- i. The payback method, the net present value method, and the internal rate of return method all focus on analyzing the **cash flows** associated with capital investment projects, whereas the simple rate of return method focuses on **incremental net operating income**.
- 5 {
- ii. Examples of cash outflows and cash inflows that accompany capital investment projects are as follows:
 - 1. **Cash outflows** include those shown on this slide. Notice the term **working capital**,

- 5 { which is defined as current assets less current liabilities.
- 6 { 2. **Cash inflows** include those shown on this slide.

Helpful Hint: The role of working capital in capital budgeting often confuses students. Emphasize that the initial investment in working capital at the beginning of the project for items, such as inventories, is recaptured at the end of the project when working capital is no longer required. Thus, working capital is recognized as a cash outflow at the beginning of the project and a cash inflow at the end of the project.

- 7 { D. **The time value of money**
- 8 { i. The time value of money concept recognizes that **a dollar today is worth more than a dollar a year from now**. Therefore, projects that promise earlier returns are preferable to those that promise later returns.
- ii. The capital budgeting techniques that best recognize the time value of money are those that involve **discounted cash flows** (the concepts of discounting cash flows and using present value tables are explained in greater detail in Appendix 8A).

II. The payback method

9 { *Learning Objective 8-1: Determine the payback period for an investment.*

10 { A. The payback method focuses on the **payback period**, which is the length of time that it takes for a project to recoup its initial cost out of the cash receipts that it generates.

11 { i. **Key concepts**

1. The payback method analyzes cash flows; however, it does not consider the time value of money.
2. When the annual net cash inflow is **the same every year**, the formula for computing the payback period is as shown.

12 { ii. **The Daily Grind – an example**

1. Assume the management of the **Daily Grind** wants to install an espresso bar in its restaurant.
a. The cost of the espresso bar is **\$140,000** and it has a **10-year life**.
b. The bar will generate annual net cash inflows of **\$35,000**.
c. Management requires a payback period of **five years or less**.
d. **What is the payback period on the espresso bar?**

13 { 2. The payback period is **4.0 years**. Therefore, management would choose to invest in the bar.

14-15 { Quick Check – the payback method

- 16 {
- iii. **Evaluation of the payback method**
 - 1. **Criticisms**
 - a. A shorter payback period **does not** always mean that one investment is more desirable than another.
 - b. The payback method **ignores cash flows after the payback period**, thus it has no inherent mechanism for highlighting differences in useful life between investments.
 - c. As previously mentioned, the payback method **does not consider the time value of money**.

Helpful Hint: Ask students to choose between two options that each require an initial investment of \$4,000. Option A returns \$1,000 at the end of each four years; option B returns \$4,000 at the end of the fourth year. Under the payback method, options A and B are equally preferable. Note, however, that option A is better, since the cash flows come earlier. Now add that in year 5, option A will produce an additional cash inflow of \$5,000 but that option B will never generate another dollar after the fourth year. Repeat the question of preference of option A or B using only the payback method. The payback method ignores the time value of money and does not measure profitability; it just measures the time required to recapture the original investment.

- 17 {
- 2. **Strengths**
 - a. It can serve as a **screening tool** to help identify which investment proposals are in the “ballpark.”
 - b. It can aid companies that are “**cash poor**” in identifying investments that will recoup cash investments quickly.
 - c. It can help companies that compete in industries **where products become obsolete rapidly** to identify products that will recoup their initial investment quickly.

iv. **Payback and uneven cash flows**

- 18 {
- 1. When the cash flows associated with an investment project change from year to year, the payback formula introduced earlier cannot be used. Instead, **the un-recovered investment must be tracked year by year.**
- 19 {
- 2. For example, if a project requires an initial investment of \$4,000 and provides uneven net cash inflows in years 1-5 as shown. **The investment would be fully recovered in year 4.**

III. **The net present value method**

- 20 {
- Learning Objective 8-2: Evaluate the acceptability of an investment project using the net present value method.*

- 21 { A. **Key concepts/assumptions**
- i. The net present value method compares the present value of a project's **cash inflows** with the present value of its **cash outflows**. The difference between these two streams of cash flows is called the **net present value**.
- 22 { ii. **Two simplifying assumptions** are usually made in net present value analysis:
1. The first assumption is that all cash flows other than the initial investment occur at the **end of periods**.
2. The second assumption is that all cash flows generated by an investment project are **immediately reinvested** at a rate of return equal to the discount rate.

B. The net present value method: an example using discount factors from Exhibits 8B-1 and 8B-2

- 23 { i. Assume the information as shown with respect to **Lester Company**.
- 24 { 1. Also assume that at the end of five years the **working capital will be released** and may be used elsewhere.
2. Lester Company's discount rate is **11%**.
3. **Should the contract be accepted?**
- 25 { ii. As a starting point, Lester's annual net cash inflow from operations of **\$80,000** is computed as shown.

- 26 { iii. Since the investments in equipment (\$160,000) and working capital (\$100,000) occur immediately, the discounting factor used is **1.000**.
- 27 { iv. The present value factor for an annuity of \$1 for five years at 11% is **3.696**. Therefore, the present value of the annual net cash inflows is **\$295,680**.
- 28 { v. The present value factor of \$1 for three years at 11% is **0.731**. Therefore, the present value of the cost of relining the equipment in three years is **\$21,930**.
- 29 { vi. The present value factor of \$1 for five years at 11% is **0.593**. Therefore, the present value of the release of working capital and the salvage value of the equipment is **\$62,265**.
- 30 { vii. The net present value of the investment opportunity is **\$76,015**.
- 31-33 { *Quick Check – net present value calculations*

C. The net present value method: an example using discount factors from Exhibits 8B-1

- 34 { i. For this next example, we'll use the same information from **Lester Company**.
- 35 { 1. Also assume that at the end of five years the **working capital will be released** and may be used elsewhere.
- 35 { 2. Lester Company's discount rate is **11%**.
- 35 { 3. **Should the contract be accepted?**

- 36 { ii. Since the investments in equipment (\$160,000) and working capital (\$100,000) occur immediately, the discounting factor used is **1.000**.
- 37 { iii. The total cash flows for years 1-5 are discounted to their present values using the discount factors from **Exhibit 8B-1**.
- 38 { iv. For example, the total cash flows in year 1 of **\$80,000** are multiplied by the discount factor of **0.901** to derive this future cash flow's present value of **\$72,080**.
- 39 { v. As another example, the total cash flows in year 3 of **\$50,000** are multiplied by the discount factor of **0.731** to derive this future cash flow's present value of **\$36,550**.
- 40 { vi. The net present value of the investment opportunity is **\$76,015**. Notice this amount equals the net present value from the earlier approach.

D. The net present value method: interpreting the results

- 41 { i. Once you have computed a net present value, you should interpret the results as follows:
1. A **positive net present value** indicates that the project's return **exceeds the discount rate**.

- 41 { 2. A **negative net present value** indicates that the project's return is **less than the discount rate**.
- 42 { 3. If the company's minimum required rate of return is used as the discount rate:
- a. A project with a **positive net present value** has a return that exceeds the minimum required rate of return and is therefore **acceptable**.
- b. A project with a **negative net present value** has a return that is less than the minimum required rate of return and is therefore **unacceptable**.
- 43 { 4. A company's **cost of capital** is usually regarded as its minimum required rate of return. The cost of capital is the **average return** that the company must pay to its **long-term creditors** and its **shareholders**. When the cost of capital is used as the discount rate, it serves as a **screening device** in net present value analysis.

E. Recovery of the original investment

- 44 { i. The net present value method automatically provides for **return of the original investment**.
- 45 { ii. To illustrate this fact, assume the facts as shown with respect to **Carver Hospital**.
- 46 { 1. Notice that the net present value of the investment is **zero**.

- 47 { 2. This implies that the cash inflows are sufficient to **recover the \$3,169 initial investment** and to provide **exactly a 10% return** on the investment

IV. The internal rate of return method

48 { *Learning Objective 8-3: Evaluate the acceptability of an investment project using the internal rate of return method.*

A. Key concepts

- 49 {
- i. The **internal rate of return** is the rate of return promised by an investment project over its useful life. It is sometimes referred to as the **yield** on a project.
 - ii. The internal rate of return is the discount rate that will result in a **net present value of zero**.
 - iii. This technique works very well if a project's cash flows are identical every year. If the cash flows are not identical every year a **trial-and-error process** can be used to find the internal rate of return.
- 50 {
- iv. If the internal rate of return is **equal to or greater than** the minimum **required rate of return**, then the project is **acceptable**. If it is **less than** the required rate of return, then the project is **rejected**.

- 50 { v. When using internal rate of return, the cost of capital acts as a **hurdle rate** that a project must clear for acceptance.

B. Internal rate of return – an example

- 51 { i. Assume the facts as shown with respect to the **Decker Company**.

- 52 { ii. Since the cash flows are the **same every year**, the equation shown can be used to compute the appropriate present value factor of **5.216**.

- 53 { iii. Using the present value of an annuity of \$1 table, the internal rate of return equals **14%**.

- 54 { iv. If Decker's minimum required rate of return is **equal to or greater** than 14%, then the machine should be purchased.

55-56 { *Quick Check – internal rate of return calculations*

C. Comparing the net present value and internal rate of return methods

- 57 { i. The net present value method offers **two important advantages** over the internal rate of return method.
1. The net present value method is often **simpler to use**.
 2. The internal rate of return method makes a **questionable assumption**—that cash inflows can be reinvested at the internal rate of return.

- 58 { a. If the internal rate of return is high, this assumption may be **unrealistic**. It is more realistic to assume that the cash flows can be **reinvested at the discount rate**, which is the underlying assumption of the net present value method.

V. Expanding the net present value method

- 59 { A. We will now expand the net present value method to include **two alternatives**. We will analyze the alternatives using the **total cost approach**.

- 60 { B. **Net present value analysis: an expanded example**
- i. Assume that **White Co.** has two alternatives—**remodel** an old car wash or remove the old car wash and **replace** it with a new one.
1. The company uses a discount rate of **10%**.
 2. The net annual cash inflows are **\$60,000** for the new car wash and **\$45,000** for the old car wash.

- 61 { ii. In addition, assume that the information as shown relates to the **installation of a new washer**.

- 62 { iii. The net present value of installing a new washer is **\$83,202**.

- 63 { iv. If White chooses to remodel the existing washer, the remodeling costs would be **\$175,000** and the cost to replace the brushes at the end of six years would be **\$80,000**.
- 64 { v. The net present value of remodeling the old washer is **\$56,405**.
- 65 { vi. While both projects yield a positive net present value, the net present value of the new washer alternative is **\$26,797 higher** than the remodeling alternative.

C. Least cost decisions

- 66 { i. In decisions where **revenues are not directly involved**, managers should choose the alternative that has the **least total cost** from a present value perspective.
- 67 { ii. **Home Furniture Company – an example**
(we will analyze this decision using the **total-cost approach**.
 - 1. Assume the following:
 - a. Home Furniture Company is trying to decide whether to **overhaul** an old delivery truck or **purchase** a new one.
 - b. The company uses a discount rate of **10%**.
- 68 { 2. The information pertaining to the old and new trucks is as shown.

- 69 { 3. The net present value of buying a new truck is (\$32,883). The net present value of overhauling the old truck is (\$42,255).
a. Notice **both numbers are negative because there is no revenue involved** – this is a **least cost** decision.
- 70 { 4. The net present value in favor of purchasing the new truck is \$9,372.

VI. Uncertain cash flows

- 71 { *Learning Objective 8-4: Evaluate an investment project that has uncertain cash flows.*

- 72 { A. **Handling the complication of uncertain future cash flows – an example**
- i. Assume that all of the cash flows related to an investment in a supertanker have been estimated except for its salvage value in 20 years.
1. Using a discount rate of **12%**, management has determined that the net present value of all the cash flows except the salvage value is a **negative \$1.04 million**.
2. This negative net present value will be offset by the salvage value of the supertanker.
3. **How large would the salvage value need to be to make this investment attractive?**
- 73 { ii. The equation shown can be used to determine that if the salvage value of the supertanker is **at least \$10 million**, the net present value of

- 73 { the investment would be positive and therefore acceptable.
1. While the salvage value is not known with certainty, the \$10 million dollar figure offers **a useful reference point** for making the decision.
- 74-75 { *Quick Check – uncertain cash flows*

VII. Preference decisions – the ranking of investment projects

- 76 { *Learning Objective 8-5: Rank investment projects in order of preference.*

A. Background

- 77 { i. Recall that when considering investment opportunities, managers must make two types of decisions – screening decisions and preference decisions.
1. **Screening decisions**, which come first, pertain to whether or not some proposed investment is acceptable.
2. **Preference decisions**, which come after screening decisions, attempt to rank acceptable alternatives from the most to least appealing.
- a. Preference decisions need to be made because the number of acceptable investment alternatives usually **exceeds** the amount of available funds.

B. Internal rate of return method

- 78 {
- i. When using the internal rate of return method to rank competing investment projects, the preference rule is: **the higher the internal rate of return, the more desirable the project.**

C. Net present value method

- 79 {
- i. The net present value of one project **cannot be directly compared** to the net present value of another project **unless the investments are equal.**
- 80 {
- ii. In the case of unequal investments, a **project profitability index** can be computed as shown. Notice:
 - 1. The project profitability indexes for investments A and B are **0.01** and **0.20**, respectively.
 - 2. The higher the project profitability index, the more desirable the project. Therefore, **investment B is more desirable than investment A.**
 - 3. Since in this type of situation, **the constrained resource is the limited funds available for investment**, the project profitability index is similar to the contribution margin per unit of the constrained resource discussed in an earlier chapter.

VIII. The simple rate of return method

81 { *Learning Objective 8-6: Compute the simple rate of return for an investment.*

82 {
i. **Key concepts**
1. The **simple rate of return method** (also known as the **accounting rate of return** or the **unadjusted rate of return**) does not focus on cash flows, rather it focuses on **accounting net operating income**.
2. The equation for computing the simple rate of return is as shown.

83 {
ii. **The Daily Grind – an example**
1. Assume the management of the **Daily Grind** wants to install an espresso bar in its restaurant.
a. The cost of the espresso bar is **\$140,000** and it has a **10-year life**.
b. The espresso bar will generate incremental revenues of **\$100,000** and incremental expenses of **\$65,000** including depreciation.
c. **What is the simple rate of return on this project?**
84 { 2. The simple rate of return is **25%**.

85 {
iii. **Criticisms of the simple rate of return**
1. **It does not consider the time value of money.**

- 85 { 2. The simple rate of return **fluctuates from year to year** when used to evaluate projects that do not have constant annual incremental revenues and expenses.
- a. The same project may appear desirable in some years and undesirable in others.

- 86 { iv. **The behavioral implications of the simple rate of return**
1. When investment center managers are evaluated using return on investment (ROI), a project's simple rate of return may motivate them to bypass investment opportunities that earn positive net present values.

IX. **Postaudit of investment projects**

- 87 { A. A postaudit is a follow-up after the project has been completed to see whether or not **expected results were actually realized**.
- i. The data used in a postaudit analysis should be **actual observed data** rather than estimated data.

Chapter 9

Lecture Notes

- 1 { Chapter theme: This chapter describes how organizations define their financial goals by preparing numerous budgets that collectively form an integrated business plan known as a **master budget**. The master budget communicates management's plans throughout the organization, allocates resources, and coordinates activities.

I. The basic framework of budgeting

- 2 { *Learning Objective 9-1: Understand why organizations budget and the processes they use to create budgets.*

- 3 { **A. Basic definitions**
- i. A **budget** is a detailed quantitative plan for acquiring and using financial and other resources over a specified forthcoming time period.
 - 1. The act of preparing a budget is called **budgeting**.
 - 2. The use of budgets to control an organization's activities is known as **budgetary control**.

- 4 { **B. Difference between planning and control**
- i. **Planning** involves developing objectives and preparing various budgets to achieve those objectives.
 - ii. **Control** involves the steps taken by management to increase the likelihood that the objectives set down

- 4 { at the planning stage are attained and that all parts of the organization are working together toward that goal.
- iii. To be effective, a good budgeting system must provide for **both** planning and control. Good planning without effective control is time wasted.

C. Advantages of budgeting

- 5 {
- i. Budgets **communicate** management's plans throughout the organization.
 - ii. Budgets force managers to **think about** and plan for **the future**.
 - iii. The budgeting process provides a means of **allocating resources** to those parts of the organization where they can be used most effectively.
 - iv. The budgeting process can uncover potential **bottlenecks** before they occur.
 - v. Budgets **coordinate** the activities of the entire organization by integrating the plans of its various parts.
 - vi. Budgets define **goals and objectives** that can serve as **benchmarks** for evaluating subsequent performance.

Helpful Hint: Mention to students that budgets are prepared for reasons other than projecting income statement and balance sheet account balances. Ask

students to think about some other information that might be provided by budgets, such as determining the need for short-term borrowing or estimating raw material needs.

D. Other terminology/concepts related to budgeting

i. Responsibility accounting

6

1. The premise of responsibility accounting is that managers should be held responsible only for those items that they can **control** to a significant extent.
 - a. Responsibility accounting systems enable organizations to **react quickly** to deviations from their plans and to **learn** from feedback obtained by comparing budgeted goals to actual results. The point is not to **penalize** individuals for missing targets.

ii. Choosing a budget period

7

1. **Operating budgets** ordinarily cover a one-year period corresponding to a company's fiscal year. Many companies divide their annual budget into four quarters.
 - a. In this chapter we focus on one-year operating budgets.
2. A **continuous or perpetual budget** is a 12-month budget that rolls forward one month (or quarter) as the current month (or quarter) is completed.

- 7 { a. This approach keeps managers focused on the future at least one year ahead.

iii. **The self-imposed budget**

- 8 { 1. A **self-imposed budget** or **participative budget** is a budget that is prepared with the full cooperation and participation of managers at all levels. It is a particularly useful approach if the budget will be used to evaluate managerial performance.

2. The **advantages** of self-imposed budgets include:

- 9 { a. Individuals at all levels of the organization are viewed as **members of the team** whose judgments are valued by top management.
b. Budget estimates prepared by front-line managers (who have intimate knowledge of day-to-day operations) are often **more accurate** than estimates prepared by top managers.
c. **Motivation is generally higher** when individuals participate in setting their own goals than when the goals are imposed from above.
d. A manager who is not able to meet a budget imposed from above can claim that it was **unrealistic**. Self-imposed budgets eliminate this excuse.

- 10 { 3. Self-imposed budgets should be reviewed by higher levels of management. Without such a review, self-imposed budgets may have

10

- too much “**budgetary slack**,” or may not be aligned with overall strategic objectives.
4. Most companies do not rely exclusively upon self-imposed budgets in the sense that **top managers usually initiate the budget process** by issuing broad guidelines in terms of overall target profits or sales. Lower level managers are directed to prepare budgets that meet those targets.

Helpful Hint: Ask students if they ever worked in an organization with a management-imposed budget or a participative budget. Solicit the reactions of students to these kinds of budgets and the effects they had on motivation and performance.

11

iv. **Human factors in budgeting**

1. The success of a budget program depends on **three important factors**:
 - a. Top management must be **enthusiastic and committed** to the budgeting process; otherwise nobody will take it seriously.
 - b. Top management must not use the budget to **pressure** employees or **blame** them when something goes wrong. This breeds hostility and mistrust rather than cooperative and coordinated efforts.
 - c. **Highly achievable budget targets** are usually preferred (rather than “stretch budget” targets) when managers are rewarded based on meeting budget targets.

E. The master budget: an overview

- i. The master budget consists of a number of separate but **interdependent** budgets.
 1. The **sales budget** shows the expected sales for the budget period expressed in dollars and units. It is usually based on a company's **sales forecast**.
 - a. All other parts of the master budget are dependent on the sales budget.
 2. The **production budget** is prepared after the sales budget. It lists the number of units that must be produced during each budget period to meet sales needs and to provide for the desired ending inventory. The production budget in turn directly influences the **direct materials, direct labor, and manufacturing overhead budgets**, which in turn enable the preparation of the **ending finished goods inventory budget**.
 - a. These budgets are then combined with data from the sales budget and the **selling and administrative expense budget** to determine the cash budget.
 3. The **cash budget** is a detailed plan showing how cash resources will be acquired and used over a specified time period.
 - a. All of the operating budgets have an impact on the cash budget.
 4. The last step of the process is to prepare a **budgeted income statement** and a **budgeted balance sheet**.

- 13-14 { ii. To help you see the “big picture” keep in mind that the 10 schedules in a master budget are designed to answer the **10 questions** as shown on the next two slides.
- 15 { iii. It also bears emphasizing that a master budget is based on various estimates and assumptions. For example, the **sales budget requires three estimates/assumptions** as follows:
1. What are the budgeted unit sales?
 2. What is the budgeted selling price per unit?
 3. What percentage of accounts receivable will be collected in the current and subsequent periods?
- 16 { iv. When **Microsoft Excel** is used to create a master budget, these types of assumptions can be depicted in a **Budgeting Assumptions tab**, thereby enabling the Excel-based budget to answer “**what-if**” **questions**.

Helpful Hint: Budgets—particularly in large organizations—can be very complex. To keep the complexity within bounds, we have simplified the budgets. Even so, these simplified budgets are intricate, and the level of detail may be overwhelming to some students. Emphasize that each step in the process is fairly simple, but the budgets must fit together for the plan to be successful. Return to Exhibit 9-2 from time to time to review the master budget interrelationships.

II. Preparing the master budget

17 { *Learning Objective 9-2: Prepare a sales budget, including a schedule of expected cash collections.*

18 { **A. The sales budget**

i. Assume the facts as shown for the Royal Company.

19 {
1. The sales budget multiplies the budgeted sales in units for each month by the selling price per unit.
a. The total sales budget for the quarter (**\$1,000,000**) is calculated by multiplying the budgeted sales in units for the quarter (**100,000**) by the selling price per unit (**\$10**).

20 {
ii. Assume the information as shown regarding Royal's expected cash collections.

21 {
1. The **first step** in calculating Royal's cash collections is to insert the **beginning accounts receivable balance (\$30,000)** into the April column of the cash collections schedule.

a. This balance will be collected in full in April.

22 {
2. The **second step** is to calculate the April credit sales that will be collected during each month of the quarter.
a. **\$140,000** ($\$200,000 \times 70\%$) will be collected in April and **\$50,000** ($\$200,000 \times 25\%$) will be collected

- 22 { in May. **\$10,000** ($\$200,000 \times 5\%$) will be uncollectible.
- 23 { 3. The **third step** is to calculate the May credit sales that will be collected during each month of the quarter.
- 24-25 { a. **\$350,000** ($\$500,000 \times 70\%$) will be collected in May and **\$125,000** ($\$500,000 \times 25\%$) will be collected in June. **\$25,000** ($\$500,000 \times 5\%$) will be uncollectible.
- 26 { *Quick Check – calculating cash collections*
- 27 { 4. The **fourth step** is to calculate the June credit sales that will be collected during the month of June.
- 28 { a. **\$210,000** ($\$300,000 \times 70\%$) will be collected in June.
- 29 { 5. The **fifth step** is to calculate the total for each column in the schedule and the total for the quarter (**\$905,000**).
- 27 { *Learning Objective 9-3: Prepare a production budget.*
- 28 { B. **The production budget** (must be adequate to meet budgeted sales and to provide for the desired ending inventory)
- 29 { i. Assume the information as shown to enable the preparation of Royal's production budget (If Royal was a merchandising company it would prepare a **merchandise purchases budget** instead of a production budget).

- 30 { 1. The **first step** in preparing the production budget is to insert the budgeted sales in units from the sales budget.
- 31 { 2. The **second step** is to calculate the required production in units for April (**26,000 units**).
a. Notice, the desired ending inventory in units for April (**10,000 units**) and the beginning inventory in units for April (**4,000 units**).
- 32-33 { *Quick Check – Calculating required production*
- 34 { 3. The **third step** is to calculate the required production for May (**46,000 units**).
a. Notice, April’s desired ending inventory (**10,000 units**) becomes May’s beginning inventory.
- 35 { 4. The **fourth step** is to calculate the required production for June (**29,000 units**).
a. Notice, we are **assuming** a desired ending inventory of **5,000 units** (which implies that projected sales in July are 25,000 units).
5. The **fifth step** is to complete the “Quarter” column.
a. Notice, April’s beginning inventory and June’s ending inventory are carried over to this column.

Helpful Hint: Many students have a tendency to add up the inventory amounts instead of using the ending or the beginning figure. Pointing this out early might reduce confusion on the part of students.

- 36 { *Learning Objective 9-4: Prepare a direct materials budget, including a schedule of expected cash disbursements for purchases of materials.*
- 37 { **C. The direct materials budget**
- i. Assume the information as shown to enable the preparation of Royal's **direct materials budget** which quantifies the raw materials that must be purchased to fulfill the production budget and to provide for adequate inventories.
- 38 { 1. The **first step** in preparing the direct materials budget is to insert the required production in units from the production budget.
- 39 { 2. The **second step** is to calculate the monthly and quarterly production needs, which in this case are stated in terms of **pounds** of direct material.
- 40 { 3. The **third step** is to calculate the materials to be purchased for April (**140,000 pounds**).
Notice:
- a. The desired ending inventory of **23,000 pounds** is 10% of the following month's production.
- b. The beginning inventory of **13,000 pounds** is the same as the March 31st ending inventory.
- 41-42 { *Quick Check – direct material purchases*

- 43 { 4. The **fourth step** is to calculate the materials to be purchased for May (**221,500 pounds**). Notice:
- a. April's desired ending inventory becomes May's beginning inventory.
- 44 { 5. The **fifth step** is to calculate the materials to be purchased for June (**142,000 pounds**) and to calculate the quarterly totals. Notice:
- a. We are **assuming** a desired ending inventory for June of **11,500 pounds**.
- b. April's beginning inventory and June's ending inventory carry over to the "Quarter" column.

Helpful Hint: Tell the students that the inventory purchases budget or the raw materials purchase budget are really just the elements of a cost of goods sold schedule in a different order.

- 45 { ii. Assume the information as shown regarding Royal's expected cash disbursements for materials.
- 46 { 1. The **first step** in calculating Royal's cash disbursements is to insert the **beginning accounts payable balance (\$12,000)** into the April column of the cash disbursements schedule.
- a. This balance will be paid in full in April.
- 47 { 2. The **second step** is to calculate the April credit purchases that will be paid during each month of the quarter.
- a. **\$28,000** ($\$56,000 \times 50\%$) will be paid in April and **\$28,000** ($\$56,000 \times 50\%$) will be paid in May.

47 { (1). The **\$56,000** is derived by multiplying **140,000** pounds by the **\$0.40** per pound purchase price.

48-49 { *Quick Check – cash disbursements calculations*

50 { 3. The remaining steps include:
a. Calculating the May and June credit purchases that are paid during each month of the quarter.
b. Calculating the totals for all columns in the schedule and the total for the quarter (**\$185,000**).

51 { *Learning Objective 9-5: Prepare a direct labor budget.*

D. The direct labor budget

52 { i. Assume the information as shown to enable the preparation of Royal's **direct labor budget** which enables the company to match its direct labor hours provided with its production needs.

53 { 1. The **first step** in preparing the direct labor budget is to insert the production in units from the production budget.
2. The **second step** is to compute the direct labor hours required to meet the production needs. Notice:
54 { a. **0.05** direct labor hours are needed per unit.
3. The **third step**, in this particular example, is to compute the direct labor hours paid.
55 { Notice:

- 55 { a. In this example, there are **guaranteed labor hours** that will be paid for regardless of production needs.
- 56 { 4. The **fourth step** is to compute the total direct labor cost. Notice:
a. With direct labor, we computed all three months at the same time. This is because there is no beginning and ending inventory to consider.
- 57-58 { *Quick Check – direct labor cost calculations*
- 59 { *Learning Objective 9-6: Prepare a manufacturing overhead budget.*
- 60 { E. **The manufacturing overhead budget**
i. Assume the information as shown to enable the preparation of Royal's **manufacturing overhead budget**. This budget provides a schedule of all costs of production other than direct materials and direct labor.
- 61 { 1. The **first step** in preparing the manufacturing overhead budget is to calculate the **variable manufacturing overhead costs** for each month and in total. Notice:
a. The direct labor hours required is taken directly from the **direct labor budget**.

62

2. The **second step** is to add the fixed manufacturing overhead costs (**\$50,000 per month**) to the variable overhead costs to arrive at total manufacturing overhead costs for each month and in total. Notice:
 - a. We can determine the predetermined overhead rate for the quarter (**\$49.70**).
 - b. Once the level of fixed costs has been determined in the budget, the costs really are fixed; hence, the time to adjust fixed costs is **during the budgeting process**.

63

3. The **third step** is to calculate the cash disbursements for manufacturing overhead by subtracting **noncash expenses** from the total manufacturing overhead costs computed in step two.
 - a. In this example, **\$20,000 of depreciation** is deducted from each month's total overhead costs to arrive at the cash disbursements for manufacturing overhead costs.

Helpful Hint: Have the students trace the amounts from the raw materials purchase, direct labor, and manufacturing overhead budgets to the cash budget. Information from some of the budgets is needed by more than one individual—in this case the manufacturing department—and the controller would require the information from these budgets.

F. The ending finished goods inventory budget

- 64 { i. Now Royal can complete the ending finished goods inventory budget.
1. The **first step** in preparing this budget is to compute the direct materials cost per unit (\$2.00).
- a. The information needed can be derived by referring back to the direct materials budget.
- 65 { 2. The **second step** is to compute the direct labor cost per unit (\$0.50).
- a. The information needed can be derived by referring back to the direct labor budget.
- 66 { 3. The **third step** is to compute the manufacturing overhead cost per unit (\$2.49) and the total inventoriable cost per unit (\$4.99). Notice:
- a. Royal is using an **absorption costing** approach to valuing its inventory.
- b. The quantities shown for direct labor and manufacturing overhead are the same (**0.05 hours**) because direct labor hours is the overhead allocation base.
- c. The predetermined overhead rate was calculated when we prepared the manufacturing overhead budget.
- 67 { 4. The **fourth step** is to calculate the value of the ending finished goods inventory (\$24,950). Notice:

67 { a. The ending inventory in units (**5,000**) is derived from the production budget.

68 { *Learning Objective 9-7: Prepare a selling and administrative expense budget.*

G. The selling and administrative expense budget

69 { i. Assume the information as shown to enable the preparation of Royal's **selling and administrative expense budget**. This budget lists the budgeted expenses for areas other than manufacturing and it is typically a compilation of many smaller, individual budgets.

70 {
1. The **first step** in preparing this budget is to multiply the variable S, G & A rate by the number of units sold.
2. The **second step** is to add in the fixed S, G & A expenses to arrive at total S, G & A expenses.
3. The **third step** is to deduct noncash S, G & A expenses to arrive at cash disbursements for S, G & A expenses.

71-72 { *Quick Check – S, G & A expense calculations*

73 { 4. The same steps are followed for the months of May and June to arrive at total cash disbursements for S, G & A expenses for the quarter of **\$230,000**.

74 { Learning Objective 9-8: Prepare a cash budget.

H. The cash budget

- 75 {
- i. The **format** of the cash budget
 - 1. This budget should be broken down into time periods that are as **short as feasible**. It consists of **four major sections**:
 - a. The **receipts section** lists all cash inflows excluding cash received from financing.
 - b. The **disbursements section** consists of all cash payments excluding repayments of principal and interest.
 - c. The **cash excess or deficiency section** determines if the company will need to borrow money or if it will be able to repay funds previously borrowed.
 - d. The **financing section** details the borrowings and repayments projected to take place during the budget period.

Helpful Hint: The idea that the cash budget should cover time periods as short as possible should be understood by students with checking accounts. Fluctuations in cash flows can lead to a negative balance during the month even though the balance is positive at both the beginning and end of the month.

- 76 {
- ii. Assume the information as shown to enable the preparation of Royal's **cash budget**.

- 77 { 1. The **first step** in preparing this budget is to calculate the total cash available (**\$210,000**). Notice:
- a. The cash collections for April (**\$170,000**) come from the schedule of expected cash collections.
- 78 { 2. The **second step** is to calculate the total cash disbursements (**\$230,000**). Notice:
- a. Each cash disbursement, except dividends, comes from a schedule or budget that had already been prepared.
- 79 { 3. The **third step** is to calculate the excess (deficiency) of cash available over disbursements (**\$20,000**).
- 80 { 4. The **fourth step** is to determine the financing requirements and the ending cash balance. Notice:
- a. Because Royal maintains a \$30,000 cash balance, **it must borrow \$50,000** on its line-of-credit.
- b. The ending cash balance (**\$30,000**) coincides with Royal's minimum requirement.
- c. The ending cash balance for April will **carry forward** to become the beginning balance for May.
- 81 { 5. These four steps are repeated for the month of May. The result is a **\$30,000 excess** of cash available over disbursements for May.
- a. Since Royal must maintain a minimum cash balance of \$30,000, it will not repay any of its loan in May.
- 82-83 { *Quick Check – cash budgeting calculations*

- 84 {
6. The same four steps are repeated for June. The result is an excess of cash available of **\$95,000**.
 - a. This excess enables Royal to repay the **\$50,000** in principal that was borrowed plus interest on the loan of **\$2,000** ($\$50,000 \times 16\% \times 3/12$).
 - b. The ending cash balance for the quarter is **\$43,000**.
 7. Once the cash budget has been completed, the budgeted income statement can be prepared. The cash budget must be prepared first so that the interest expense can be determined for the budgeted income statement.
- 85 {
- 86 { *Learning Objective 9-9: Prepare a budgeted income statement.*

I. The budgeted income statement

- 87 {
- i. The numbers for the budgeted income statement come from other budgets that have already been prepared. More specifically:
 1. The sale revenue comes from the **sales budget**.
 2. The cost of goods sold, on a per unit basis, comes from the **ending finished goods inventory budget**.
 3. The selling and administrative expenses come from the **selling and administrative expenses budget**.
 4. The interest expense comes from the **cash budget**.

Helpful Hint: Indicate that, for simplicity, income taxes were not included in these budgets, but taxes must be considered in a company's budgeting process.

88 { *Learning Objective 9-10: Prepare a budgeted balance sheet.*

J. The budgeted balance sheet

89 { i. Assume the information as shown to enable the preparation of the budgeted balance sheet.

- 90 {
1. The budgeted balance sheet is prepared as follows:
 - a. Cash (**\$43,000**) is taken from the ending cash balance of the cash budget.
 - b. Accounts Receivable (**\$75,000**) is **25%** of June's sales (**\$300,000**).
 - c. Raw materials inventory (**\$4,600**) is calculated by multiplying the ending inventory of raw material in pounds (**11,500**) by the cost per pound (**\$0.40**).
 - d. The finished goods inventory (**\$24,950**) is taken from the ending finished goods inventory budget.
 - e. Land, equipment, and common stock are all **given**.
 - f. Accounts payable (**\$28,400**) is **50%** of June's purchases (**\$56,800**).
 - g. The ending retained earnings (**\$336,150**) is calculated by adding net income (**\$239,000**) to the
- 91 {

91 { beginning retained earnings
(\$146,150), and then subtracting
dividends (\$49,000).