

# Principles of Managerial Accounting







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# INTRODUCTION

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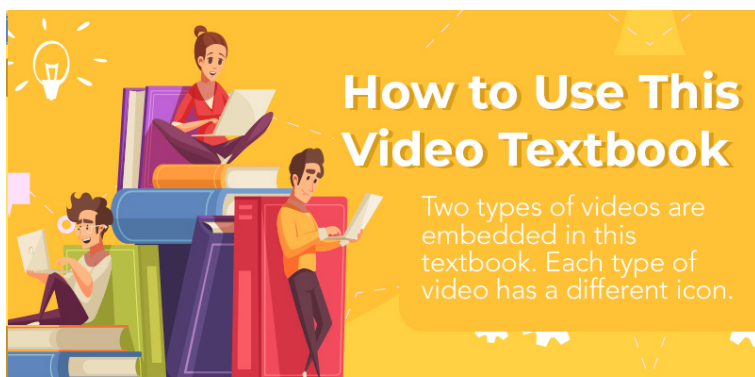
*Principles of Managerial Accounting* is an innovative video textbook that is intended to be watched as much as it is read. Users learn fundamental managerial accounting principles by reading about the concepts in the text immediately followed by watching short videos where the concepts are applied in demonstration problems. Each chapter contains detailed written explanations of fundamental managerial accounting concepts such as cost behavior, job costing, cost classifications, cost volume profit analysis, incremental decision making, budgeting, and variance analysis. Video Illustrations are embedded within the written text to actively demonstrate the accounting concepts. Each chapter is concluded with a series of comprehensive “Practice Video Problems” in which the concepts are applied to unique business situations. Interactive elements are also embedded throughout this textbook. “Check your understanding” questions follow the major learning objectives. And interactive “Review” and “Homework” questions are included at the end of every chapter.

This video textbook is particularly suited for distance education courses, hybrid courses, personal interest self-study,

or any other circumstance in which users don't receive the educational benefits from traditional, in-person lectures.

# HOW TO USE THIS VIDEO TEXTBOOK

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## How to Use This Video Textbook

Two types of videos are embedded in this textbook. Each type of video has a different icon.



**Video Illustration videos** are active learning videos that supplement the text on the page. You won't find this Information in the text so you must watch the video to see the concepts in action.



**Practice Video Problem videos** are comprehensive problems that supplement the text on the page. In these videos, the concepts are applied to unique business situations. You won't find this information in the text so you must watch the video to see the concepts in action.

# ABOUT THE AUTHOR

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related to the scholarship of teaching and learning. Additionally, she is the founding member of two successful educational conferences, the 3T: Teaching, Techniques and Technology Conference and the Ei3: Equity, Inclusion, Innovation, and Impact undergraduate student research conference.

In her free time, Patty enjoys meditation, nature, and animals. She lives on a five-acre horse farm where she maintains what could be called a small petting zoo. She enjoys spending time with her husband (Duane), two daughters (Kelly & Stephanie), and her granddaughter (Kinsley).

### ***NOTE TO STUDENTS***

*I wrote this book for my students. In recent years, textbook costs, like everything else, have increased exponentially. I published this book as an Open Educational Resource, so students did not need to purchase yet another expensive textbook. I hope you enjoy this video textbook. It is my gift to you.*

# ACKNOWLEDGEMENTS

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I appreciate the support of my family as well the the University of Cincinnati, Clermont College.

I also want to acknowledge Sharon Strickland. She contributed content for the Check your understanding, Review questions, and Homework questions.



Sharon Strickland, MS Taxation

## Academic and Professional

I earned my Accounting and Taxation degrees from The University of Cincinnati. I served the State of Ohio Department of Taxation as Audit and Tax Technical Training Manager. I currently teach and create course content related to Financial and Managerial Accounting, and Taxation of Individuals through The University of Cincinnati, Lindner School of Business and Clermont College, and Gateway Online as part of The Kentucky Community and Technical

College System. I have also taught accounting courses at The University of Dayton, Mount Saint Joseph University, and UC Blue Ash College. I serve as Vice Chair of the Batavia Township Zoning Appeals Board and previously served on the Clermont County Chamber of Commerce's Agenda for the Future, on the Finance Committee of the Clermont County Senior Services, as a board member of the Clermont County Planning Commission, as Program Manager of Batavia Rotary, and as voting manager for the Clermont County Board of Elections.

## **Personal Biography**

I enjoy teaching, creating content, participating in and leading yoga classes, gardening, and hiking with my friends and pets. I offer yoga classes at my privately owned studio, am in a Euchre Club, and am the founding member of Mt. Holly Book Club. I enjoy life with my husband, a mechanic and builder. We share our home with our two German Shepherds and litter of four cats. My twin adult sons both work in the electrical industry where one is a mechanical engineer and the other a project manager.

## **Statement of Teaching Philosophy**

My goal as an accounting teacher is to prepare students to meet the demands of the employment market for technically and ethically educated accounting professionals that possess

the abilities to think critically and make rational decisions. Successful students will communicate effectively using the language of business to accurately apply essential accounting principles in a manner that reflects the values of responsibility and trust. Successful students will also possess an understanding of where the information is sourced, why the information is essential, and how the information is used. I best provide this education by effectively communicating expectations, providing clear, concise, and engaging information in multiple formats, using relative examples, accurately demonstrating application of principles through completion of exercises that reinforce specific learning objectives, providing ample opportunity for practice with feedback and refinement, and constantly being a model of ethics in action.



1.

# MANAGERIAL ACCOUNTING AND COST CONCEPTS

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Learning Objectives LO

- LO1 Distinguish the different purposes of financial accounting and managerial accounting
- LO2 Distinguish between product and period costs and classify product costs as direct material, direct labor, or manufacturing overhead
- LO3 Distinguish between fixed, mixed, and variable costs, and relate them to cost drivers
- LO4 Define the relevant range of production
- LO5 Use the high-low method to predict future costs
- LO6 Contrast the contribution margin income statement and the traditional income statement
- LO7 Construct a traditional income statement
- LO8 Construct a contribution margin income statement and calculate the contribution margin amount and ratio

# Managerial accounting versus financial accounting

## LO1

In general, **financial accounting** is concerned with classifying, recording, and reporting financial transactions in a formal accounting system. Financial accounting is relatively uniform and prescribed by various regulatory bodies, such as the Securities and Exchange Commission, the Financial Accounting Standards Board, and the Public Company Accounting Oversight Board. Accountants, higher management, creditors, investors, and other external users are the primary users of financial accounting reports.

**Managerial accounting** is concerned with classifying, analyzing, and reporting data for internal decision making. Managerial accounting tools are used by management to plan, control, and evaluate business operations and to make internal business decisions. Managerial accounting tools and reports are not prescribed by a regulatory body. Instead, they are customized to meet the specific needs of the organization's internal users. Managers and internal decision makers are the primary users of managerial accounting reports and tools.

## Cost classification: Product or period LO2

**Cost classification** is the process of separating costs into different categories. The costs incurred by an organization can be classified in many different ways. An important cost classification in accounting is distinguishing product costs from period costs. In financial accounting, product costs are treated differently than period costs. As a general rule, product costs are capitalized as a part of the inventory asset account; whereas, period costs are expensed as incurred.

**Product costs** are all costs associated with purchasing or producing inventory for resale.

**Period costs** are all other costs not associated with purchasing or producing inventory for resale but are necessary for sustaining the organization, selling the inventory, and servicing customers.

## Merchandising business: Product and period cost classifications

A **merchandising business** is a business entity that purchases finished inventory products from the business that manufactures the inventory with the intent to resale it and make a profit. A merchandiser makes a profit by marking up the inventory and selling it at a higher price to its customers.

Retail stores such as Walmart and Target are examples of merchandising operations.

For a merchandiser, the costs of purchasing and holding the inventory are **product costs**. All other costs associated with sustaining the organization and selling the product are classified as period costs. **Period costs** include all non-inventory costs such as rent, utilities, wages, customer service, and advertising. While period costs are important to sustaining the organization, selling the inventory, and servicing customers, they are not included in the cost of the inventory.

To illustrate, assume that Kelly owns a small business selling seat cushions at sporting events. She buys the cushions from a wholesale company for \$1 each and resales them to customers at the stadium for \$5 each. Last year, she sold 10,500 seat cushions. She also paid \$15,000 for rent on her booth and \$9,600 for miscellaneous expenses. In this example, product costs are the cost of purchasing the inventory for resell. Product costs are calculated as \$1 per cushion times 10,500 sold equals \$10,500. Period costs are \$15,000 rent plus \$9,600 miscellaneous expenses for a total of \$24,600. Period costs are the other non-inventory costs Kelly incurred to run her business.

## Manufacturing business: Product and period cost classifications

A **manufacturing business** is a business entity that uses raw

materials, parts, or other components to make a finished good. The finished goods are considered inventory in a manufacturing organization. A manufacturer makes a profit by selling the inventory for more than it costs them to produce the inventory for resell.

For a manufacturer, the costs associated with making the inventory are product costs. In manufacturing, the three categories of costs included in **product costs** are:

**Direct materials**—raw materials costs that can be easily and economically traced to the production of the product.

**Direct labor**—manufacturing labor costs that can be easily and economically traced to the production of the product.

**Manufacturing overhead**—all other indirect costs associated with manufacturing the product that are not direct material or direct labor. All indirect—not direct material or direct labor—costs incurred in the manufacturing process are included in manufacturing overhead. Examples of manufacturing overhead costs include indirect materials, e.g. glue, nails, sandpaper; indirect labor, e.g. the production supervisor's salary or quality control; and all other production costs incurred to run the production facility, e.g. rent, utilities, and taxes on the production facility.

All other costs associated with sustaining the organization and selling the product are classified as period costs. **Period**

**costs** include all non-inventory costs such as the costs to provide administrative and selling services including rent, utilities, wages, customer service, and advertising. While period costs are important to sustaining the organization, selling the inventory, and servicing customers, they are not included in the cost of producing inventory.

### Video Illustration 1-1: Identifying product and period cost classifications for a manufacturer LO2

Cincy Chips manufactures microchips for small electronic devices. Classify the costs in Exhibit 1-1 as **product costs** or **period costs**. If the cost is a product cost, classify the cost as **direct material** (DM), **direct labor** (DL), or **manufacturing overhead** (OH).

The processes to solve the following scenario are demonstrated in Video Illustration 1-1 below.

***Exhibit 1-1 Cost classification chart and video explanation***

Manufacturing Cost Classifications		
	Product vs. period	DM, DL, or OH
Wages for assembly line workers		
Rent for the production factory		
Salaries for customer service department		
Copper for microchips		
Depreciation on office equipment		
Salary for accountant		
Salary for assembly line supervisor		
Utilities for production factory		
Rent for corporate headquarters		



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## Check your understanding LO2



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## Cost behavior: Variable, fixed, and mixed LO3

Another important classification in managerial accounting is cost behavior. **Cost behavior** is how a cost reacts to changes in production, usage, or sales quantity. Cost behavior is classified as variable, fixed, or mixed.

**Variable cost**—the same cost per unit but the total cost depends on the quantity produced, used, or sold.

Variable costs are variable in relation to some kind of **activity driver**. An activity driver is an activity that causes the incurrence of the variable cost. Common activity drivers are units of sales, units of production, direct labor hours worked, or machine hours used.

**Fixed cost**—the same cost in total regardless of the quantity produced, used, or sold but the per-unit cost changes depending on the quantity produced, used, or sold.

**Mixed cost**—a cost that has both a variable and a fixed component. The variable component of a mixed cost must be variable in relationship to an **activity driver**.

An effective manager *must* consider cost behavior in order to predict future costs.

To illustrate cost behavior assume that Big Drink Company sells drinks in souvenir cups at an entertainment venue. Big Drink purchases the souvenir cups from a manufacturer for \$1 each. Then they sell the cups for \$10 filled with the customer's choice of beverage.

The cost of the souvenir cups is a **variable cost**. The activity driver is the number of units sold. One unit sold requires one cup. The cost per cup is always \$1 per unit but the total cost incurred depends on how many drinks are sold. For example, if they sell 100 drinks, the total costs are \$1 times 100 equals \$100. If they sell 500 drinks, the total costs are \$1 times 500

equals \$500. Per unit cost is always \$1 but total cost changes depending on activity.

The cost of renting the booth at the entertainment venue is a **fixed cost**. Assume Big Drink pays \$3,500 per month to rent a booth at the entertainment venue. The total cost for rent is always the same regardless of how many drinks they sell. However, the per-unit cost allocated to drinks sold changes depending on the quantity sold. For example, if Big Drink sells 100 drinks the rent amount allocated per-unit is \$3,500 divided by 100 equals \$35 per drink. If they sell 500 drinks, the rent amount allocated per-unit is \$3,500 divided by 500 equals \$7 per drink. The total cost is always \$3,500 but the per unit cost changes depending on activity.

The cost charged for utilities is usually a **mixed cost**. For example, Big Drink pays a minimum charge regardless of how much electricity is used. The minimum charge is fixed because it does not change depending on actual usage. Then they pay a charge per kilowatt-hour used. Kilowatt-hours used is the **activity driver**. The charge based on kilowatt-hour is variable since it depends on usage. The total electric bill has both a fixed and variable component so it is considered a mixed cost.

# Video Illustration 1-2: Cost classification and cost behavior LOs 2,3

Cincy Chips produces microchips for small electronic devices. They produced and sold 600 microchips in the current month. Select financial data for Cincy Chips is provided in Exhibit 1-2. Determine the **cost classifications** and **cost behavior** for the below costs.

The processes to solve the following scenario are demonstrated in Video Illustration 1-2 below.

## Exhibit 1-2 Cost classification/behavior chart and video explanation

		Product or period	Fixed, variable, or mixed
Sales	\$80 per unit		
Cost of goods sold (cost to produce inventory sold)	\$30 per unit		
Shipping	\$5 per unit		
Rent corporate office	\$7,000 per month		
Electricity corporate office	\$400 fixed, \$0.25 per unit		
General office expenses	\$12,000 per month		



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### Check your understanding LO3



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## Relevant range of production

### LO4

The **relevant range of production** is the range between a minimum and a maximum production activity where certain revenue and expense levels can be expected to occur. Revenue and expense amounts will likely increase or decrease when production activity falls outside of the relevant range. In a manufacturing environment, **product** and **period costs** can be estimated with a reasonable degree of accuracy within this relevant range of production. Cost estimates are less likely to be accurate when production falls outside of the relevant range.

For example, at Cincy Chips the manufacturing line can produce up to 1,000 units per day. Production in excess of 1,000 units per day would require the company to purchase

a new manufacturing line which would significantly change the current cost estimates. Therefore, maximum production in the relevant range is set at 1,000 units.

## Predicting mixed costs LO5

As mentioned in the preceding section, a **mixed cost** has both a **variable** and a **fixed** component. The variable component of a mixed cost must change in relation to an **activity driver** for the cost to be considered mixed. Accordingly, the first step to identify a mixed cost is to verify that the cost has a linear relationship to an activity driver. A linear relationship means that the cost increases or decreases as the activity driver increases or decreases.

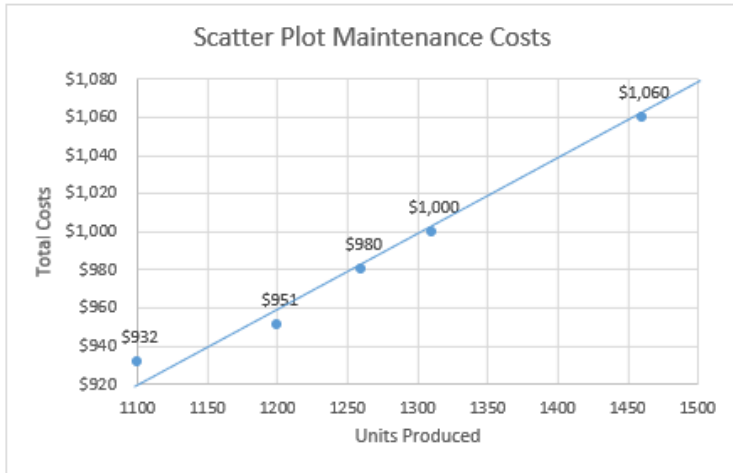
A **scatter plot chart** is used to determine if a cost has a linear relationship to an activity driver. A scatter plot shows if a linear relationship exists between two sets of data – cost and activity driver in this case. If a linear relationship is shown on the scatter plot, then the cost is related to the activity driver. If a linear relationship is not shown on the scatter plot, then the cost is unrelated to the activity driver. A new scatter plot may be prepared to determine if the cost is related to a different activity driver. Alternatively, the cost may increase and decrease randomly, meaning it is not fixed, variable, or mixed. This is uncommon. Most recurring costs can be classified as fixed, variable, or mixed.

Before a scatter plot can be prepared, historical cost data must be collected. To illustrate, assume that maintenance costs are not fixed or variable. The manager believes the number of units produced is the activity driver for maintenance costs. Historical data for five months and the corresponding scatter plot is provided in Exhibit 1-3. Since the scatter plot clearly shows a linear relationship, maintenance cost is considered a mixed cost. The activity driver is the number of units produced.

***Exhibit 1-3 Data for maintenance costs and corresponding scatter plot***

Maintenance costs		
Units		
Month	Produced	Total costs
January	1260	\$ 980
February	1200	\$ 951
March	1310	\$ 1,000
April	1100	\$ 932
May	1460	\$ 1,060





When a linear relationship exists, the formula for a linear regression line can be used to predict mixed costs. The linear regression line formula is given in Exhibit 1-4. This is also the cost formula used to calculate mixed costs.

***Exhibit 1-4 Cost formula to calculate mixed costs***

$$Y = a + bx$$

**Y** = total cost

**a** = fixed cost

**b** = variable cost per unit

**x** = total activity driver

# High-low method for creating mixed cost formulas

The **high-low method** is a simple and widely used method to estimate a **mixed cost's variable** and **fixed** components. The high-low method assumes that the difference in cost between the highest use observation and the lowest use observation is the variable portion of the cost. This method isolates the variable costs attributed to the difference in the activity driver.

Continuing the example from the preceding section, the high-low method can be used to estimate the fixed and variable components of maintenance cost since the cost was identified as mixed. It is important to note that when the relationship between the cost and the activity driver is not perfectly linear, the resulting cost formula is approximate.

The high-low method has four steps. These steps are outlined below and illustrated using the data in Exhibit 1-3.

**Step 1.** Find the difference between the highest use observation and lowest use observation.

	Units Produced	Total costs
Highest (May)	1,460	\$ 1,060
Lowest (April)	<u>1,100</u>	<u>\$ 932</u>
Difference	360	\$ 128

**Step 2.** Calculate the variable cost per unit by dividing the

difference in cost by the difference in activity. The difference between the highest use and lowest use is assumed to be the variable portion incurred by the difference in activity.

$$\begin{aligned} & \$128 \text{ different in cost} / 360 \text{ difference in units} = \\ & \$0.356 \text{ (rounded) variable cost per unit.} \end{aligned}$$

**Step 3.** For the highest or lowest observation (both will result in the same number), use the variable cost from step 2 to calculate the fixed component.

*Lowest observation (May).* In May, they produced 1,460 units and \$0.356 per unit is variable. Total variable costs are  $1,460 \times 0.356 = \$520$  (rounded). Subtract total variable costs from the total costs in May to get total fixed costs,  $\$1,060 - \$520 \text{ variable} = \$540$  fixed.

*Highest observation (April).* In April, they produced 1,100 units and \$0.356 per unit is variable. Total variable costs are  $1,100 \times 0.356 = \$392$  (rounded). Subtract total variable costs from the total costs in April to get total fixed costs,  $\$932 - \$392 \text{ variable} = \$540$  fixed.

**Step 4:** Create the cost formula using the data from steps 2 and 3.

The cost formula to estimate maintenance costs is \$540 fixed plus \$0.356 variable costs per unit of production. Using the  $Y = a + bx$  cost formula introduced above, the cost formula for maintenance

costs would be stated as  $\$540 + \$0.356x$ , whereas  $x$  is the activity driver for the cost.

When the data is not perfectly linear, it is important to note that the cost formula produced by the high-low method only works on the highest and lowest observations since these are the data points used in the calculation. To illustrate, refer to the historical data for maintenance costs given in Exhibit 1-3. In January, 1,260 units were produced, and actual maintenance costs were \$980. The high-low method cost formula would predict or estimate the cost for January as  $\$540 \text{ fixed} + (\$0.356 \times 1,260) = \$989$  (rounded). Although the cost formula produces a number that is slightly higher than the actual cost of \$980, the estimate is close enough to predict costs for internal managerial accounting purposes.

### **Video Illustration 1-3:** Using cost behavior to predict future costs LO<sub>5</sub>

Stephanie, the production manager, is collecting data for the November budget. Cost data are generated by the manager for each department. The production manager is responsible for

estimating the costs for rent expense, cost of goods sold, and electricity. Data for September and October are provided in Exhibit 1-5. Complete the budget data for November.

The processes to solve the following scenario are demonstrated in Video Illustration 1-3 below.

***Exhibit 1-5 Budgeting chart and video explanation***

Production Output	September 3,000 units	October 3,300 units	November 3,100 units
Rent	\$7,500	\$7,500	
Cost of Goods Sold	\$3,600	\$3,960	
Electricity	\$900	\$930	

### High-low method

**Step 1** – Difference    **Step 2** – Variable cost  
**Step 3** – Fixed cost



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## Check your understanding Los



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## Traditional versus contribution margin income statement LO6

An **income statement** also referred to as a profit and loss statement, reports an organization's **sales revenue** and **expenses** for a specified period of time. Sales revenue is the income received by a company from its sales of goods or the provision of services. Expenses are the cost of operations that a company incurs to generate revenue. Generally, the benefit of the cost is used in the same period in which the corresponding revenue is reported. The formula to compute **net operating income**, sometimes referred to as net income or net profit, is the organization's revenues less its expenses. If an organization has more revenue, the resulting number is positive and represents net income or profit. If an organization has more

expenses, the resulting number is negative and represents a net loss.

On a **traditional income statement**, costs or expenses are classified as product or period. On a **contribution margin income statement**, costs or expenses are classified as **variable** or **fixed**. Regardless of how the costs are classified, reported net operating income or loss is always the same on both income statement formats.

## Traditional income statement

### LO7

A **traditional income statement** is primarily used for financial reporting purposes. A traditional income statement, reports an organization's **revenue** and **expenses** for a specified period of time. On a traditional income statement, the organization's expenses are presented based on **product cost** and **period cost** classifications.

### Video Illustration 1-4: Traditional income statement



## explained

An example of a traditional income statement is presented in Exhibit 1-6 and discussed in Video Illustration 1-4.

### ***Exhibit 1-6 Traditional income statement and video explanation***

Traditional Income Statement	
Sales	\$ 720,000
Cost of goods sold	324,000
Gross margin	\$ 396,000
Selling & administrative expenses:	
Facilities expenses	\$ 68,100
Administrative salaries	151,200
Selling and advertising expenses	93,660
Total selling & administrative expenses	312,960
Net operating income	\$ 83,040



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### Check your understanding LO6, LO7



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## **Video Illustration 1-5:** **Preparing a traditional** **income statement** LO7

Cincy Chips manufactures microchips for small electronic devices. They produced and sold 600

microchips in the current month. Select financial data for Cincy Chips is provided in Exhibit 1-7.

Prepare a **traditional income statement**.

The processes to solve the following scenario are demonstrated in Video Illustration 1-5 below.

***Exhibit 1-7 Financial data, traditional income statement format, and video explanation***

Cincy Chips select financial data:

Sales	\$80 per unit
Cost of goods sold	\$30 per unit
Shipping	\$5 per unit
Rent corporate office	\$7,000 per month
Electricity corporate office	\$400 fixed, \$0.25 per unit
General office expenses	\$12,000 per month

Traditional Income Statement	
Sales	
Cost of goods sold	_____
Gross margin	
Selling and admin. expenses:	
_____	
_____	
_____	
Total selling and admin. expenses	_____
Net operating income	_____



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**Check your understanding** Los 6,7



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## Contribution margin income statement LO8

A **contribution margin income statement** is primarily used by internal users, usually management, for planning operations, controlling operations, and making decisions. Like a **traditional income statement**, the contribution margin income statement reports an organization's **revenue** and **expenses** for a specified period of time. The contribution margin income statement classifies expenses on the basis of cost behavior—**variable** versus **fixed**.

## Video Illustration 1-6: Contribution margin income statement explained LO8

An example of a **contribution margin income statement** is presented in Exhibit 1-8 and discussed in Video Illustration 1-6.

### ***Exhibit 1-8 Contribution margin income statement and video explanation***

Contribution Margin Income Statement			
	Q1,000	Per unit	CM Ratio
Sales	\$720,000	\$ 720	100%
Less variable costs	430,000	430	60%
Equals contribution margin	\$290,000	\$ 290	40%
Less fixed costs	206,960		
Equals net income	\$ 83,040		



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## Check your understanding **LO8**



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## Video Illustration 1-7: Preparing a contribution margin income statement LO8

Cincy Chips produces microchips for small electronic devices. They produced and sold 600 microchips in the current month. Select financial data for Cincy Chips is provided in Exhibit 1-9.

Prepare a **contribution margin income statement**.

The processes to solve the following scenario are demonstrated in Video Illustration 1-7 below.

***Exhibit 1-9 Financial data, contribution***

***margin income statement format, and video explanation***

Cincy Chips select financial data:

Sales	\$80 per unit
Cost of goods sold	\$30 per unit
Shipping	\$5 per unit
Rent corporate office	\$7,000 per month
Electricity corporate office	\$400 fixed, \$0.25 per unit
General office expenses	\$12,000 per month

**Contribution Margin Income Statement**

	Q	Per unit	CM Ratio
Sales			
Variable costs:			
_____			
_____			
_____			
Total variable costs			
Contribution margin			
Fixed costs:			
_____			
_____			
_____			
Total fixed costs			
Net income			



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## Check your understanding **LO8**



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## Practice Video Problems

*The chapter concepts are applied to  
comprehensive business scenarios in the below  
Practice Video Problems.*

## Practice Video Problem 1-1: Product, period, fixed, and variable costs LOs 2, 3, 4

Crazy Candy's Carpets makes whimsical and eccentric rugs. The relevant range of production is 10,000 to 14,000 units per month. When she produces and sells 12,000 units the average costs per unit are as follows:

	Average cost per unit
Direct material	\$9.00
Direct labor	\$3.00
Variable manufacturing overhead	\$1.50
Fixed manufacturing overhead	\$2.00
Fixed selling expenses	\$3.50
Sales commissions	\$1.25
Variable administrative expenses	\$0.75

**Required 1:** What is the total amount of **product costs** incurred to make 14,000 units?

**Required 2:** What is the total amount of **period costs** incurred to sell 14,000 units?

**Required 3:** What is the total amount of costs incurred to make and sell 11,000 units?



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## Practice Video Problem 1-2: Traditional income statement LO6

Magick Musicals sells custom guitars that they purchase from a local artist. Magick purchases

the guitars from the artist for \$960 each, marks them up, and resells them for \$2,200 each. Magick’s general and administrative costs are presented below.

In May, Magick purchased and sold 150 guitars.

Costs	Cost formula
Sales salaries and commissions	\$4,000 per month plus 10% of sales
Shipping guitars to customers	\$12 per guitar
Utilities	\$2,400 per month
Depreciation of office equipment	\$1,200 per month
Administrative salaries	\$25,000 per month
Customer service	\$6,000 per month plus \$15 per sale

**Required:** Prepare a **traditional format income statement** for May

Traditional Income Statement	
Sales	
Cost of goods sold	_____
Gross margin	
Selling and admin. expenses:	
_____	
_____	
_____	
_____	
_____	
Total selling and admin. expenses	_____
Net operating income	_____



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## **Practice Video Problem 1-3:** Contribution margin income statement LO7

Magick Musicals sells custom guitars that they purchase from a local artist. Magick purchases the guitars from the artist for \$960 each, marks them up, and resells them for \$2,200 each. Magick's general and administrative costs are presented below.



Costs	Cost formula
Sales salaries and commissions	\$4,000 per month plus 10% of sales
Shipping guitars to customers	\$12 per guitar
Utilities	\$2,400 per month
Depreciation of office equipment	\$1,200 per month
Administrative salaries	\$25,000 per month
Customer service	\$6,000 per month plus \$15 per sale

In May, Magick purchased and sold 150 guitars.

**Required:** Prepare a **contribution margin income statement** for May. Show revenue and variable costs on both a total and a per-unit basis.

Contribution Margin Income Statement			
	Q	Per unit	CM Ratio
Sales			
Variable costs:			
Total variable costs			
Contribution margin			
Fixed costs:			
Total fixed costs			
Net income			



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## Review Questions

*Review questions reinforce the chapter content.*

### **Review 1-1**



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## **Review 1-2**



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## **Review 1-3**



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### Review 1-4



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### Review 1-5



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### Review 1-6



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## **Review 1-7**



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# Homework Questions

*Homework questions can be used for additional*

*practice or can be assigned in an academic setting. Full feedback is not available online. Homework questions can be assigned, with auto-grading and export, to specific learning management platforms, e.g., Canvas, Blackboard, etc. Contact the author for details.*

### Homework 1-1



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### Homework 1-2



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### Homework 1-3



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### Homework 1-5



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## **Homework 1-6**



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## **Homework 1-7**



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## Homework 1-8



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## Homework 1-9



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## Homework 1-10



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2.

# JOB-ORDER COSTING

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## Learning Objectives LO

LO1 Describe a job-order costing system

- LO2 Describe the flow of inventory costs in a job-order costing system
- LO3 Calculate the organization-wide predetermined manufacturing overhead rate
- LO4 Apply manufacturing overhead to jobs using an organization-wide predetermined manufacturing overhead rate
- LO5 Complete a job-cost sheet and compute the total cost of a job, cost per unit, and selling price
- LO6 Calculate multiple predetermined manufacturing overhead rates

## Job-order costing LO1

**Job-order costing** is an accounting system used to assign manufacturing costs to the products or services that an organization produces. **Product costs**, or inventory costs, include the costs for **direct material**, **direct labor**, and **manufacturing overhead**. In a job-order costing system, product costs are assigned directly to the products or jobs as they are produced or completed.

Organizations that produce unique or custom products or services typically use a job-order costing system. For example, a

construction company specializing in new home construction uses a job-order costing system. The costs for direct material, direct labor, and manufacturing overhead is assigned directly to the homes using the materials or labor. When a home is finished, the company has a record of the actual costs incurred to build each house.

The costs incurred during the manufacturing process are accumulated in inventory accounts within the organization's accounting system. Inventory accounts are classified as assets. **Assets** are items that an organization owns that have future value to the organization. The inventory accounts commonly used in a job-order costing system include the **Raw Materials account**, **Manufacturing Overhead account**, **Work in Process account**, and **Finished Goods account**. Product costs, or manufacturing costs, flow through these accounts until the product is complete. The total cost to manufacture the finished product is held in the Finish Goods inventory account until the product is sold.

Once a product is sold, it is no longer an asset in the organization's possession. At that point, the costs to manufacture the product are moved from the Finished Goods inventory asset account to the Cost of Goods Sold account. Cost of goods sold is classified as an **expense** account. At the same time, the revenue collected from the sale is recorded in the Sales revenue account. The **sales revenue** less the **cost of goods sold** equals the **gross profit** made on the product.

**Period costs** are deducted from gross profit to arrive at net operating income, also referred to as net profit.

Check your understanding LO1



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## Job-order costing flow of inventory costs LO2

The inventory **asset** accounts and **expense** accounts used in a job-order costing system are discussed in detail in this section. The accounting terms of debit and credit are used to identify the increases and decreases made to each account during the process. A summary of the accounting equation and the

accounting rules of debit and credit are provided in Exhibit 2-1 below. Additionally, the flow of costs in a job-order costing system is demonstrated in Video Illustration 2-1.

***Exhibit 2-1 Accounting equation and rules for debits and credits***

Assets		=	Liabilities	+	Equity			
Debit increases			Debit decreases		Common Stock	--	Dividends	
Credit decreases			Credit increases		Debit decreases		Debit increases	
					Credit increases		Credit decreases	
							Revenue	--
							Debit decreases	
							Credit increases	
								Expenses
								Debit increases
								Credit decreases

## Raw materials (direct and indirect)

The costs for all raw materials—direct and indirect—purchased to manufacture the product are debited to the **Raw Materials account**. The credit for raw materials costs is typically recorded in the Cash account or a related **liability** account. **Direct materials** are raw materials that can be easily and economically traced to the production of the product. **Indirect materials** are raw materials that cannot be easily and economically traced to the production of the product, e.g. glue, nails, sandpaper, towels, etc.

When materials are requisitioned for manufacturing, all materials are credited out of the **Raw Materials** inventory account. Direct materials are debited into the **Work In Process** inventory account and indirect materials are debited to the **Manufacturing Overhead account**.



## Labor

The costs for direct labor is debited to the **Work In Process** inventory account and indirect labor is debited to the **Manufacturing Overhead account**. Typically, a **liability** account such as Salaries Payable is credited. **Direct labor** costs are manufacturing labor costs that can be easily and economically traced to the production of the product. **Indirect labor costs** are manufacturing labor costs that cannot be easily and economically traced to the production of the product, e.g. the production supervisor's salary or quality control.

Non-manufacturing labor costs, such as office or administrative wages, are **period costs**. Non-manufacturing labor costs are debited to an **expense** account for wages or salaries. A **liability** account such as Salaries Payable is credited.

## Manufacturing overhead

Actual manufacturing overhead costs are debited to the **Manufacturing Overhead account** as they are incurred. The credit for these costs is typically recorded in the Cash account or a related **liability** account. **Manufacturing overhead** costs include all indirect costs associated with manufacturing the product that are not **direct material** or **direct labor**, such as **indirect materials**, **indirect labor**, and all other production costs incurred to run the production facility, e.g. rent, utilities,

janitorial services, and taxes on the production facility. For example, when the rent or property taxes are paid on the production factory the Manufacturing Overhead account is debited and the Cash account is credited.

**Manufacturing overhead costs** are applied to the jobs in process using a **predetermined manufacturing overhead rate**. The predetermined manufacturing overhead rate is discussed in detail in subsequent sections of this chapter. When manufacturing overhead is applied to the jobs in process, it is credited from the **Manufacturing Overhead account** and debited to the **Work In Process** account.

## Work in process (WIP)

**Work in Process (WIP)** is the inventory account where product costs—direct material, direct labor, and manufacturing overhead—are accumulated while the jobs are in the manufacturing process.

## Finished goods

When a job is finished, the total costs for the job are moved from the **Work In Process** inventory account (credit) to the Finished Goods inventory account (debit). The **Finished Goods** inventory account is where finished inventory is reported at the cost to produce—direct material, direct labor, and manufacturing overhead—until it is sold.

## Cost of goods sold

When the inventory is sold, the total costs for the job are moved from the **Finished Goods** inventory account (credit) to the Cost of Goods Sold expense account (debit). **Cost of Goods Sold** is the expense account used to report the costs associated with purchasing or manufacturing the inventory sold.

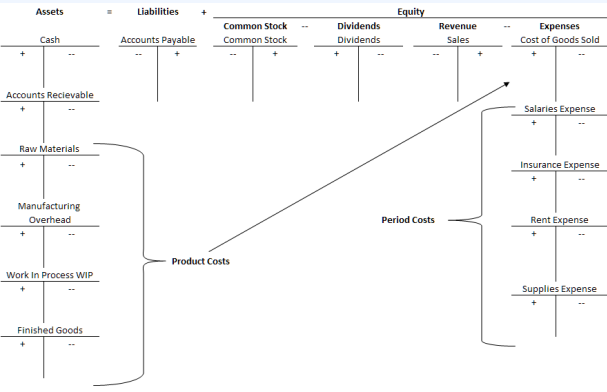
**Sales revenue** is also recorded when the job is sold. Gross profit for the job is calculated as the sales revenue collected from the customer less the cost of the goods sold. In a job-order costing system, cost of goods sold represents total production costs, e.g. **direct material**, **direct labor**, and **manufacturing overhead**.

### Video Illustration 2-1: Demonstrating cost flow in a job-order costing system LO2

A chart of accounts is presented in Exhibit 2-1 to demonstrate the cost flow in a job-order costing system. The chart is arranged using the accounting equation format,  $\text{Assets} = \text{Liabilities} +$

Equity. The chart includes T-accounts for the accounts commonly used in a job-order costing system. The job-order costing flow is described in detail in Video Illustration 2-1.

***Exhibit 2-2 Chart of accounts used for job-order cost accounting and video explanation***





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Check your understanding LO2



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## Predetermined manufacturing overhead rate

### LO3

All manufacturing, or **product costs**, that are not **direct material** or **direct labor**, are recorded in the **Manufacturing Overhead account**. Direct material and direct labor are applied directly to the jobs and do not flow through the Manufacturing Overhead account. Manufacturing overhead includes indirect materials, such as glue, screws, and nails; indirect labor, such as wages for the production supervisor or production maintenance personnel; and all other costs incurred to manufacture a product, such as rent, insurance, taxes, and utilities paid for the manufacturing facilities.

Manufacturing overhead is applied to jobs using a **predetermined manufacturing overhead rate**. Unlike **direct material** or **direct labor**, it not easy to apply

manufacturing overhead costs directly to jobs. Manufacturing overhead costs are not incurred uniformly and many of these costs are not directly traceable to the jobs in process. For example, an organization might pay property taxes on the production plant twice a year. These property taxes are considered indirect manufacturing costs and should be applied to all jobs produced during the year and not just the jobs in process at the time the taxes are paid.

Think of manufacturing overhead as a pool or bucket of all indirect product costs. At the *beginning* of the period, the total amount of manufacturing overhead costs are *estimated* based on historical data and current year production estimates. Throughout the year, the total amount of estimated manufacturing overhead is uniformly applied to the jobs in process using some type of allocation base or cost driver. An **allocation base** or cost driver is a production activity that drives costs. Common allocation bases are direct labor hours, machine hours, direct labor dollars, or direct materials dollars. At the end of the year, the estimated applied overhead costs and actual overhead costs incurred are reconciled and any difference is adjusted.

An organization-wide, or organizational, predetermined manufacturing overhead rate is computed by dividing the total estimated manufacturing overhead amount by the total estimated **allocation base** or cost driver. Total estimated overhead includes all **product costs** and is commonly separated into fixed manufacturing overhead and variable

manufacturing overhead. Allocation bases will vary across organizations. For example, an organization that produces a labor intensive product might select direct labor hours as the allocation base. Whereas, an organization that relies on machines instead of laborers might use machine hours as the allocation base.

The formula for computing an organization-wide predetermined manufacturing overhead rate is presented in Exhibit 2-3.

***Exhibit 2-3 Formula for organization-wide predetermined manufacturing overhead rate.***

$$\frac{\text{Total estimated manufacturing overhead (fixed + variable)}}{\text{Total estimated allocation base}} = \text{Predetermined manufacturing overhead rate}$$

## **Video Illustration 2-2:**

### **Computing an organization-wide predetermined manufacturing overhead rate**

#### **LO3**

The processes to solve the following scenario are demonstrated in Video Illustration 2-2 below.



Cincy Chips produces microchips for small electronic devices. On January 1, Cincy Chips estimates that they will produce 50,500 microchips and run 2,080 machine hours in the upcoming year. The company uses a **organization-wide manufacturing overhead rate**. Manufacturing overhead is allocated to jobs based on machine hours. The cost formula to estimate manufacturing overhead at the beginning of the year is \$128,960 fixed plus \$33 variable overhead per machine hour. Compute the organization-wide predetermined manufacturing overhead rate using the template provided in Exhibit 2-4.

***Exhibit 2-4 Formula for organizational predetermined manufacturing overhead rate and video explanation***

Organizational predetermined manufacturing overhead rate

\_\_\_\_\_ =



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Check your understanding LO3



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## Applying manufacturing overhead to jobs LO4

The **predetermined manufacturing overhead rate** is computed *before* the period starts, usually at the beginning of a year or quarter. **Manufacturing overhead** is then applied to the jobs as the work is completed throughout the year. In a job-order costing system, the predetermined overhead rate is applied to the jobs based on the job's actual use of the **allocation base** or cost driver used to calculate the predetermined rate.

### Video Illustration 2-3:

## Applying manufacturing overhead to jobs LO4

The processes to solve the following scenario are demonstrated in Video Illustration 2-3 below.

Cincy Chips produces microchips for small electronic devices. The **predetermined manufacturing overhead** rate is \$95 per machine hour (total estimated overhead \$197,600 / 2,080 total estimated machine hours). Job 36A was for 75 microchips and used 3.5 machine hours. Compute the manufacturing overhead applied to Job 36A.

### ***Exhibit 2-5 Applying overhead to jobs video explanation***

Overhead applied to Job36A



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Check your understanding LO4



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## Job cost sheets LO5

All manufacturing costs incurred to complete a job are recorded on job cost sheets. Job cost sheets can be kept on physical paper or digitally. A standard **job cost sheet** records all **direct material**, **direct labor**, and **manufacturing overhead** costs applied to a job. Typically, a job cost sheet also records the total costs, the number of units, the cost per unit, as well as the selling price for each job.

## Video Illustration 2-4: Completing a job cost sheet

LO5, LO7

The processes to solve the following scenario are demonstrated in Video Illustration 2-4 below. Cincy Chips produces microchips for small electronic devices. The predetermined manufacturing overhead rate is \$95 per machine hour. Job 69B was for 500 microchips and used 22 machine hours. Production used \$13,500 of direct material and worked 21 direct labor hours at a rate of \$20 per hour. Complete the job cost sheet for Job 69B given in Exhibit 2-6.

### ***Exhibit 2-6 Job cost sheet and video explanation***

Job Cost Sheet Job 69B			
Beginning Balance			
Direct Material			Total
Direct Labor	Hours	Rate	Total
Manufacturing Overhead	MH	Rate	Total
Total Job Costs			
	#Units	Cost per unit	



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Check your understanding LO5, LO7



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## Multiple predetermined manufacturing overhead rates LO6

In some cases, organizations choose not to use a single, **organization-wide predetermined manufacturing overhead rate** to apply **manufacturing overhead** to the products or services produced. In the preceding sections, an organization-wide predetermined manufacturing overhead rate was calculated. Many organizations have multiple departments or processes that consume different amounts of manufacturing overhead resources at different rates. In these organizations, a single manufacturing overhead rate, while more simplistic, may not accurately apply overhead to the final product. An organization with multiple departments or processes may choose to apply manufacturing overhead using multiple predetermined manufacturing overhead rates. When

**multiple predetermined manufacturing overhead rates** are used, manufacturing overhead costs are allocated to specific departments or processes and then applied to jobs using an **allocation base** that drives the overhead costs for that department or process.

Before **multiple predetermined manufacturing overhead rates** can be computed, manufacturing overhead costs must be assigned to departments or processes. Then the departmental or process manufacturing overhead rate is computed by dividing the total estimated manufacturing overhead assigned to the department or process by the total estimated allocation base or cost driver incurred within that department or process.

It is important to note, that only **manufacturing overhead** costs that are allocated to the department or process as well as the **allocation base** or cost driver incurred within the same department or process are used to compute a departmental predetermined manufacturing overhead rate.

The formula for computing the departmental predetermined manufacturing overhead rates is presented in Exhibit 2-7.

***Exhibit 2-7 Formula for departmental predetermined manufacturing overhead rates.***

$$\frac{\text{Estimated manufacturing overhead allocated to department (fixed + variable)}}{\text{Estimated allocation base incurred in department}} = \text{Departmental predetermined manufacturing overhead rate}$$

## **Video Illustration 2-5:** **Computing multiple predetermined manufacturing overhead rates** LO6

The processes to solve the following scenario are demonstrated in Video Illustration 2-5 below.

SunCo, Inc. manufactures widgets. The manufacturing process has two departments—fabrication and finishing. In the fabrication department, laborers pour composite materials into custom carved molds. Fabrication is a labor intensive process. After molding, the widgets are sent to the finishing department. In finishing, the widgets are put on an automated production line where they are heated and coated. Finishing is a machine intensive process.

SunCo, Inc. assigns manufacturing overhead to the products produced using departmental predetermined manufacturing overhead rates. Manufacturing overhead is applied based on labor hours in the fabrication department and

machine hours in the finishing department. Relevant data are provided in Exhibit 2-8. Compute the departmental predetermined manufacturing overhead rates for the fabrication and finishing departments.

***Exhibit 2-8 Data for departmental predetermined manufacturing overhead rates and video explanation.***

	Overhead	Machine hours	Labor hours
Fabrication	\$ 360,000	900	15,000
Finishing	\$ 180,000	12,000	3,300
Total	\$ 540,000	12,900	18,300

Departmental predetermined manufacturing overhead rates			
	Overhead	Cost driver	Rate
Fabrication			
Finishing			



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Check your understanding LO6



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## Practice Video Problems

*The chapter concepts are applied to comprehensive business scenarios in the below Practice Video Problems.*

**Practice Video Problem 2-1:**  
Compute organizational  
predetermined  
manufacturing overhead rate,  
total job costs, and selling

## price LOs3,4,5,7

Kelly Shuck Productions uses a job-order costing system. At the beginning of the year, the company made the following estimates:

Beginning of the year manufacturing overhead estimates:	
Direct labor hours required to support estimated production	140,000
Machine hours required to support estimated production	70,000
Fixed manufacturing overhead costs	\$ 784,000
Variable manufacturing overhead costs per direct labor hour	\$ 2.00
Variable overhead costs per machine hour	\$ 3.00

During the year, Job KAS3 was started and completed. The following information is available with respect to this job:

Job KAS3	
Direct materials	\$ 175
Direct labor	\$ 225
Direct labor hours	15
Machine hours	5

**Required 1:** Compute the organization-wide predetermined manufacturing overhead rate

(single rate for the entire organization) with direct labor hours as the allocation base.

**Required 2:** Assume that Kelly uses the organizational predetermined manufacturing overhead rate calculated in requirement 1. Compute the total manufacturing cost of Job KAS3.

**Required 3:** If Kelly uses a markup percentage of 200% of its total manufacturing cost, what is the selling price for Job KAS3 (based on the total costs of computed in requirement 2)?





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## **Practice Video Problem 2-2:** Compute organizational predetermined manufacturing overhead rate, total job costs, and selling price LOs3,4,5,7

Kelly Shuck Productions uses a job-order costing system. At the beginning of the year, the company made the following estimates:

**Beginning of the year manufacturing overhead estimates:**

Direct labor hours required to support estimated production	140,000
Machine hours required to support estimated production	70,000
Fixed manufacturing overhead costs	\$ 784,000
Variable manufacturing overhead costs per direct labor hour	\$ 2.00
Variable overhead costs per machine hour	\$ 3.00

During the year, Job KAS3 was started and completed. The following information is available with respect to this job:

Job KAS3	
Direct materials	\$ 175
Direct labor	\$ 225
Direct labor hours	15
Machine hours	5

**Required 1:** Compute the organizational predetermined manufacturing overhead rate (single rate for the entire organization) with machine hours as the allocation base.

**Required 2:** Assume that Kelly uses the organizational predetermined manufacturing overhead rate calculated in requirement 1.

Compute the total manufacturing cost of Job KAS3.

**Required 3:** If Kelly uses a markup percentage of 200% of its total manufacturing cost, what is the selling price for Job KAS3 (based on the total costs of computed in requirement 2)?



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**Practice Video Problem 2-3:**  
Compute departmental  
predetermined  
manufacturing overhead

rates, total job costs, and cost per unit **LOs 4,5,6,7**

Rookwood Pottery makes a variety of pottery products that it sells to retailers. The company uses a job-order costing system. Relevant data are provided below.

	Department		Total
	Molding	Painting	
Direct labor hours	\$ 12,000	\$ 60,000	\$ 72,000
Machine hours	\$ 70,000	\$ 8,000	\$ 78,000
Fixed manufacturing overhead costs	\$ 497,000	\$ 615,000	\$ 1,112,000
Variable manufacturing overhead per machine hour	\$ 1.50	n/a	
Variable manufacturing overhead per labor hour	n/a	\$ 2.00	

The following information was recorded for Job B53, which was started and completed during the year.

	Department	
	Molding	Painting
Direct labor hours	30	84
Machine hours	110	20
Direct materials	\$ 770	\$ 1,332
Direct labor costs	\$ 525	\$ 1,470

**Required 1:** Assume that Rookwood uses departmental predetermined manufacturing overhead rates to apply manufacturing overhead costs to jobs. The predetermined manufacturing overhead rate in the Molding Department is based on machine-hours, and the rate in the Painting Department is based on direct labor-hours. Compute the predetermined manufacturing overhead rates used in the Molding Department and the Painting Department.

**Required 2:** Assume that Rookwood uses the departmental predetermined manufacturing overhead rates calculated in requirement 1. Compute the total costs of Job B53.

**Required 3:** If Job B53 contained 50 units, compute the cost per unit (based on the total costs of Job B53 computed in requirement 2).



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## Review Questions

*Review questions reinforce the chapter content.*

### **Review 2-1**



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## **Review 2-2**



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## **Review 2-3**



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### **Review 2-4**



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### **Review 2-5**



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### **Review 2-6**





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## **Review 2-7**



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## Homework Questions

*Homework questions can be used for additional practice or can be assigned in an academic setting.*

*Full feedback is not available online. Homework questions can be assigned, with auto-grading and export, to specific learning management platforms, e.g., Canvas, Blackboard, etc. Contact the author for details.*

### Homework 2-1



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### Homework 2-2



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## Homework 2-3



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## Homework 2-4



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## Homework 2-5



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## Homework 2-6



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3.

## PROCESS COSTING

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## Learning Objectives LO

LO1 Describe a process costing system

LO2 Describe the flow of inventory costs in a process costing system

LO3 Compute the manufacturing overhead rate in a process costing system

LO4 Apply manufacturing overhead to products using a process costing system

# Process costing

New chapter under review.

4.

## COST VOLUME PROFIT (CVP) ANALYSIS

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## Learning Objectives LO

LO1 Identify the purposes of cost volume profit analysis

L02 Explain how the contribution margin income statement is used for cost volume profit analysis

L03 Apply cost volume profit analysis to show the effects on net operating income from changes in variable costs, fixed costs, selling price, and sales volume

L04 Calculate the breakeven point in sales dollars and units sold

L05 Calculate target profit in sales dollars and units sold

## Purposes of cost volume profit (CVP) analysis L01

**Cost volume profit (CVP) analysis** helps managers make many important decisions about what products and services to offer, what prices to charge, what marketing strategy to use, and what cost structure to maintain. Cost structure is the type and proportion of fixed and variable costs in relation to the organization's total costs. The primary purpose of cost volume profit analysis is to estimate how profits are affected by the following five factors:

1. Selling prices
2. Sales volume
3. Unit variable costs
4. Total fixed costs
5. Mix of products sold

### Check Your Understanding LO1



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## CVP analysis using the contribution margin income statement LO2

**Cost volume profit (CVP) analysis** is based on cost behavior. Cost behavior is how a cost reacts to changes in production or sales quantity. Cost behavior is discussed in detail in Chapter 1. To recap, cost behavior is classified as variable, fixed, or mixed.

**Variable cost**—cost is the same per unit but the total changes depending on quantity

**Fixed cost**—cost is the same in total regardless of quantity but the per unit cost changes depending on quantity

**Mixed cost**—cost has both a variable and a fixed component

Cost behavior must be considered to estimate how profits

are affected by changes in sales prices, sales volume, unit variable costs, total fixed costs, and the mix of products sold. The **contribution margin income statement** classifies costs on the basis of cost behavior. For this reason, it is an essential tool for cost volume profit analysis. The contribution margin income statement is covered in detail in Chapter 1. In this chapter, cost volume profit analysis using the contribution margin income statement is introduced.

### Video Illustration 4-1: Discussion of CVP and the contribution margin income statement LOs1,2

Kinsley Shuck, the founder of Kinsley's Concepts, designed a radical new toy that can be programmed to perform various tasks. The programmable toy was an immediate success, and sales grew to the point that Kinsley moved the company's headquarters out of her garage and into a rented manufacturing space. Kinsley sold 500 toys in the first year of operation. The contribution margin income statement for

Kinsley’s Concepts first year of operations is presented in Exhibit 4-1.

***Exhibit 4-1 Contribution margin income statement and video explanation***

Kinsley's Concepts			
Contribution Margin Income Statement			
	Q500	Per unit	CM Ratio
Sales	\$120,000	\$ 240	100%
Less variable costs	72,000	144	60%
Equals contribution margin	\$ 48,000	\$ 96	40%
Less fixed costs	30,000		
Equals net income	<u>\$ 18,000</u>		



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## CVP analysis when sales quantity changes LO<sub>3</sub>

The **contribution margin** represents the margin that an organization can make or lose as the number of units sold increases or decreases. The most common error in calculating the effect of changes in sales quantity on **net operating income** is using the sales price instead of the contribution margin. To illustrate, refer to the data for Kinsley's Concepts presented in Exhibit 4-1. How much would net operating income change if Kinsley sold one more unit? A common mistake is to assume that net income would increase by the sales price or \$240. However, this is incorrect. If Kinsley sells one more unit, she will gain \$240 in sales revenue and incur \$144 of variable expenses. Sales revenue and variable expenses are both variable, meaning the per unit is the same, but the total changes in relation to the quantity sold. Therefore, net income would increase by \$96, the current contribution margin.

The effect of changes in sales quantity on net income can also be calculated using the contribution margin ratio. The **contribution margin ratio** represents the percentage of gross margin an organization can make or lose as the number of units sold increases or decreases. The contribution margin ratio stays the same when the sales quantity changes. Refer to the data in Exhibit 4-1. The contribution margin ratio for

Kinsley's Concepts is 40%. For every dollar of sales, 60% will be used to cover variable expenses, and 40% will be left to increase the contribution margin. If Kinsley sells one more unit, she will gain \$240 in sales revenue. The contribution margin ratio can be used to calculate the additional variable expenses she will incur as  $\$240 \times 60\% = \$144$ . The additional contribution margin can be calculated as  $\$240 \times 40\% = \$96$ .

Fixed costs are not affected by changes in sales quantity within an organization's **relevant range of production**. For example, refer to Exhibit 4-1. Kinsley's Concepts reported fixed expenses of \$30,000. Assume that \$2,000 is the monthly rent on her new manufacturing space. The rental contract fixes the rent amount. The landlord will not increase or decrease the monthly rent based on how many units Kinsley sells or produces in the space. Accordingly, fixed costs do not change when sales quantity changes.

If Kinsley sells one more unit, the contribution margin will increase by \$96. Fixed costs will be unaffected (\$30,000). Net operating income will increase to  $\$18,000 + 96 = \$18,096$ .

If Kinsey sells 100 more units, the contribution margin will increase by  $100 \times \$96 = \$9,600$ . Fixed costs will be unaffected (\$30,000). Net operating income will increase to  $\$18,000 + 9,600 = \$27,600$ .

If sales decrease by 50 units, the contribution margin will decrease by  $50 \times \$96 = \$4,800$ . Fixed costs will be unaffected (\$30,000). Net operating income will decrease to  $\$18,000 - 4,800 = \$13,200$ .



## Video Illustration 4-2: Using CVP to forecast changes in contribution margin and net operating income from an increase in sale quantity LO<sub>3</sub>

Kinsley's Concepts is currently selling 500 toys per year. The contribution margin income statement for Kinsley's Concepts first year of operations is presented in Exhibit 4-2. Assume sales increase from 500 toys to 550 toys.

### ***Exhibit 4-2 Contribution margin income statement and video explanation***

Kinsley's Concepts			
Contribution Margin Income Statement			
	Q500	Per unit	CM Ratio
Sales	\$120,000	\$ 240	100%
Less variable costs	<u>72,000</u>	<u>144</u>	<u>60%</u>
Equals contribution margin	\$ 48,000	\$ 96	40%
Less fixed costs	<u>30,000</u>		
Equals net income	<u><u>\$ 18,000</u></u>		

Kinsley's Concepts			
Contribution Margin Income Statement			
	Q	Per unit	CM Ratio
Sales			
Less variable costs	_____	_____	_____
Equals contribution margin	_____		
Less fixed costs	_____		
Equals net income	=====		



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Check Your Understanding L03



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## CVP analysis and changes on net operating income LO<sub>3</sub>

Cost volume profit analysis can be used to analyze the effect on net operating income from changes in fixed costs, also considered a change in the cost structure. Cost structure is the type and proportion of fixed and variable costs related to the organization's total costs.

Managers, owners, or accountants use cost volume profit (CVP) analysis to estimate how profits are affected by changes in sales quantity, sales price, variable costs, fixed costs, and sales mix. The overall effect of changes in sales quantity, sales price, variable costs, and fixed costs are discussed below. The effects of these changes are calculated in Video Illustration 4-3, Video Illustration 4-4, and Video Illustration 4-5.

## Changes in sales quantity

As demonstrated in Video Illustration 4-2 in the preceding section, cost volume profit analysis can be used to analyze the effect on net operating income from changes in sales quantity. A change in sales quantity does not change the per unit amounts for revenue, variable costs, or contribution margin. The contribution margin ratio will not change. However, a change in sales quantity will change the total amounts for total sales dollars, total variable costs, and total contribution margin. Fixed costs are not affected by a change in sales quantity. Since total contribution margin is changed, net operating income will also change.

## Changes in sales price

Cost volume profit analysis can be used to analyze the effect on net operating income from changes in sales price. A change in sales price is a per unit change, so it affects the per unit amounts on the contribution margin income statement. Contribution margin is sales less variable costs. When sales price changes, per unit variable costs remain the same, but per unit contribution margin changes. This change also affects the total amount for sales dollars, variable costs, and contribution margin. The new total amount is calculated as the new per unit amounts times the sales quantity. Fixed costs are not affected

by a change in sales quantity. Since total contribution margin is changed, net operating income will also change.

## Changes in variable costs

Cost volume profit analysis can be used to analyze the effect on net operating income from changes in variable costs, also considered a change in **cost structure**. A change in variable cost is a per unit change, so it affects the per unit amounts on the contribution margin income statement. When variable cost changes, per unit sales price remains the same, but the per unit contribution margin changes. The total amount for sales dollars, variable costs, and contribution margin are also changed. The new total amount is calculated as the new per unit amounts times the sales quantity. Fixed costs are not affected by a change in variable costs. Since total contribution margin is changed, net operating income will also change.

## Changes in fixed costs

Cost volume profit analysis can be used to analyze the effect on net operating income from changes in fixed costs, also considered a change in the cost structure. Changes in fixed costs do not affect sales quantity, sales revenue, variable costs, or contribution margin. A change in fixed cost affects net operating income.

### **Video Illustration 4-3: Using CVP to show the effects on net operating income from changes in fixed costs and sales quantity LO<sub>3</sub>**

Kinsley's Concepts is currently selling 500 toys per year. A contribution margin income statement is presented in Exhibit 4-3. Kinsley's Concepts reported the following contribution margin income statement for their first year of operations. The sales manager feels that a \$6,000 increase in the advertising budget would increase sales by \$9,600 to a total of 540 units. Should the advertising budget be increased?

***Exhibit 4-3 Contribution margin income statement and video explanation***

Kinsley's Concepts Contribution Margin Income Statement			
	Q500	Per unit	CM Ratio
Sales	\$120,000	\$ 240	100%
Less variable costs	<u>72,000</u>	<u>144</u>	<u>60%</u>
Equals contribution margin	\$ 48,000	\$ 96	40%
Less fixed costs	<u>30,000</u>		
Equals net income	<u>\$ 18,000</u>		

Kinsley's Concepts Contribution Margin Income Statement			
	Q	Per unit	CM Ratio
Sales			
Less variable costs	_____	_____	_____
Equals contribution margin	_____		
Less fixed costs	_____		
Equals net income	<u>_____</u>		



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## **Video Illustration 4-4: Using CVP to show the effects on net operating income from changes in variable costs** LO3

Refer to the original in Exhibit 4-4. Kinsley's Concepts is currently selling 500 toys per year. Kinsley's Concepts reported the following contribution margin income statement for their first year of operations. Kinsley is considering the use of higher-quality components, which would increase variable costs (and thereby reduce the contribution margin) by \$6 per toy. However, the sales manager predicts that using higher-quality components would increase sales to 550 toys per year. Should the higher-quality components be used?

***Exhibit 4-4 Contribution margin income statement and video explanation***



Kinsley's Concepts Contribution Margin Income Statement			
	Q500	Per unit	CM Ratio
Sales	\$120,000	\$ 240	100%
Less variable costs	<u>72,000</u>	<u>144</u>	<u>60%</u>
Equals contribution margin	\$ 48,000	\$ 96	40%
Less fixed costs	<u>30,000</u>		
Equals net income	<u>\$ 18,000</u>		

Kinsley's Concepts Contribution Margin Income Statement			
	Q	Per unit	CM Ratio
Sales			
Less variable costs	_____	_____	_____
Equals contribution margin	_____		
Less fixed costs	_____		
Equals net income	<u>_____</u>		



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## **Video Illustration 4-5: Using CVP analysis to show the effects on net operating income from changes in sales price and fixed costs LO<sub>3</sub>**

Refer to the original data in Exhibit 4-5. Kinsley's Concepts is currently selling 500 toys per year. Kinsley's Concepts reported the following contribution margin income statement for their first year of operations. To increase sales, the sales manager would like to cut the selling price by \$40 per toy and increase the advertising budget by \$15,000 per year. The sales manager believes that if these two steps are taken, unit sales will increase by 200 toys per year. Should the changes be made?

***Exhibit 4-5 Contribution margin income statement and video explanation***

Kinsley's Concepts Contribution Margin Income Statement			
	Q500	Per unit	CM Ratio
Sales	\$120,000	\$ 240	100%
Less variable costs	<u>72,000</u>	<u>144</u>	<u>60%</u>
Equals contribution margin	\$ 48,000	\$ 96	40%
Less fixed costs	<u>30,000</u>		
Equals net income	<u>\$ 18,000</u>		

Kinsley's Concepts Contribution Margin Income Statement			
	Q	Per unit	CM Ratio
Sales			
Less variable costs	_____	_____	_____
Equals contribution margin	_____		
Less fixed costs	_____		
Equals net income	<u>_____</u>		



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## Break even point and target profit LOs 4.5

The **contribution margin income statement** can be used to compute break even and target profit. **Break even** is the point at which net operating income equals zero. Or, an organization breaks even when its sales revenue covers total costs—both variable and fixed. Break even is an important calculation, especially in new or start-up organizations. An organization should know how many units it needs to sell in order to cover its costs. In fact, most business plans and start-up business financing requests require the break even calculation to be reported. For example, an organization might discover they need to sell 10,000 units to break even when the demand for the product is only 2,000 units. In this case, the company cannot break even given current expenses and sales demand so they should not produce the product or they need to reduce costs.

**Target profit** is the point at which net operating income equals a specified amount. The calculation for target profit is closely related to break even. Target profit is calculated when an organization needs to know the quantity of sales required to cover total costs and earn a certain net profit.

The formulas to compute **break even** and **target profit** are provided in Exhibit 4-6.

***Exhibit 4-6 Break even and target profit formulas***

$$\text{Break even and target profit in units} = \frac{\text{Fixed Expenses} + \text{Target Profit (\$0 for breakeven)}}{\text{CM per unit}^*}$$

$$\text{Break even and target profit in sales dollars} = \frac{\text{Fixed Expenses} + \text{Target Profit (\$0 for breakeven)}}{\text{CM ratio}^*}$$

*\*Contribution margin per unit or CM per unit (Sales price per unit – variable costs per unit)*

*\*Contribution margin ratio or CM ratio (contribution margin in dollars / sales revenue in dollars)*

## Video Illustration 4-6: Calculating breakeven and target profit LOs4,5

A contribution margin income statement for Kinsley's Concepts is provided in Exhibit 4-5. Use this data to compute break even in units and sales dollars.

***Exhibit 4-5 Contribution margin income statement and video explanation***

Kinsley's Concepts			
Contribution Margin Income Statement			
	Q500	Per unit	CM Ratio
Sales	\$120,000	\$ 240	100%
Less variable costs	<u>72,000</u>	<u>144</u>	<u>60%</u>
Equals contribution margin	\$ 48,000	\$ 96	40%
Less fixed costs	<u>30,000</u>		
Equals net income	<u>\$ 18,000</u>		

Compute the breakeven in units sold and sales dollars for Kinsley’s Concepts.

Break even in units sold

Break even in sales dollars

Assume that Kinsley’s Concepts wants to earn a target profit of \$10,000. Compute the number of sales required in units and sales dollars.

Target profit in units sold

Target profit in sales dollars



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Check Your Understanding LO4,5



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## Practice Video Problems

*The chapter concepts are applied to comprehensive business scenarios in the below Practice Video Problems.*

### **Practice Video Problem 4-1** **Part 1:** Calculating break even and target profit, LOs4,6

Sweet Eats reported the following contribution margin income statement for their first year of operations.



Sweet Eats			
Contribution Margin Income Statement			
	Q20,000	Per unit	CM Ratio
Sales	\$360,000	\$ 18.00	100%
Less variable costs	198,000	9.90	55%
Equals contribution margin	\$162,000	\$ 8.10	45%
Less fixed costs	110,000		
Equals net income	<u>\$ 52,000</u>		

**Required 1:** Compute the break even in both sales units and sales dollars for Sweet Eats.

Break even in units sold

Break even in sales dollars

**Required 2:** Compute target profit in both sales units and sales dollars assuming that Sweet Eats is projecting \$75,000 in net income.

Target profit in units sold

Target profit in sales dollars



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## **Practice Video Problem 4-1**

### **Part 2: Cost volume profit (CVP) analysis change in sales quantity, sales price, and fixed expenses LO2,3**

Sweet Eats is currently selling 20,000 treats per year. A contribution margin income statement for the first year of operations is provided below. Compute net income assuming the selling price decreases by \$1.50 per unit, fixed expenses increase by \$10,000, and the number of units sold decreases by 5%.

Sweet Eats Contribution Margin Income Statement			
	Q20,000	Per unit	CM Ratio
Sales	\$360,000	\$ 18.00	100%
Less variable costs	<u>198,000</u>	<u>9.90</u>	<u>55%</u>
Equals contribution margin	\$162,000	\$ 8.10	45%
Less fixed costs	<u>110,000</u>		
Equals net income	<u><u>\$ 52,000</u></u>		

Sweet Eats Contribution Margin Income Statement			
	Q	Per unit	CM Ratio
Sales			
Less variable costs	_____	_____	_____
Equals contribution margin	_____		
Less fixed costs	_____		
Equals net income	<u>_____</u>		



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## **Practice Video Problem 4-1**

### **Part 3: Cost volume profit (CVP) analysis change in sales quantity, sales price, variable expenses LO2,3**

Sweet Eats is currently selling 20,000 treats per year. A contribution margin income statement for the first year of operations is provided below. Compute net income assuming the selling price increases by 5%, variable expenses decrease by 0.45 cents per unit, and the number of units sold increases by 12%.

Sweet Eats Contribution Margin Income Statement			
	Q20,000	Per unit	CM Ratio
Sales	\$360,000	\$ 18.00	100%
Less variable costs	<u>198,000</u>	<u>9.90</u>	<u>55%</u>
Equals contribution margin	\$162,000	\$ 8.10	45%
Less fixed costs	<u>110,000</u>		
Equals net income	<u>\$ 52,000</u>		

Sweet Eats Contribution Margin Income Statement			
	Q	Per unit	CM Ratio
Sales			
Less variable costs	_____	_____	_____
Equals contribution margin	_____		
Less fixed costs	_____		
Equals net income	<u>_____</u>		



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## Review Questions

*Review questions reinforce the chapter content.*





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## Homework Questions

*Homework questions can be used for additional practice or can be assigned in an academic setting. Full feedback is not available online. Homework questions can be assigned, with auto-grading and export, to specific learning management platforms, e.g., Canvas, Blackboard, etc. Contact the author for details.*



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5.

## SEGMENTED INCOME REPORTING

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## Learning Objectives LO

LO1 Explain the purposes and advantages of segmented income reporting

- LO2 Prepare a segmented income statement
- LO3 Compute contribution margin and segment margin
- LO4 Identify and account for segment traceable fixed costs and common fixed costs
- LO5 Segments within segments
- LO6 Segment cost volume profit analysis
- LO7 Compute breakeven for the whole organization as well as individual segments within the organization

## Purposes of segmented income reporting LO1

In addition to companywide income reporting, managers or owners also need to measure the profitability of individual segments within their organizations. An **organizational segment** is a part or activity within an organization about which managers would like cost, revenue, or profit data. Organizational segments can include divisions, individual stores, geographic regions, customers, or product lines. For example, Graeters Ice Cream will look at the profitability of

the company as a whole as well as the profitability of each individual retail location. The individual stores are considered segments within the organization. Graeters might also look at the profitability of product lines across all locations. In this case, the data would be segmented by product lines, such as ice cream and bakery items. A large or complex organization may segment the overall financial data in multiple ways in order to analyze the various parts.

The contribution margin format is used to prepare **segmented income statements**. The **contribution margin income statement** classifies costs on the basis of cost behavior. Cost behavior is how a cost reacts to changes in production or sales quantity. Cost behavior is classified as **variable**, **fixed** or **mixed**.

The company Media Masters is used in the following sections to demonstrate the process of preparing segmented income statements. Media Masters is a rapidly growing social media game development company. The company's programmers develop online games for social media applications and cell phones.

## Video Illustration 5-1:

## Overview of organizational segments LO1

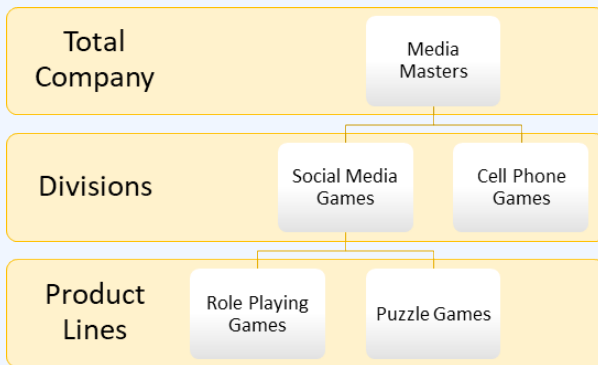
Media Masters recently launched a series of successful social media games causing a spike in customer subscriptions and sales revenue. To manage growth and make informed decisions, the company's Chief Operating Officer requested the company's contribution margin income statement as well as segmented income statements.

A contribution margin income statement for the total company and an example of the company's segments are presented in Exhibit 5-1. Media Masters is currently reporting total net operating income of \$25,000. The company has two major divisions—social media games and cell phone games. Each division can be further segmented into product lines. For example, the social media games division consists of two major project lines—role playing games and puzzle games.

### ***Exhibit 5-1 Media Masters contribution***

***margin income statement, organizational segments, and video explanation***

Media Masters		
Contribution Margin Income Statement		
	Q500,000	Per unit
Sales	\$500,000	\$1.00
Variable expenses	<u>165,000</u>	<u>0.33</u>
Contribution margin	\$335,000	\$0.67
Fixed expenses	<u>310,000</u>	
Net income	<u><u>\$25,000</u></u>	





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Check your understanding LO1



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## Prepare a segmented income statement LO2

A **segmented income statement** is based on the **contribution margin income statement** format. The contribution margin income statement and segmented income statement by division for Media Masters is presented in Exhibit 5-2. Notice that **net operating income** \$25,000 is the same on both statements. Although variable and fixed costs are allocated differently on the segmented income statement, net operating income will always be the same.

*Exhibit 5-2 Media Masters Contribution margin income statement and Segmented income statement by division*

<b>Media Masters</b>		
<b>Contribution Margin Income Statement</b>		
	<b>Q500,000</b>	<b>Per unit</b>
Sales	\$500,000	\$1.00
Variable expenses	<u>165,000</u>	<u>0.33</u>
Contribution margin	\$335,000	\$0.67
Fixed expenses	<u>310,000</u>	
Net income	<u><u>\$25,000</u></u>	

<b>Segments Reported by Division</b>			
	<b>Total Company</b>	<b>Divisions</b>	
		<b>Social Media Games</b>	<b>Cell Phone Games</b>
Sales	\$500,000	\$270,000	\$230,000
Variable expenses:			
Variable cost of goods sold	105,000	50,400	54,600
Other variable expenses	<u>60,000</u>	<u>36,000</u>	<u>24,000</u>
Total variable expenses	<u>165,000</u>	<u>86,400</u>	<u>78,600</u>
Contribution margin	335,000	183,600	151,400
Traceable fixed expenses	<u>260,000</u>	<u>140,400</u>	<u>119,600</u>
Divisional segment margin	75,000	43,200	31,800
Common fixed expenses (not traceable to divisions)	<u>50,000</u>		
Net operating income	<u><u>\$25,000</u></u>		

There are two major differences between a segmented income statement and a contribution margin income statement. First, contribution margin income statement reports one **contribution margin** whereas the segmented income statement reports the contribution margin as well as

the **segment margin**. Second, the contribution margin income statement reports fixed expenses in total whereas the segmented income statement divides fixed expenses between **traceable fixed expenses or costs** and **common fixed expenses or costs**. Both of these differences are discussed in detail in the below sections.

## Contribution margin and segment margin LO<sub>3</sub>

### Contribution margin

**Segmented income reporting** traces **sales revenue, variable costs**, and **fixed costs** to the **organizational segments** responsible for generating the sales revenue or costs. Since sales revenue and variable costs are typically driven by units sold these items can be easily traced to a particular segment. For example, it is easy to determine if a sale was a social media game or a cell phone game.

As illustrated in Exhibit 5-2, both the contribution margin income statement and the segmented income statement report contribution margin. Contribution margin is computed the same way on both statements. Contribution margin is calculated as sales revenue less variable expenses. Sales revenue is considered a variable revenue. Both sales revenue and variable expenses are typically driven by units of sales or units

of production. Since unit sales and units of production are easily traceable to a division, sales revenue and variable expenses are generally easy to allocate to a specific segment.

## Segment margin

Refer to Exhibit 5-2. The contribution margin is \$335,000 for both the contribution margin income statement and the segmented income statement. Contribution margin is the sales revenue less variable expenses on both statements. On the segmented income statement, **traceable fixed costs** are subtracted from the contribution margin to calculate the segment margin. Segment margin represents the sales revenue of a particular segment less variable expenses and fixed expenses that are traceable to the segment. Or, segment margin can be interpreted as the profitability of a particular segment before common fixed costs are incurred.

**Common fixed costs** are not allocated to a particular segment since they are common costs. Instead, common fixed costs are subtracted from the total company segment margin to arrive at net operating income. For Media Masters in Exhibit 5-2, the total divisional segment margin is \$75,000. Common fixed costs are subtracted from the total divisional segment margin to arrive at net operating income of \$25,000.

Check your understanding LO3



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## Fixed costs and the segmented income statement LO4

Unlike variable revenue and variable costs, **fixed costs** are more difficult to allocate to segments since some fixed costs are generated by a particular segment and some fixed costs are common to all the segments.

## Traceable fixed costs

**Traceable fixed costs** are costs that can be traced directly to an **organizational segment**. For example, assume that the social media games segment employs a product developer that works solely on social media games. Her salary is a fixed cost that is traceable to that division. Another way to look at traceable fixed costs is that they are costs that would be eliminated if the segment were eliminated.

Refer to the contribution margin income statement in Exhibit 5-2. Total fixed costs for Media Masters is \$310,000. Now refer to the segmented income statement in Exhibit 5-2. Of the \$310,000 in total fixed costs, management determined that \$260,000 were traceable to the two divisions, with \$140,400 traceable to the social media games division and \$119,600 traceable to the cell phone games divisions.

## Common fixed costs

**Common fixed costs** are costs that are common to, or shared by, all **organizational segments**. For example, the President of Media Masters manages both divisions. Her salary would be considered a common fixed cost since it is not traceable to a particular segment. For the purposes of **segment income reporting**, common fixed costs are not used to calculate the **segment margin** since these costs are not traceable to the segment and would not be eliminated if the segment were

eliminated. Instead, common fixed costs are deducted from the segment margin to arrive at **net operating income**.

Refer to the segmented income statement in Exhibit 5-2. Total fixed costs less traceable fixed costs leaves common fixed costs,  $\$310,000 - 260,000 = \$50,000$  common fixed costs. Since these costs are shared by the segments, they are not used to calculate the segment margin.

Check your understanding LO4



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## Organizational segments within segments LO5

An organization can have many layers of segments. Larger organizational segments can be further divided into segments within that segment. Refer to Exhibit 5-3 below. Media Masters has two large divisions—social media games and cell phone games. The social media games division can be further divided into product lines—role playing games and puzzle games.

It is important to note, that **common fixed costs** are not considered when a larger segment is divided into smaller segments. The segment margin for the larger segment is the total amount allocated to the smaller segments. Refer to Exhibit 5-3 below, the segment margin for social media games is \$43,200. When further segmented by product lines within the social media games segment, this amount becomes the total amount for the social media games segment. Variable revenue and variable expenses are then allocated between the product lines. Total segment fixed costs are divided into fixed costs traceable to the project lines and common fixed costs. To illustrate, of the \$140,400 of total fixed costs allocated to the social media games segment, \$31,950 and \$58,250 are traceable to role playing games and puzzle games respectively. The remaining  $\$140,400 - \$31,950 - \$58,250 = \$50,200$  becomes



common fixed costs allocated to the social media games segment.

Exhibit 5-3 illustrates the functionality of segmented income statement reporting. Media Masters is reporting **net operating income** of \$25,000. While total company net operating income is valuable information, it does not show which segments within the organization are performing well and which are not. As shown in Exhibit 5-3, the social media games division is profitable overall however only one of the product lines within that division is profitable. Segmented income statements provide detailed information for management to make informed decisions about particular segments within an organization.

***Exhibit 5-3 Media Masters segmented income statement by division and product line***

### Segmented Income Reporting Media Masters

Segments Reported by Division			
		Divisions	
	Total Company	Social Media Games	Cell Phone Games
Sales	\$500,000	\$270,000	\$230,000
Variable expenses:			
Variable cost of goods sold	105,000	50,400	54,600
Other variable expenses	60,000	36,000	24,000
Total variable expenses	<u>165,000</u>	<u>86,400</u>	<u>78,600</u>
Contribution margin	335,000	183,600	151,400
Traceable fixed expenses	<u>260,000</u>	<u>140,400</u>	<u>119,600</u>
Divisional segment margin	75,000	43,200	31,800
Common fixed expenses (not traceable to individual divisions)	<u>50,000</u>		
Net operating income	<u>\$25,000</u>		

Segments Reported by Product Line			
		Product Lines	
	Social Media Games	Role Playing Games	Puzzle Games
Sales	\$270,000	\$186,300	\$83,700
Variable expenses:			
Variable cost of goods sold	50,400	33,264	17,136
Other variable expenses	36,000	21,600	14,400
Total variable expenses	<u>86,400</u>	<u>54,864</u>	<u>31,536</u>
Contribution margin	183,600	131,436	52,164
Traceable fixed expenses	<u>90,200</u>	<u>31,950</u>	<u>58,250</u>
Divisional segment margin	93,400	99,486	(6,086)
Common fixed expenses (not traceable to product lines)	<u>50,200</u>		
Division net income	<u>\$43,200</u>		

## Segment cost volume profit

## (CVP) analysis LO6

**Cost volume profit (CVP) analysis** can be applied to the whole organization and to particular segments within the organization. Cost volume profit analysis is covered in detail in chapter 4. Cost volume profit analysis requires a **contribution margin format income statement**. **Segmented income statements** for segments within an organization or subsegments within a larger segment are prepared using the contribution margin format, so it is possible to use cost volume profit analysis on individual segments. Cost volume profit analysis is used to make important decisions about selling prices, sales volume, unit variable costs, total fixed costs, and the mix of products sold.

### Video Illustration 5-2: Segment cost volume profit analysis LO6

Media Masters' segmented income statement for the social media product lines is shown in Exhibit 5-3. Currently, the puzzle games product line is showing a net operating loss of \$(6,086).

Management is considering additional social media advertising to promote the puzzle games product line. The accountant estimated that spending an additional \$10,000 on advertising would result in \$24,000 in additional sales revenue for the puzzle games product line. Should management invest in the social media advertising campaign?

The processes to solve this scenario are demonstrated in Video Illustration 5-2.

***Exhibit 5-4 Media Masters contribution margin statement template and video explanation***

	Current		Proposed	
	Puzzle games	CM ratio	Puzzle games	CM ratio
Sales	\$83,700			
Variable expenses:				
Variable cost of goods sold	17,136			
Other variable expenses	14,400			
Total variable expenses	\$31,536			
Contribution margin	\$52,164			
Traceable fixed expenses	58,250			
Divisional segment margin	(\$6,086)			



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## Breakeven calculations for segmented income reporting

### L07

Breakeven is the point at which **net operating income** equals zero. Breakeven can be computed for the whole organization or for individual segments within the organization. Or, an organization or segment breaks even when its **sales revenue** covers its total costs—both **variable** and **fixed**. The formulas to compute breakeven in sales dollars for the whole organization

as well as breakeven in sales dollars for segments within the organization are provided below.

***Exhibit 5-5 Breakeven formulas***

<b>Whole organization breakeven in sales dollars</b>	$\frac{\text{Traceable fixed expenses} + \text{Common fixed expenses}}{\text{Total CM ratio}^*}$
<b>Segment breakeven in sales dollars</b>	$\frac{\text{Segment traceable fixed expenses}}{\text{Segment CM ratio}^*}$

*\*Contribution margin ratio or CM ratio (contribution margin in dollars/  
sales revenue in dollars)*

## Video Illustration 5-3: Computing breakeven LO7

Media Masters' **segmented income statement** for the total company and its two divisions is presented in Exhibit 5-6. Compute **breakeven** for the whole organization and breakeven for the social media games division.

***Exhibit 5-6 Media Masters data and video  
explanation for computing breakeven***

Segments Reported by Division			
	Total Company	Divisions	
		Social Media Games	Cell Phone Games
Sales	\$500,000	\$270,000	\$230,000
Variable expenses:			
Variable cost of goods sold	105,000	50,400	54,600
Other variable expenses	60,000	36,000	24,000
Total variable expenses	165,000	86,400	78,600
Contribution margin	335,000	183,600	151,400
Traceable fixed expenses	260,000	140,400	119,600
Divisional segment margin	75,000	43,200	31,800
Common fixed expenses (not traceable to divisions)	50,000		
Net operating income	\$25,000		

Breakeven in sales dollars for the whole organization

Breakeven in sales dollars for social media games segment



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Check your understanding LO7



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## Practice Video Problems

*The chapter concepts are applied to comprehensive business scenarios in the below Practice Video Problems.*

### **Practice Video Problem 5-1** **Part 1: Segmented income statements** LOs2,3,4

Whole Universe, a wholesale distributor of electronic products, has been experiencing losses for the last two fiscal quarters. The most recent

quarterly **contribution margin income statement** is presented below.

	Total Company
Sales	\$210,000
Variable expenses:	
Variable cost of goods sold	93,000
Other variable expenses	3,500
Total variable expenses	96,500
Contribution margin	113,500
Fixed expenses	136,000
Net income	(\$22,500)

In an effort to isolate the problem, the CFO asked for **segmented income reporting** by division. The company has two divisions, Alpha and Omega. Additional divisional data is provided below.

	Divisions	
	Alpha	Omega
Sales	\$69,300	\$140,700
Variable costs of goods sold (% of total)	37%	63%
Other variable expenses (% of total)	33%	67%
Traceable fixed expenses	42,000	61,200

**Required 1:** Prepare a contribution format income statement segmented by divisions.

Segments Reported by Division			
	Total Company	Divisions	
		Alpha	Omega
Sales			
Variable expenses:			
Variable cost of goods sold			
Other variable expenses			
Total variable expenses			
Contribution margin			
Traceable fixed expenses			
Divisional segment margin			
Common fixed expenses (not traceable to divisions)			
Net operating income			



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# Practice Video Problem 5-1

## Part 2: Segment cost volume profit analysis LO6

**Required 2:** As a result of a marketing study, the CFO believes that sales in the Alpha division could be increased to \$97,000 if monthly advertising traceable to the Alpha division were increased by \$6,000. Would you recommend the proposed increase to advertising? Show computations to support your answer.

	Current		Proposed	
	Alpha	CM ratio	Alpha	CM ratio
Sales	\$69,300			
Variable expenses:				
Variable cost of goods sold	34,410			
Other variable expenses	1,155			
Total variable expenses	\$35,565			
Contribution margin	\$33,735			
Traceable fixed expenses	42,000			
Divisional segment margin	<u>(\$8,265)</u>			



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## Practice Video Problem 5-2: Companywide and segment breakeven LO7

Ba Boutique sells high-end, custom-made clothes. The company has two branch locations in Ohio, one in Cincinnati and one in Loveland. Ba Boutique's segmented income statement for the total company and branch locations is provided below.

Segments Reported by Branches

	Total Company	Branches	
		Loveland Branch	Cincinnati Branch
Sales	\$1,000,000	\$402,000	\$598,000
Variable expenses:	630,000	346,500	283,500
Contribution margin	370,000	55,500	314,500
Traceable fixed expenses	210,000	93,111	116,889
Divisional segment margin	160,000	(37,611)	197,611
Common fixed expenses (not traceable branches)	50,000		
Net operating income	\$110,000		

**Required 1:** Compute breakeven in sales dollars for the whole organization.

**Required 2:** Compute breakeven in sales dollars for the Loveland Branch

**Required 3:** Compute breakeven in sales dollars for the Cincinnati Branch



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## Review Questions

*Review questions reinforce the chapter content.*

### **Review 5-1**



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## **Review 5-2**



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## **Review 5-3**



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### Review 5-4



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## Homework Questions

*Homework questions can be used for additional practice or can be assigned in an academic setting. Full feedback is not available online. Homework questions can be assigned, with auto-grading and*

*export, to specific learning management platforms, e.g., Canvas, Blackboard, etc. Contact the author for details.*

### Homework 5-1



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### Homework 5-2



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### Homework 5-3



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## Homework 5-4



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## Homework 5-5



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### Homework 5-7



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### Homework 5-8



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### Homework 5-6



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6.

# BUDGETING

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### Learning Objectives LO

- LO1 Describe the purposes of organizational budgeting
- LO2 Describe the budgeting process using a master budget
- LO3 Prepare a sales budget
- LO4 Prepare a production budget

- LO5 Prepare a direct materials purchases budget
- LO6 Prepare a direct labor budget
- LO7 Prepare a manufacturing overhead budget
- LO8 Prepare a cost of goods sold budget
- LO9 Prepare a selling and administrative budget
- LO10 Prepare a budgeted income statement

## Purposes of budgeting LO1

Budgeting is a powerful tool that is widely used for planning, executing, and evaluating organizational operations. A **budget** is a detailed financial plan for future time periods. Budgets are typically prepared before the budgeted period begins. For this reason, budgeted amounts are estimates and not actual amounts. Most organizations use historical data and current operating plans to estimate budgeted amounts. In an established organization, an effective manager can make these estimates with remarkable accuracy. For example, if the lease payment is \$2,000 per month it is easy to project in the upcoming budget that yearly rent expense will be \$24,000. However, budgets are not static. Budgets are frequently revised during the period due to unforeseen circumstances such as a change in economic conditions, changes in sales demand, or other factors that affect the organization.

Budgets are used by organizations for planning, controlling, and evaluating performance.

**Planning.** The budget is created prior to the time period



covered by the budget. The completed budget is then used by management to help plan operations including activities like scheduling production, purchasing materials, and making capital investments.

**Controlling.** The budget is used to control operations during the time period covered by the budget. It sets forth expected targets and limitations. The budget projects sales and revenue targets, production targets, and spending limitations for budgeted expenditures. For example, the budgets establishes the amount to be spent on raw materials; direct labor; and selling, general, and administrative expenses. It is the responsibility of management to ensure that actual expenditures are within the budgetary guidelines.

**Performance evaluation.** The budget is also used to evaluate the actual results achieved during the time period covered by the budget. Performance evaluation involves comparing the actual results to the results projected in the budget. Comparing budgeted activities to actual results is a widely used method for performance evaluation at all levels of the organization. For example, management can evaluate various departments or activities to see if they met expected targets or stayed within budgeted spending limitations. This feedback can be used to correct organizational inefficiencies or in some cases to justify adjusting budgeting projections and assumptions going forward.

Check your understanding LO1



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## Master budget LO2

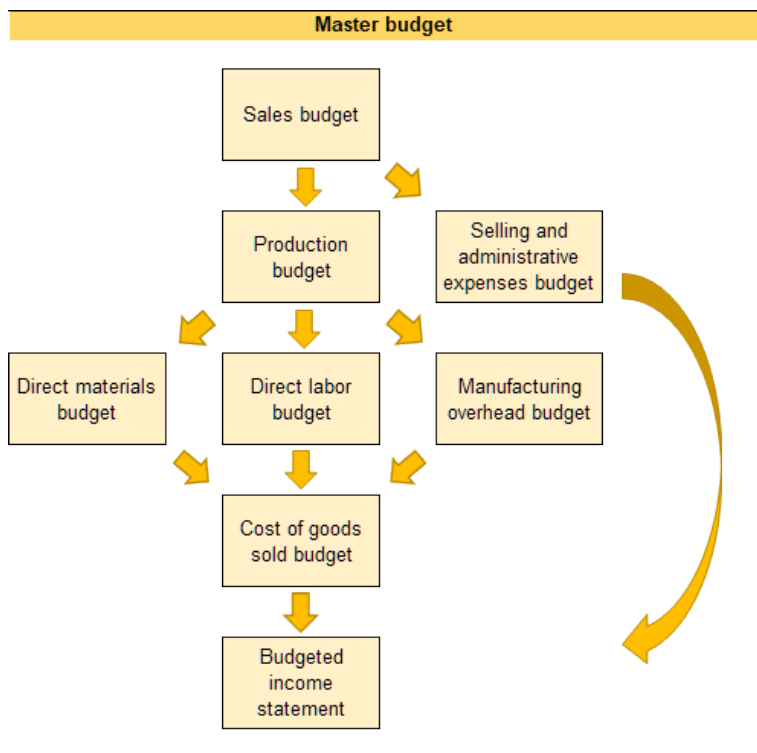
An organization's collection of budgets is known as the **master budget**. An organization's master budget consists of a set of interrelated but independent budgets that articulate the organization's sales, production, profit, and financial position for a specified time period. A master budget is a tool used by management to effectively plan, control, and evaluate business operations.

A flowchart showing significant independent budgets

included in the master budget for a manufacturing organization, and how these individual budgets interrelate is provided in Exhibit 6-1.

As demonstrated in Exhibit 6-1, the budgets are interrelated with some budgets feeding into other budgets. For this reason, budgets must be completed in a specific order. The sales budget is the first budget completed in the master budget. The estimated sales number drives many organizational decisions such as how many units to produce, how many people to employ, and what kind of facilities are necessary to support that level of sales activity.

***Exhibit 6-1 Relationship between individual budgets within a master budget***



Check your understanding LO2





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## Sales budget LO<sub>3</sub>

The **sales budget** is the first budget prepared in the master budget. Estimated sales is the basis for the individual budgets within the master budget. Estimating sales is a fundamental part of the budgeting process. Estimated sales are used to project everything else, such as sales revenue collected, production needs, and organizational expenditures.

The example of Wonderball, Inc. is used to illustrate the individual budgets. The Wonderball is a unique stress ball made from crushed crystals. Due to innovative social media marketing, Wonderball is trending on nearly every social media platform. Sofia, the creator and owner of Wonderball, Inc. is preparing a master budget for her second year of operations. Sofia decided to prepare the master budget by quarter.

The first budget she needs to prepare is the sales budget. The sales budget is provided in Exhibit 6-2. First, Sophia estimated the number of units she believes the company will sell in the upcoming period. She looked at past sales data to project the number of units sold in each quarter. She projects a sharp increase in sales in quarter 4 (Q4) due to holiday gift-giving. Each unit sells for \$15. The sales budget is calculated by multiplying the budgeted units in sales by the selling price per unit to get total sales dollars. Total sales dollars for her second year of operations is estimated to be \$3,915,000.

***Exhibit 6-2 Sales budget for Wonderball, Inc.***

Sales Budget Wonderball, Inc.						
	Year 2 Quarters				Year 3	
	Q1	Q2	Q3	Q4	Yr2 Total	Q1
Budgeted unit sales	57,000	63,000	60,000	81,000	261,000	54,000
Selling price per unit	\$15	\$15	\$15	\$15	\$15	\$15
Total sales	\$855,000	\$945,000	\$900,000	\$1,215,000	\$3,915,000	\$810,000

## Video Illustration 6-1: Preparing the sales budget

Stephanie Shuck invented a revolutionary new product called the Water Wiz. The Water Wiz

can be programmed to deliver the perfect amount of water and nutrients to virtually any type of potted plant. The company experienced a profitable first year of operations. In the final quarter of the first year, Stephanie decided to compile a master budget to plan for the second year of operations.

For this illustration, assume that Stephanie only sells one product, the Water Wiz. The Water Wiz sells for \$20 per unit. For the upcoming year, she expects to sell 20,000 units in the first quarter, 24,000 units in the second quarter, 33,000 units in the third quarter, and 40,000 units in the fourth quarter. In the first quarter of year 3, she expects to sell 21,000 units. Prepare the sales budget.

***Exhibit 6-3 Constructing a sales budget  
video explanation***

Construct the sales budget	Year 2 Quarters				Year 3	
	Q1	Q2	Q3	Q4	Yr2 Total	Q1
Budgeted unit sales						
Selling price per unit						
Total sales						



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Check your understanding LO3



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## Production budget LO4

The **production budget** is prepared after the sales budget. The production budget estimates the number of units that need to be produced to meet sales demand and to maintain a desired level of finished goods inventory on hand. Normally making and storing a large quantity of excess inventory is not recommended. However, producing a small amount of excess inventory or a desired level of ending finished goods inventory is standard practice. The excess inventory serves as a buffer in case sales demand is more than expected, production issues occur, or the organization needs additional inventory for another reason. Maintaining a small amount of excess inventory is preferable to running out of inventory.

The production budget for Wonderball, Inc. is provided in Exhibit 6-4 below. The production budget starts with budgeted units in sales taken from the sales budget. Sofia needs to produce the units she intends to sell each quarter. Also,

she would like to produce additional units to have on hand. Specifically, she wants to produce a desired ending finished goods inventory in the current quarter equal to 20% of the next quarter's budgeted units in sales. Sofia began the first quarter of year 2 with 11,400 units in the beginning finished goods inventory account. This beginning inventory was carried forward from quarter 4 of year 1. The 11,400 was the desired ending inventory that she produced in quarter 4 of year 1. Since the ending inventory from one quarter becomes the beginning inventory in the next quarter, the company will start each quarter with 20% of the current quarter's budgeted sales on hand. In the first quarter of year 3, the desired ending finished goods inventory is projected to be 12,700 units.

The formula for calculating the production budget is budgeted units in sales plus desired ending inventory (20% of the next quarter's budgeted units of sales in this case) equals total production needs. For quarter 1, the desired ending inventory is 20% of the budgeted units in sales for quarter 2, or  $63,000 \text{ units} \times 20\% = 12,600 \text{ units}$ . For each quarter, we only need to produce some of the total production needs since we carried forward additional units from the last quarter. The desired ending inventory from one quarter becomes the beginning inventory in the next quarter. The beginning inventory for quarter 1 is given above as 11,400 units carried forward from Q4 of year 1. The ending inventory for quarter 1 (12,600) then becomes the beginning inventory for quarter 2. The beginning inventory carried forward from the previous

quarter is subtracted from total production needs to arrive at required production in units for the current quarter.

***Exhibit 6-4 Production budget for Wonderball, Inc.***

Production Budget Wonderball, Inc.						
	Year 2 Quarters				Year 3	
	Q1	Q2	Q3	Q4	Yr2 Total	Q1
Budgeted units sales	57,000	63,000	60,000	81,000	261,000	54,000
Add desired ending inventory	12,600	12,000	16,200	10,800	10,800	12,700
Total needs	69,600	75,000	76,200	91,800	271,800	66,700
Less beginning inventory	11,400	12,600	12,000	16,200	11,400	10,800
Required production in units	58,200	62,400	64,200	75,600	260,400	55,900

## Video Illustration 6-2: Preparing the production budget

Stephanie wants to maintain a desired ending finished goods inventory in the current quarter equal to 10% of the next quarter's production. Stephanie began the first quarter of year 2 with 2,000 units of Water Wiz in the beginning finished goods inventory account. In the first quarter of year 3, the desired ending finished goods inventory is projected to be 2,700 units. Prepare the production budget.

**Exhibit 6-5 Constructing a production budget video explanation**

Construct the production budget	Year 2 Quarters				Year 3	
	Q1	Q2	Q3	Q4	Yr2 Total	Q1
Budgeted unit sales						
Add desired ending inventory						
Total needs						
Less beginning inventory						
Required production in units						



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Check your understanding LO4



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## Direct materials purchases budget LO5

After the production budget is completed, the **direct materials purchases budget** is prepared. The direct materials purchases budget estimates the amount of direct raw materials purchases needed to produce the units scheduled for production plus the desired level of raw materials ending inventory. Purchasing a small quantity of excess raw materials, referred to as the desired amount of ending raw materials inventory, acts as a buffer in case additional raw materials are needed due to unexpected supply chain issues, production issues, or sales demand.

It is common to use several different direct materials to produce a final product in a manufacturing environment. A

direct materials budget is prepared for each direct material used. For example, the production of a student desk may require three direct materials—wood, hardware, and stain. A separate raw materials budget is created for each of these materials. It is also common for the quantity of raw material used to produce one unit of product to be more or less than one unit of the raw material. In the student desk example, each desk may require 12 feet of wood board. The quantity of wood needed to produce one desk is 12 feet, two desks 24 feet, and three desks 36 feet.

Continuing with the Wonderball, Inc. example, the direct materials purchases budget is prepared after the production budget. Finely crushed quartz crystal is the only direct material used to produce the Wonderball. The crushed crystal is poured into a specialized machine with a small amount of proprietary chemical additives. The chemical additives are accounted for as indirect materials or manufacturing overhead. The crushed crystal mixture is pressurized, causing the particles to form a bond. Each unit requires 1.2 pounds of crushed crystal. The crushed crystal costs \$3.00 per pound.

The direct materials purchases budget for Wonderball, Inc. is provided in Exhibit 6-6 below. The direct materials purchases budget starts with the required production in units taken from the production budget. Sofia must purchase the materials required for each quarter's production needs. Also, she would like to purchase additional raw materials to have on hand. Specifically, she wants to maintain a desired ending

raw materials inventory in the current quarter equal to 10% of the next quarter's total raw materials needs. The ending inventory in one quarter becomes the beginning inventory in the next quarter. Sofia began the first quarter of year 2 with 6,984 pounds of raw materials in the beginning raw materials inventory account. The desired ending raw materials inventory purchased in quarter 4 of year 1 is carried forward as the beginning raw materials inventory for quarter 1 of year 2.

The formula for calculating the costs for direct materials starts by taking the required production in units (from the production budget) times raw materials required per unit to get the total raw materials needs. Each unit of Wonderball requires 1.2 pounds of crushed crystal. Raw materials needs plus the desired ending inventory (10% of the next quarter's total raw materials needs in this case) equals total needs. For quarter 1, the desired ending raw materials inventory is 10% of the total needs of quarter 2, or  $74,880 \text{ pounds} \times 10\% = 7,488$ . We only need to purchase some of the total raw material needs since we carried forward raw materials inventory from the last quarter. The desired ending inventory from one quarter becomes the beginning inventory in the next quarter. The beginning inventory carried forward from the previous quarter is subtracted from the total needs to arrive at raw materials that need to be purchased. This amount is multiplied by the cost per unit of material to get the cost of raw materials purchases. The direct materials costs per unit are calculated at the bottom of the raw materials purchases budget.

**Exhibit 6-6 Direct materials purchases budget for Wonderball, Inc.**

Direct Materials Purchases Budget Wonderball, Inc.						
	Year 2 Quarters				Year 3	
	Q1	Q2	Q3	Q4	Yr2 Total	Q1
Required production in units	58,200	62,400	64,200	75,600	260,400	55,900
Times raw materials required per unit	1.2	1.2	1.2	1.2	1.2	1.2
Total raw material needs	69,840	74,880	77,040	90,720	312,480	67,080
Add desired ending raw materials inventory	7,488	7,704	9,072	31,248	31,248	
Total needs	77,328	82,584	86,112	121,968	343,728	
Less beginning raw materials inventory	6,984	7,488	7,704	9,072	6,984	
Raw materials to be purchased	84,312	90,072	93,816	131,040	350,712	
Times material cost per unit	\$ 3.00	\$ 3.00	\$ 3.00	\$ 3.00	\$ 3.00	
Cost of raw materials purchases	\$252,936	\$270,216	\$281,448	\$393,120	\$1,052,136	

**Direct material costs per unit**

Raw material required for one unit (in lbs.)	1.2
Times material cost per unit of material	\$ 3.00
Direct material costs per unit	\$ 3.60

**Video Illustration 6-3:**  
**Preparing the direct materials purchases budget**

Assume that Stephanie wants to maintain a desired ending raw materials inventory in the current quarter equal to 20% of the next quarter’s production. The only raw material used to produce a single unit is the 3 pounds of eco-friendly, biodegradable composite material. The



composite material costs \$1.00 per pound. Stephanie began the first quarter of year 2 with 12,240 pounds in the beginning raw material inventory account. Prepare the direct material purchases budget.

***Exhibit 6-7 Constructing a direct materials purchases budget video explanation***

Construct the raw materials purchases budget	Year 2 Quarters				Year 3	
	Q1	Q2	Q3	Q4	Yr2 Total	Q1
Required production in units						
Raw materials required for one unit						
Total production needs						
Add desired ending inventory raw materials						
Total needs per quarter						
Less beginning inventory raw materials						
Raw materials to be purchased						
Times material cost per unit of material						
Cost of raw materials purchases						
Direct material costs per unit						
Raw material required for one unit						
Times material cost per unit of material						
Direct material costs per unit						



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Check your understanding LOS



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## Direct labor budget LO6

After the production budget is prepared the direct labor budget is prepared. The direct labor budget calculates the total number of labor hours and the total cost of direct labor needed to satisfy production.

It is common for the number of direct labor hours needed to produce one unit to be more or less than one hour of direct labor. Continuing with the Wonderball, Inc. example, assume that a worker can load and process one Wonderball every 6 minutes. The direct labor hours needed to produce a single unit is 0.10 of an hour (6 minutes / 60 minutes in an hour). The worker is paid \$15 per hour.

The direct labor budget for Wonderball, Inc. is provided in Exhibit 6-8 below. The direct labor budget starts with the required production in units taken from the production budget. The formula for calculating the costs of direct labor starts by taking the required production in units (from the

production budget) times direct labor hours required to complete one unit to get the total number of direct labor hours required. Next, take total direct labor hours times the direct labor rate per hour to get total direct labor costs. The direct labor costs per unit is calculated at the bottom of the direct labor budget.

***Exhibit 6-8 Direct labor budget for Wonderball, Inc.***

Direct Labor Budget Wonderball, Inc.					
	Year 2 Quarters				
	Q1	Q2	Q3	Q4	Yr2 Total
Required production in units	58,200	62,400	64,200	75,600	260,400
Times direct labor hours per unit	0.10	0.10	0.10	0.10	0.10
Total direct labor hours	5,820	6,240	6,420	7,560	26,040
Times direct labor rate per hour	\$15	\$15	\$15	\$15	\$15
Total direct labor costs	\$87,300	\$93,600	\$96,300	\$113,400	\$390,600
<b>Direct labor costs per unit</b>					
Direct labor hours required per unit	0.10				
Times direct labor rate per hour	\$15.00				
Direct labor cost per unit	\$1.50				

**Video Illustration 6-4:**  
**Preparing the direct labor budget**

Assume that each unit of Water Wiz requires 0.25 direct labor hours to complete. The average

direct labor rate is \$15 per hour. Prepare the direct labor budget.

**Exhibit 6-9 Constructing a direct labor budget video explanation**

Construct the direct labor budget	Year 2 Quarters				
	Q1	Q2	Q3	Q4	Yr2 Total
Required production in units					
Direct labor hours required per unit					
Total direct labor hours					
Times direct labor rate per hour					
Total direct labor costs					
Direct labor costs per unit					
Direct labor hours required per unit					
Times direct labor rate per hour					
Direct labor cost per unit					



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Check your understanding LO6



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## Manufacturing overhead budget LO7

The final budget to determine **product costs** is the **manufacturing overhead budget**. The manufacturing overhead budget calculates the total manufacturing overhead that will be incurred to satisfy production needs.

Manufacturing overhead includes **indirect materials** used in production, such as glue, screws, and nails; **indirect labor** used in production, such as wages for the production supervisor or quality control; and all other costs incurred to

manufacture a product, such as rent, insurance, taxes, and utilities incurred on the manufacturing facilities.

Manufacturing overhead is classified as **variable** or **fixed**. Variable manufacturing overhead costs are the same per unit, but total costs depend on the quantity produced. Fixed manufacturing overhead costs are the same in total regardless of the quantity produced.

After carefully classifying all indirect product costs as variable, fixed, or mixed, Sophia determined that each unit of Wonderball consumes \$0.12 of variable manufacturing overhead and total fixed manufacturing overhead is \$21,500. The manufacturing overhead budget is presented in Exhibit 6-10.

***Exhibit 6-10 Manufacturing overhead budget for Wonderball, Inc.***

Manufacturing Overhead Budget Wonderball, Inc.					
	Year 2 Quarters				
	Q1	Q2	Q3	Q4	Yr2 Total
Required production in units	58,200	62,400	64,200	75,600	260,400
Variable overhead rate per unit	\$0.12	\$0.12	\$0.12	\$0.12	\$0.12
Total variable overhead	\$6,984	\$7,488	\$7,704	\$9,072	\$31,248
Fixed overhead per quarter	21,500	21,500	21,500	21,500	86,000
Total manufacturing overhead	\$28,484	\$28,988	\$29,204	\$30,572	\$117,248

**Overhead applied per unit produced**

Total manufacturing overhead	\$117,248
Divided by total required production in units	260,400
Total overhead applied per unit	\$ 0.45 *rounded

## Video Illustration 6-5: Preparing the manufacturing overhead budget

Assume that each units of Water Wiz requires \$0.10 of variable manufacturing overhead per unit produced and total fixed manufacturing overhead is \$41,000 per quarter.

### *Exhibit 6-11 Constructing a manufacturing overhead budget video explanation*

Construct the manufacturing overhead budget	Year 2 Quarters				
	Q1	Q2	Q3	Q4	Yr2 Total
Required production in units					
Variable overhead rate per unit					
Total variable overhead					
Fixed overhead per quarter					
Total manufacturing overhead					
Overhead applied per unit produced					
Total manufacturing overhead					
Divided by total required production in units					
Total overhead applied per unit					





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Check your understanding LO7



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## Cost of goods sold budget

### LO8

The cost of goods sold budget is prepared after the raw materials budget, direct labor budget, and manufacturing overhead budgets are prepared. The cost of goods sold budget determines the estimated cost for the inventory sold during the period. **Cost of goods sold** is the total manufacturing costs, or **product costs**, incurred to make the products that were sold. Product costs include the costs for **direct material**, **direct labor**, and **manufacturing overhead**.

Cost of goods sold per unit is the sum of direct materials per unit, direct labor per unit, and manufacturing overhead per unit. These numbers are taken from the direct materials budget, direct labor budget, and manufacturing overhead budget. The estimated number of sales in units is taken from

the sales budget. The cost of goods sold budget for Wonderball, Inc. is provided in Exhibit 6-12.

***Exhibit 6-12 Cost of goods sold budget for Wonderball, Inc.***

Cost of Goods Sold Budget Wonderball, Inc.					
	Year 2 Quarters				
	Q1	Q2	Q3	Q4	Yr2 Total
Sales in units	57,000	63,000	60,000	81,000	261,000
Times cost of goods sold per unit	\$5.55	\$5.55	\$5.55	\$5.55	\$5.55
Total cost of goods sold	<u>\$316,350</u>	<u>\$349,650</u>	<u>\$333,000</u>	<u>\$449,550</u>	<u>\$1,448,550</u>
<b>Cost of good sold per unit</b>					
Direct material costs per unit	\$3.60 (see direct materials budget)				
Direct labor cost per unit	1.50 (see direct labor budget)				
Total overhead applied per unit	0.45 (see manufacturing overhead budget)				
Cost of goods sold per unit	<u>\$5.55</u>				

## Video Illustration 6-6: Preparing the cost of goods sold budget

The cost of goods sold budget for Water Wiz is presented in Exhibit 6-13 below. Prepare the cost of goods sold budget using data from the sales budget, raw material budget, and manufacturing overhead budget.

***Exhibit 6-13 Constructing a cost of goods sold budget video explanation***

Construct the cost of good sold budget	Year 2 Quarters				
	Q1	Q2	Q3	Q4	Yr2 Total
Sales in units (see sales budget)					
Times cost of goods sold per unit					
Total cost of goods sold					
<u>Cost of good sold per unit</u>					
Direct material costs per unit					(see raw materials budget)
Direct labor cost per unit					(see direct labor budget)
Total overhead applied per unit					(see manufacturing overhead budget)
Cost of goods sold per unit					



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## Check your understanding LO8



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## Selling and administrative expenses budget LO9

The **selling and administrative expenses budget** must be prepared before a budgeted income statement can be prepared. Selling and administrative expenses (S&A expenses) are classified as period costs, or any cost not necessary to manufacture the product. Product costs-direct material, direct labor, and manufacturing overhead-are included in the cost of goods sold budget. All costs that are not product costs are considered period costs. Although period costs are not

necessary to produce the product, they are necessary to sustain the organization.

Selling and administrative expenses are typically classified as **variable** or **fixed**. After carefully classifying all selling and administrative costs as variable, fixed, or mixed, Sophia determined that each unit of Wonderball incurred \$6.30 variable selling and administrative costs and fixed selling and administrative costs per quarter totaled \$97,200. The selling and administrative expenses budget is presented in Exhibit 6-14.

***Exhibit 6-14 Selling and administrative expenses budget for Wonderball, Inc.***

Selling and Administrative Expenses Budget Wonderball, Inc.					
	Year 2 Quarters				
	Q1	Q2	Q3	Q4	Yr2 Total
Budgeted units sales	57,000	63,000	60,000	81,000	261,000
Variable S&A expenses per unit	\$6.30	\$6.30	\$6.30	\$6.30	\$6.30
Total variable S&A expenses	\$359,100	\$396,900	\$378,000	\$510,300	\$1,644,300
Fixed S&A expenses					
Advertising	\$60,000	\$60,000	\$60,000	\$60,000	\$240,000
Corporate salaries	24,000	24,000	24,000	24,000	96,000
Insurance	6,300	6,300	6,300	6,300	25,200
Depreciation	2,700	2,700	2,700	2,700	10,800
Miscellaneous S&A expenses	4,200	4,200	4,200	4,200	16,800
Total fixed S&A expenses	\$97,200	\$97,200	\$97,200	\$97,200	\$388,800
Total S&A expenses	\$456,300	\$494,100	\$475,200	\$607,500	\$2,033,100

## **Video Illustration 6-7:** **Preparing the selling and administrative expenses (S&A expenses) budget**

Assume that Stephanie projects the following selling and administrative expenses: variable S&A expenses \$6.20 per unit; advertising \$25,000 per quarter; corporate salaries \$60,000 per quarter; insurance \$12,000 per quarter; property taxes \$1,000 per quarter; depreciation \$21,000 per quarter; miscellaneous S&A expenses \$9,000 per quarter.

***Exhibit 6-15 Constructing a selling and  
administrative budget video explanation***

Construct the selling and administrative expenses (S&A expenses) budget	Year 2 Quarters				
	Q1	Q2	Q3	Q4	Yr2 Total
Budgeted units sales					
Variable S&A expenses per unit					
Total variable S&A expenses					
Fixed S&A expenses					
Advertising					
Corporate salaries					
Insurance					
Property Taxes					
Depreciation					
Miscellaneous S&A expenses					
Total fixed S&A expenses					
Total S&A expenses					



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Check your understanding LO9





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## Budgeted income statement

### LO10

After all the other budgets are prepared, budgeted financial statements can be prepared. Standard financial statements include the income statement, balance sheet, and statement of cash flows. The income statement reports the organization's profitability during a specific period. The balance sheet reports the organization's financial position at a single point in time. The statement of cash flows reports an organization's cash inflows and outflows during a specific period. The focus of this section is the budgeted income statement.

As mentioned above, the **budgeted income statement** reports the organization's profitability. Since budgets are typically prepared prior to the budgeted period, the budgeted

income statement can be used to forecast profits for the upcoming period. The income statement for a manufacturing organization is sales less cost of goods sold equals gross margin. Selling and administrative expenses are subtracted from the gross margin to arrive at net operating income. Data to completed the budgeted income statement is taken from the sales budget, cost of goods sold budget, and selling and administrative expenses budget. The budgeted income statement for Wonderball, Inc. is provided in Exhibit 6-16.

***Exhibit 6-16 Budgeted income statement for Wonderball, Inc.***

Budgeted Income Statement Wonderball, Inc.	
Sales	\$3,915,000 (see sales budget)
Cost of goods sold	<u>1,448,550 (see cost of goods sold budget)</u>
Gross margin	\$2,466,450
Selling and administrative expenses	<u>2,033,100 (see S&amp;A expenses budget)</u>
Net operating income	<u>\$433,350</u>

**Video Illustration 6-8:**  
**Preparing the budgeted  
income statement**

Use the data provided in the sales budget, cost

of goods sold budget, and selling and administrative expenses budget to prepare the budgeted income statement.

***Exhibit 6-17 Constructing budgeted income statement video explanation***

Construct the budgeted income statement	
<div>Water Wiz Budgeted Income Statement For fiscal year 2</div>	
Sales	_____ (see sales budget)
Cost of Goods Sold	_____ (see cost of goods sold budget)
Gross Margin	
Selling and administrative expenses	_____ (see S&A expenses budget)
Net operating income	_____



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Check your understanding LO10



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## Practice Video Problems

*The chapter concepts are applied to comprehensive business scenarios in the below Practice Video Problems.*

### Practice Video Problem 6-1:

## Sales and production budgets

Alli Oop produces and sells pink basketballs for professional players and charity events. The company is entering its second year of operations. The company projects the following sales in units for the upcoming fiscal year: 8,000 units Q1; 9,300 units Q2; 6,000 units Q3; 5,000 units Q4; and 9,000 units in quarter 1 of year 3. The basketballs sell for \$18 per unit.

Alli Oop wants to maintain a desired ending finished goods inventory in the current quarter equal to 20% of the next quarter's production. The company began the first quarter of year 2 with 1,600 basketballs in the beginning finished goods inventory. In the first quarter of year 3, the desired ending finished goods inventory is projected to be 1,200 basketballs.

**Required 1:** Prepare the sales and production budgets

Sales budget	Year 2 Quarters				Year 3	
	Q1	Q2	Q3	Q4	Yr2 Total	Q1
Budgeted unit sales						
Selling price per unit						
Total sales						
Production budget	Year 2 Quarters				Year 3	
	Q1	Q2	Q3	Q4	Yr2 Total	Q1
Budgeted unit sales						
Add desired ending inventory						
Total needs						
Less beginning inventory						
Required production in units						



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**Practice Video Problem 6-2**  
**Part 1:** Budgets to determine  
product costs and cost of  
goods sold

Alli Oop produces and sells pink basketballs for

professional players and charity events. The company is entering its second year of operations. The company's production budget reported the following production in units for the upcoming fiscal year: 8,260 units Q1; 8,640 units Q2; 5,800 units Q3; 5,800 units Q4; and 8,400 units in quarter 1 of year 3.

Each basketball requires 2 pounds of rubber material at a cost of \$1.50 per pound. Alli Oop wants to maintain a desired ending raw materials inventory in the current quarter equal to 10% of the next quarter's production. The company began the first quarter of year 2 with 1,652 pounds of raw material in beginning inventory.

**Required 1:** Prepare the raw materials purchases budget

Construct the raw materials purchases budget	Year 2 Quarters				Year 3	
	Q1	Q2	Q3	Q4	Yr2 Total	Q1
Required production in units						
Raw materials required for one unit						
Total production needs						
Add desired ending inventory raw materials						
Total needs per quarter						
Less beginning inventory raw materials						
Raw materials to be purchased						
Times material cost per unit of material						
Cost of raw materials purchases						
Direct material costs per unit						
Raw material required for one unit						
Times material cost per unit of material						
Direct material costs per unit						



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## Practice Video Problem 6-2

### Part 2: Budgets to determine product costs and cost of goods sold

Alli Oop produces and sells pink basketballs for professional players and charity events. The company is entering its second year of operations. The company's production budget reported the following production in units for the upcoming fiscal year: 8,260 units Q1; 8,640 units Q2; 5,800 units Q3; 5,800 units Q4; and 8,400 units in quarter 1 of year 3.

Each basketball requires .10 direct labor hours to produce. The average pay rate for direct labor is \$18 per hour. Manufacturing overhead is projected to be \$0.50 per unit variable and fixed overhead \$45,000 per quarter.

**Required 2:** Prepare the direct labor budget and manufacturing overhead budget

Construct the direct labor budget	Year 2 Quarters				
	Q1	Q2	Q3	Q4	Yr2 Total
Required production in units					
Direct labor hours required per unit					
Total direct labor hours					
Times direct labor rate per hour					
Total direct labor costs					
<u>Direct labor costs per unit</u>					
Direct labor hours required per unit					
Times direct labor rate per hour					
Direct labor cost per unit					
Construct the manufacturing overhead budget	Year 2 Quarters				
	Q1	Q2	Q3	Q4	Yr2 Total
Required production in units					
Variable overhead rate per unit					
Total variable overhead					
Fixed overhead per quarter					
Total manufacturing overhead					
<u>Overhead applied per unit produced</u>					
Total manufacturing overhead					
Divided by total required production in units					
Total overhead applied per unit					



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## Practice Video Problem 6-2

### Part 3: Budgets to determine product costs and cost of goods sold

Alli Oop produces and sells pink basketballs for professional players and charity events. The company is entering its second year of operations. The company projects the following sales in units for the upcoming fiscal year: 8,000 units Q1; 9,300 units Q2; 6,000 units Q3; 5,000 units Q4; and 9,000 units in quarter 1 of year 3. The basketballs sell for \$18 per unit.

**Required 3:** Prepare the cost of goods sold budget

Cost of good sold budget	Year 2 Quarters				
	Q1	Q2	Q3	Q4	Yr2 Total
Sales in units (see sales budget)					
Times cost of goods sold per unit					
Total cost of goods sold					
Cost of good sold per unit					
Direct material costs per unit					(see raw materials budget)
Direct labor cost per unit					(see direct labor budget)
Total overhead applied per unit					(see manufacturing overhead budget)
Cost of goods sold per unit					



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## Practice Video Problem 6-3: Budgeted income statement

Alli Oop produces and sells pink basketballs for professional players and charity events. The company is entering its second year of operations. The sales budget reported 28,300 in total sales in units for year 2. Each basketball

sells for \$18 per unit. Total sales dollars is \$509,400. The cost of goods sold budget reported the total cost of goods sold of \$328,727. The selling and administrative budget reported total selling and administrative expenses as \$150,900.

**Required 1:** Prepare the budgeted income statement for fiscal year 2

Budgeted income statement	
	<i>Alli Oop Budgeted Income Statement For fiscal year 2</i>
Sales	
Cost of Goods Sold	_____
Gross Margin	
Selling and administrative expenses	_____
Net operating income	_____



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## Review Questions

*Review questions reinforce the chapter content.*

### **Review 6-1**



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## **Review 6-2**



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## **Review 6-3**



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## Homework Questions

*Homework questions can be used for additional practice or can be assigned in an academic setting.*

*Full feedback is not available online. Homework questions can be assigned, with auto-grading and export, to specific learning management platforms, e.g., Canvas, Blackboard, etc. Contact the author for details.*

### **Homework 6-1**





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## Homework 6-2



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## Homework 6-3



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### Homework 6-4



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### Homework 6-5



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### Homework 6-6



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## Homework 6-6



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## Homework 6-7



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7.

# FLEXIBLE BUDGETING AND PERFORMANCE EVALUATION

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### Learning Objectives LO

- LO1 Describe planning budgets
- LO2 Prepare a planning budget
- LO3 Describe the limitations of planning budgets
- LO4 Prepare a flexible budget

LO5 Prepare a flexible budget performance evaluation report

LO6 Calculate and analyze activity variances

LO7 Calculate and analyze revenue and spending variances

## Planning budgets LO1

A **planning budget** is a detailed financial plan for future time periods. An organization's collection of planning budgets is known as the **master budget**. The master budget and the processes used to create the planning budgets contained in the master budget are covered in detail in chapter 6. Planning budgets are prepared before the budgeted time period begins. For this reason, the amounts used to construct the planning budgets are estimates, not actual amounts. Organizations use historical data along with sales and production projections to make the estimates used in the planning budgets.

Estimated sales typically drive an organization's revenue, expense, and profit projections. **Cost formulas** and **revenue formulas** are used to compute the individual amounts forecasted in the planning budgets. A cost formula is used to predict the expected cost for a specific expenditure. A revenue formula is used to predict expected revenue for a given level of sales activity.

The cost and revenue formulas used for budgeting are developed based on cost or revenue behavior. Costs and revenues are classified into one of three categories of **cost behavior**—variable, fixed, or mixed. Variable costs or revenues are the same amount per unit, but the total amount depends on quantity. Fixed costs or revenues are the same in total regardless of quantity, but the per unit amount changes depending on the quantity. And mixed costs or revenues have both a variable and a fixed component.

Variable and mixed revenue formulas and cost formulas are driven by an **activity driver**, such as expected sales or production. Most revenues are considered variable, so only costs are discussed in the following category descriptions.

**Variable costs.** The cost formula for a variable cost is the cost per unit times the activity driving the cost, usually sales or production. For example, assume that shipping costs are \$4 for every unit sold. Shipping is a variable cost since it is always \$4 per unit, but the total depends on how many units are sold. The cost formula for shipping would be \$4 per unit sold, which is noted as \$4Q, where Q equals the activity driver, quantity sold in this case.

**Fixed costs.** The cost formula for fixed costs is a lump sum amount. For example, assume that rent expense is \$2,000 a month. The cost formula for rent would be \$2,000 per month in total. However, if the cost for rent is allocated to the units produced or sold, the per unit amount for rent will change depending on the quantity sold or produced. For example, if



production is 100 units, rent expense is allocated as  $\$2,000 / 100 \text{ units} = \$20$  per unit. However, if production is 1,000 units, rent expense is allocated as  $\$2,000 / 1,000 \text{ units} = \$2$  per unit. Regardless of quantity, the total is always \$2,000.

**Mixed costs.** The cost formula for mixed costs has both a variable and a fixed component. Utilities are a good example of a mixed cost. Typically, utility companies charge a fixed monthly fee plus a charge per unit for the services used. For example, assume that electricity is \$50 per month plus \$0.25 per kilowatt used. The cost formula for electricity would be \$50 plus \$0.25 times the quantity used, which is noted as  $\$50 + \$0.25Q$ , where Q equals the activity driver, kilowatts in this case.

## Prepare a planning budget

### LO2

Before a planning budget can be prepared, the **revenue formulas** and **cost formulas** necessary to complete the particular budget need to be compiled. This chapter will focus on the budgeted income statement. An income statement shows an organization's revenues less its expenses to arrive at net operating income or net operating loss. On a **traditional income statement**, costs or expenses are classified as **product** or **period**.

The example of Healthy Mats is used to illustrate how a

planning budget is prepared. Amara designed a PEMF therapy mat. The PEMF mat emits low-frequency waves. PEMF therapy is a nonpharmaceutical intervention for treating chronic pain, acute injuries, and overall cellular regeneration. The revenue formula and cost formulas for Healthy Mats' budgeted income statement are given in Exhibit 7-1.

***Exhibit 7-1 Healthy Mats revenue and costs formulas for the planning budget income statement***

Revenue and cost formulas	
Sales	\$150Q
Cost of goods sold	\$60Q
Wages and salaries	\$18,000 per month
Employee benefits	\$7,200 per month
Shipping expense	\$12Q
Rent expense	\$5,400 per month
Utilities expense	\$200 plus \$0.20Q
Insurance expense	\$930 per month
Office expenses	\$6,000 plus \$2Q

Amara uses the revenue and cost formulas given in Exhibit 7-1 to compile the planning budget income statement. Amara estimates that she will sell 700 units in December. The planning budget income statement is provided in Exhibit 7-2 below.

**Variable revenue and costs.** The revenue formula and cost formulas for sales (\$150Q), cost of goods sold (\$60Q), and shipping expense (\$12Q) are variable. Total revenue or cost

is calculated as the per unit amount times estimated sales quantity, 700 units in this case. Total sales revenue is  $700 \times \$150 = \$105,000$ , and total cost of goods sold is  $700 \times \$60 = \$42,000$ .

**Fixed costs.** Since the cost formulas for wages and salaries, employee benefits, rent expense, and insurance expense are fixed, total costs are given. Fixed costs do not change in relation to changes in sales activity.

**Mixed costs.** The cost formulas for utilities expense and office expenses are mixed, so they have a fixed and a variable component. The fixed component does not change in relation to sales quantity; however, the variable component does change in relation to sales quantity. The total cost for utilities expense is  $\$200 + (700 \times \$0.20) = \$340$ , and the total cost for office expenses is  $\$6,000 + (700 \times \$2) = \$7,400$ .

***Exhibit 7-2 Healthy Mats planning budget income statement***

<b>Healthy Mats</b>	
<b>Planning Budget Income Statement</b>	
<b>For December, 20xx</b>	
Sales (units)	<b>700</b>
Sales	\$105,000
Cost of goods sold	<u>42,000</u>
Gross margin	\$63,000
Wages and salaries	18,000
Employee benefits	7,200
Shipping expense	8,400
Rent expense	5,400
Utilities expense	340
Insurance expense	930
Office expenses	<u>7,400</u>
Net operating income	<u><u>\$15,330</u></u>

**Video Illustration 7-1:**  
**Preparing a planning budget**  
**income statement** LO2

Vera, a self-trained chef, opened a new restaurant called Vera’s Vittles in a historic, inner-city neighborhood. Her menu showcases classic Southern dishes passed down from her great

grandmother. Since opening approximately two years ago, the restaurant has received rave local reviews and was recently named the best Southern restaurant in the city. At the end of December, Vera wants to prepare a planning budgeted income statement for the upcoming month, January. Her **revenue formula** and **cost formulas** are given in the chart below. Vera estimates approximately 2,000 diners will eat at the restaurant in January. Prepare a planning budgeted income statement for Vera's Vittles for the month of January.

***Exhibit 7-3 Preparing a planning budget income statement video explanation***

	Cost/revenue formula
Sales	\$16.50Q
Cost of goods sold	\$4.25Q
Wages and salaries	\$12,000 per month
Employee benefits	\$2,000 per month
Dining supplies	\$0.75Q
Rent expense	\$1,200 per month
Utilities	\$400 plus \$0.10Q
Insurance	\$550 per month
Misc. expenses	\$1,000 plus \$0.20Q

**Vera's Vittles**  
**Planning Budgeted Income Statement**  
**For January, Year3**

# of diners (Q) \_\_\_\_\_

Sales

Cost of goods sold

Gross margin

Wages and salaries

Employee benefits

Dining supplies

Rent expense

Utilities

Insurance

Misc. expenses

Net operating income



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Check your understanding LO 1



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## Limitations of planning budgets LO<sub>3</sub>

**Planning budgets** are helpful in the planning and controlling phases of operations but not as useful for performance evaluation. During the planning phase, these budgets are used by management to help plan operations, including activities such as scheduling production, purchasing materials, and making capital investments. And during the controlling phase, planning budgets set forth revenue targets and spending limitations.

It is usually not appropriate to use a **planning budget** during the performance evaluation phase of operations. The reason is that the actual quantity sold or produced is rarely the same as the estimated quantity projected in the planning budget. Performance evaluation occurs at the end of the budget cycle and is the process of comparing the budgeted



estimates to the actual results. While planning budget quantities are usually close to actual results, it is nearly impossible to predict the actual sales quantity and costs before the period begins. If the planning budget and actual results are based on different sales quantities, they cannot be directly compared.

The example of Healthy Mats is continued to illustrate the limitations of using planning budgets for performance evaluation. Assume that the company actually sold 750 units during January. At the beginning of January, Amara generated the actual income statement showing the actual revenue earned and expenses incurred. The planning budget income statement and the actual income statement are provided in Exhibit 7-4.

***Exhibit 7-4 Healthy Mats planning budget income statement and actual income statement***

<b>Healthy Mats Planning Budget Income Statement For December, 20xx</b>		<b>Healthy Mats Actual Income Statement For December, 20xx</b>	
Sales (units)	<b>700</b>	Sales (units)	<b>750</b>
Sales	\$105,000	Sales	\$111,250
Cost of goods sold	<u>42,000</u>	Cost of goods sold	<u>45,900</u>
Gross margin	<b>\$63,000</b>	Gross margin	<b>\$65,350</b>
Wages and salaries	18,000	Wages and salaries	18,800
Employee benefits	7,200	Employee benefits	7,300
Shipping expense	8,400	Shipping expense	8,900
Rent expense	5,400	Rent expense	5,400
Utilities expense	340	Utilities expense	360
Insurance expense	930	Insurance expense	930
Office expenses	<u>7,400</u>	Office expenses	<u>7,320</u>
Net operating income	<b><u>\$15,330</u></b>	Net operating income	<b><u>\$16,340</u></b>

Refer to Exhibit 7-4 above. Since the actual sales quantity is higher than the planned sales quantity, it makes sense that both actual revenue and expenses are higher than the budgeted amounts. However, it is difficult to determine how much higher revenue and expenses should be in the actual income statement. Accordingly, it is difficult to determine if the revenue targets and expense limitations were achieved, not achieved, or exceeded.

## **Video Illustration 7-2:** **Incompatibility of planning budgets and actual results for performance evaluation**

### **LO3**

Assume that on February 1st Vera ran the below accounting report from her computerized accounting system showing the actual income statement for the month of January. The report includes the actual revenue collected from customers and the actual cash paid for expenses. During January, Vera actually served 2,400 diners. Can you evaluate Vera's actual

performance against the planning budget prepared in December?

***Exhibit 7-5 Planning budgeted income statement and actual income statement***  
***video explanation***

Vera's Vittles Planning Budgeted Income Statement For January, Year3 # of diners (Q) 2000		Vera's Vittles Actual Income Statement For January, Year3 # of diners (Q) 2400	
Sales	\$33,000	Sales	\$38,200
Cost of goods sold	8,500	Cost of goods sold	11,200
Gross margin	\$24,500	Gross margin	\$27,000
Wages and salaries	12,000	Wages and salaries	11,400
Employee benefits	2,000	Employee benefits	1,800
Dining supplies	1,500	Dining supplies	2,250
Rent expense	1,200	Rent expense	1,200
Utilities	600	Utilities	650
Insurance	550	Insurance	550
Misc. expenses	1,400	Misc. expenses	1,380
Net operating income	\$5,250	Net operating income	\$7,770



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## Check your understanding LO2



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## Prepare a flexible budget LO4

**Planning budgets** are prepared before the period begins and are based on the planned level of activity for the period. The actual level of activity, as well as the actual financial results, are known after the period is over. If the planned activity is different from the actual activity, the planning budget cannot be used to evaluate performance during the period. Instead, a flexible budget must be prepared for performance evaluation.

A **flexible budget** is the planning budget forecasted using the actual level of activity instead of the planned level of

activity. The flexible budget uses the same cost formulas as the planning budget but is prepared using the actual sales quantity as the **activity driver**. The flexible budget adjusts revenue and expenditure targets to match the actual level of activity. Reforecasting enables the user to compare flexible budget targets to actual results and evaluate actual performance.

The flexible budget income statement for Healthy Mats is provided in Exhibit 7-6. The flexible budget uses actual quantity with the planning revenue and cost formulas given in Exhibit 7-1 above. The company actually sold 750 units during January.

***Exhibit 7-6 Healthy Mats flexible budget income statement***

<b>Healthy Mats</b>	
<b>Flexible Budget Income Statement</b>	
<b>For December, 20xx</b>	
Sales (units)	<b>750</b>
Sales	\$112,500
Cost of goods sold	<u>45,000</u>
Gross margin	\$67,500
Wages and salaries	18,000
Employee benefits	7,200
Shipping expense	9,000
Rent expense	5,400
Utilities expense	350
Insurance expense	930
Office expenses	<u>7,500</u>
Net operating income	<u><u>\$19,120</u></u>

**Video Illustration 7-3:**  
**Preparing a flexible budget**  
**income statement** LO4

In December, Vera estimated approximately 2,000 diners would eat at the restaurant in January. She prepared a planning budget based on 2,000 diners. During January, Vera actually

served 2,400 diners. Her revenue formula and cost formulas are given in the chart below. Prepare a flexible budgeted income statement.

***Exhibit 7-7 Preparing a flexible budget income statement video explanation***

	Cost/revenue formula
Sales	\$16.50Q
Cost of goods sold	\$4.25Q
Wages and salaries	\$12,000 per month
Employee benefits	\$2,000 per month
Dining supplies	\$0.75Q
Rent expense	\$1,200 per month
Utilities	\$400 plus \$0.10Q
Insurance	\$550 per month
Misc. expenses	\$1,000 plus \$0.20Q

<b>Vera's Vittles</b>	
<b>Flexible Budgeted Income Statement</b>	
<b>For January, Year3</b>	
# of diners (Q)	_____
Sales	
Cost of goods sold	_____
Gross margin	
Wages and salaries	
Employee benefits	
Dining supplies	
Rent expense	
Utilities	
Insurance	
Misc. expenses	_____
Net operating income	=====





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Check your understanding LO3



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## Prepare a flexible budget performance evaluation report LOs 5,6,7

**Flexible budget variances** are used in the performance evaluation phase. A **variance** is any discrepancy found when two or more items are compared. Flexible budget variances are the discrepancies between the planning budget, flexible budget, and actual operating results.

There are two main types of variances evaluated when flexible budgets are analyzed—**activity variances** and **revenue and spending variances**. Variances are classified as favorable or unfavorable depending on the perceived effect of the difference on the organization. For example, a variance indicating an increase in revenue is considered favorable, whereas a variance indicating an increase in expenses is considered unfavorable.

**Activity variances** are the difference between the **planning budget** and the **flexible budget**. Activity variances are solely the result of changing the activity level from the planning quantity used for the planning budget to the actual quantity used for the flexible budget.

**Revenue and spending variances** are the difference between the **flexible budget** and the actual financial results. Revenue and spending variances are used to evaluate how well the organization achieved revenue, cost, and profit targets.

A flexible budget performance evaluation report shows the planning budget, flexible budget, actual results, activity variances, and revenue and spending variances. The flexible budget performance evaluation report for Healthy Mats is provided in Exhibit 7-8 and discussed below.

***Exhibit 7-8 Healthy Mats flexible budget performance evaluation report***

<b>Healthy Mats</b> <b>Flexible Budget Performance Evaluation Report</b> <b>For December, 20xx</b>							
Planning budget		Activity variances	Flexible budget		Revenue/spending variances	Actual results	
Sales (units)	700		Sales (units)	750		Sales (units)	750
Sales	\$105,000	<b>\$7,500 F</b>	Sales	\$112,500	<b>\$1,250 U</b>	Sales	\$111,250
Cost of goods sold	<u>42,000</u>	<b>3,000 U</b>	Cost of goods sold	<u>45,000</u>	<b>900 U</b>	Cost of goods sold	<u>45,900</u>
Gross margin	<b>\$63,000</b>	<b>4,500 F</b>	Gross margin	<b>\$67,500</b>	<b>2,150 U</b>	Gross margin	<b>\$65,350</b>
Wages and salaries	18,000	<b>0</b>	Wages and salaries	18,000	<b>800 U</b>	Wages and salaries	18,800
Employee benefits	7,200	<b>0</b>	Employee benefits	7,200	<b>100 U</b>	Employee benefits	7,300
Shipping expense	8,400	<b>600 U</b>	Shipping expense	9,000	<b>100 F</b>	Shipping expense	8,900
Rent expense	5,400	<b>0</b>	Rent expense	5,400	<b>0</b>	Rent expense	5,400
Utilities expense	340	<b>10 U</b>	Utilities expense	350	<b>10 U</b>	Utilities expense	360
Insurance expense	930	<b>0</b>	Insurance expense	930	<b>0</b>	Insurance expense	930
Office expenses	<u>7,400</u>	<b>100 U</b>	Office expenses	<u>7,500</u>	<b>180 F</b>	Office expenses	<u>7,320</u>
Net operating income	<b><u>\$15,330</u></b>	<b>3,790</b>	Net operating income	<b><u>\$19,120</u></b>	<b>2,780 U</b>	Net operating income	<b><u>\$16,340</u></b>

## Analyzing activity variances LO6

As stated above, activity variances are the difference between the **planning budget** and the **flexible budget**. Activity variances are solely the result of changing the activity level from the planning quantity used for the planning budget to the actual quantity used for the flexible budget. To calculate the activity variances, subtract the planning budget amount and the flexible budget amount. All variances are shown as positive numbers even if the resulting calculation is negative. For example, the activity variance for sales is  $\$105,000 - \$112,500 = \$7,500$ , the cost of goods sold activity variance is  $\$42,000 - \$45,000 = \$3,000$ , and so forth.

Activity variances are classified as favorable or unfavorable depending on the perceived effect of the difference on the organization. For example, Amara planned to earn \$105,000 in sales revenue. However, she sold more units than planned, so her projected revenue is \$7,500 higher. Since projected revenue

for the actual number of units sold is more than planned revenue, the variance is favorable (F). The \$4,500 increase in gross margin and the \$3,790 increase in net operating income are also favorable (F). Higher gross margin and net operating income means that the organization was more profitable.

The logic for analyzing expense activity variances is the opposite. She planned to spend \$42,000 on cost of goods sold. However, she sold additional units, so her projected cost of goods sold increased to \$45,000. The \$3,000 in increased cost of goods sold expense is unfavorable (U). The activity variances for fixed costs are zero since the same cost formulas are used for the planning and flexible budget. The activity variances for the remaining variable or mixed costs will be unfavorable if the actual quantity is higher than the planned quantity and favorable if the actual quantity is lower than the planned quantity.

Caution must be exercised when analyzing activity variances. Variable and mixed costs are assumed to increase and decrease in relation to sales quantity. For example, Healthy Mats sold 50 more units than they had planned. Each unit was shipped to the customer. Therefore, \$600 in additional shipping expenses is expected. If Healthy Mats had sold 50 units less than planned, variable and mixed expenses would be lower on the flexible budget. Although lower expenses are considered favorable, selling fewer units is not favorable for the organization overall.

## Analyzing revenue and spending variances LO7

Revenue and spending variances are the difference between the **flexible budget** and the actual financial results. The flexible budget and actual results are based on the same sales quantity, so they are comparable. Revenue and spending variances are used to evaluate how well the organization achieved revenue, cost, and profit targets. To calculate the revenue and spending variances, subtract the flexible budget amount and the actual amount. All variances are shown as positive numbers even if the resulting calculation is negative. For example, refer to Exhibit 7-9. The revenue variance for sales is  $\$112,500 - 111,250 = \$1,250$ , the cost of goods sold activity variance is  $\$45,000 - 45,900 = \$900$ , and so forth.

Revenue and spending variances are classified as favorable if the organization achieved its revenue, cost, and profit targets and unfavorable if it did not achieve these goals. In Exhibit 7-9, the flexible budget projected sales revenue of \$112,500, but the actual revenue was \$1,250 less. This decrease in revenue is unfavorable. The organization missed its revenue target. Amara would use this information to investigate the cause of the revenue variance and make corrections as required. She may find that she offered coupon codes in December to boost sales and did not account for this when she prepared the revenue cost formulas for the budget. Alternatively, she may find that the customer service representative offered discounts

due to shipping delays. In this case, Amara would need to investigate the delays and take corrective action if possible.

The logic used to analyze spending variances is the opposite of the logic used for revenue variances. For example, cost of goods sold was \$900 more than projected on the flexible budget. An increase in an expense is unfavorable. Amara would use this information to determine if the increased cost was due to unforeseen production issues or if the increase was permeant, such as an increase in raw materials or labor costs. Depending on the cause, she might try to resolve the production issues or increase her variable cost per unit for the cost of goods sold cost formula.

Overall, the revenue variance for net income is \$2,780 unfavorable. Healthy Mats did not meet the revenue or spending targets they projected for a sales level of 750 units. As mentioned above, the cause of each revenue and spending variance should be investigated, and corrective action should be taken when possible. If it is determined that the cause of the variance is long-term or permeant, then the revenue formulas or cost formulas used for budgeting should be updated.

## **Video Illustration 7-4:**

# Preparing flexible budget performance evaluation report and analyzing the variances LOs5,6,7

For this illustration, assume that Vera wants to analyze activity variances as well as the spending and revenue variances found when the planning budget, flexible budget, and actual results are compared. Prepare a flexible budget performance evaluation report detailing these variances.

## Exhibit 7-9 Preparing flexible budget performance evaluation report and analyzing the variances video explanation

Vera's Vittles Flexible Budget Performance Evaluation Report For January, Year 3					
Planning budget	Activity variances	Flexible budget	Revenues/spending variances	Actual results	
# of diners (Q)	2000	# of diners (Q)	2400	# of diners (Q)	2400
Sales	\$33,000	Sales	\$39,600	Sales	\$38,200
Cost of goods sold	8,500	Cost of goods sold	10,200	Cost of goods sold	11,200
Gross margin	\$24,500	Gross margin	\$29,400	Gross margin	\$27,000
Wages and salaries	12,000	Wages and salaries	12,000	Wages and salaries	11,400
Employee benefits	2,000	Employee benefits	2,000	Employee benefits	1,800
Dining supplies	1,500	Dining supplies	1,800	Dining supplies	2,250
Rent expense	1,200	Rent expense	1,200	Rent expense	1,200
Utilities	600	Utilities	640	Utilities	650
Insurance	550	Insurance	550	Insurance	550
Misc. expenses	1,400	Misc. expenses	1,480	Misc. expenses	1,380
Net operating income	\$5,250	Net operating income	\$9,730	Net operating income	\$7,770





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Check your understanding LOS



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## Practice Video Problems

*The chapter concepts are applied to comprehensive business scenarios in the below Practice Video Problems.*

### Practice Video Problem 7-1: Preparing a planning budget LO2

Wanda Wallace owns ReStore a furniture repair and restoration shop. Her sales have increased recently due to a renewed interest in reclaimed and restored furniture made popular

on cable television. While the number of furniture repairs has steadily increased, Wanda is concerned that profits are not increasing at the same pace. She decided to prepare a planning budget for March to set revenue and expense targets for the shop. She expects to repair 120 pieces of furniture during March. She developed the following revenue formula and cost formulas for the shop.

**Required 1:** Prepare ReStore’s planning budgeted income statement for March.

ReStore cost/revenue formulas	
Sales	\$175Q
Materials expense	\$35Q
Wages and salaries	\$9,000 per month
Employee benefits	\$1,200 per month
Shop supplies	\$4Q
Rent expense	\$1,000 per month
Utilities	\$150 plus \$0.25Q
Insurance	\$720 per month
Misc. expenses	\$480 plus \$0.10Q

**ReStore**  
**Planning Budgeted Income Statement**  
**For March, Year xxxx**

# of repairs (Q) \_\_\_\_\_

Sales

Expenses:

Materials expense

Wages and salaries

Employee benefits

Shop supplies

Rent expense

Utilities

Insurance

Misc. expenses

Net operating income

\_\_\_\_\_  
=====



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## **Practice Video Problem 7-2:** **Preparing a flexible budget** **LO4**

The March planning budget for Wanda's furniture repair shop, ReStore, was prepared in the first practice video problem. On April 1st the actual results for the month of March were available. She originally planned to repair 120 pieces of furniture during March but she actually repaired 145 pieces of furniture. Using the revenue formula and cost formulas for the shop, prepare a flexible budget for March.

**Required 1:** Prepare ReStore’s flexible budget for March.

ReStore cost/revenue formulas	
Sales	\$175Q
Materials expense	\$35Q
Wages and salaries	\$9,000 per month
Employee benefits	\$1,200 per month
Shop supplies	\$4Q
Rent expense	\$1,000 per month
Utilities	\$150 plus \$0.25Q
Insurance	\$720 per month
Misc. expenses	\$480 plus \$0.10Q

<b>ReStore</b>	
<b><i>Flexible Budgeted Income Statement</i></b>	
<b><i>For March, Year xxxx</i></b>	
# of repairs (Q)	_____
Sales	
Expenses:	
Materials expense	
Wages and salaries	
Employee benefits	
Shop supplies	
Rent expense	
Utilities	
Insurance	
Misc. expenses	_____
Net operating income	=====



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### **Practice Video Problem 7-3:** Prepare a flexible budget performance evaluation report and analyze the variances LOs 5,6,7

The March planning budget and flexible budget for Wanda's furniture repair shop, ReStore, were prepared in the first two practice video problems. On April 1st the actual results for the month of March were available. She originally planned to repair 120 pieces of furniture during March but she actually repaired 145 pieces of furniture.



**Required 1:** Using the data provided from the first two practice video problems prepare a flexible budget performance evaluation report and analyze the variances.

<b>ReStore</b> <b>Flexible Budget Performance Evaluation Report</b> <b>For March, Year xxxx</b>					
Planning budget	Activity variances	Flexible budget	Revenue/spending variances	Actual results	
# of repairs (Q)		# of repairs (Q)		# of repairs (Q)	
Sales	\$21,000	Sales	\$25,375	Sales	\$24,480
Expenses:		Expenses:		Expenses:	
Materials expense	\$4,200	Materials expense	\$5,075	Materials expense	\$6,800
Wages and salaries	9,000	Wages and salaries	9,000	Wages and salaries	9,000
Employee benefits	1,200	Employee benefits	1,200	Employee benefits	1,200
Shop supplies	480	Shop supplies	580	Shop supplies	640
Rent expense	1,000	Rent expense	1,000	Rent expense	1,000
Utilities	180	Utilities	186	Utilities	190
Insurance	720	Insurance	720	Insurance	680
Misc. expenses	492	Misc. expenses	495	Misc. expenses	740
Net operating income	<u>\$3,728</u>	Net operating income	<u>\$7,119</u>	Net operating income	<u>\$4,230</u>



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## Review Questions

*Review questions reinforce the chapter content.*

### Review 7-1



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### Review 7-2



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### Review 7-3



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### Review 7-4



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### Review 7-5



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## **Review 7-6**



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## **Homework Questions**

*Homework questions can be used for additional*

*practice or can be assigned in an academic setting.*

*Full feedback is not available online. Homework questions can be assigned, with auto-grading and export, to specific learning management platforms, e.g., Canvas, Blackboard, etc. Contact the author for details.*

### Homework 7-1



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### Homework 7-2



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### Homework 7-3



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### Homework 7-4



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8.

# STANDARD COSTS AND VARIANCE ANALYSIS

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## Learning Objectives LO

LO1 Describe the purpose of standard costs used for manufacturing costs

L02 Compute the direct materials price and quantity variances and explain their significance

L03 Compute the direct labor rate and efficiency variances and explain their significance

L04 Compute the variable manufacturing overhead rate and efficiency variances and explain their significance

## Purpose of standard costs L01

**Standards** are cost or revenue targets used to make financial projections and evaluate performance. The **cost formulas** used for budgeting are considered standards. Standards set forth the expected revenue or cost for a particular item. For example, if the cost formula for supplies is \$3 per unit (\$3Q), it is also considered the standard cost for supplies. Managers can use the standard cost formula to make projections about supplies expense or to evaluate the actual amount spent on supplies.

All manufacturing and the costs associated with providing services should have established **standard cost** targets. This chapter focuses on standard costs and standard cost variances related to variable manufacturing costs. Manufacturing costs, or the cost incurred to manufacture a product for resell, are

also known as product costs. As discussed in previous chapters, three categories comprise total product cost—direct material, direct labor, and manufacturing overhead. Standard costs are established for all three categories of product costs.

Standards for variable manufacturing costs include both quantity and price standards. The quantity standard establishes how much of an input is needed to make a product or provide a service. The price standard specifies how much each quantity of input should cost. These standards can be used to make financial projections and to evaluate performance by comparing the standards to actual performance at the end of the period. Any discrepancy between the standard and actual costs is known as a variance. Standard variances are considered a red flag for management to investigate and determine their cause.

Direct material and direct labor are considered variable manufacturing costs, since the total amount for these costs changes based on production. Manufacturing overhead is typically a mixed cost consisting of a variable and a fixed component. Fixed manufacturing overhead is, by definition, fixed and should not change as long as production remains within the relevant range. The fixed portion of manufacturing overhead is analyzed by comparing the projected or budgeted amount of fixed manufacturing overhead to the actual amount of fixed overhead incurred using the same process presented in the flexible budgeting chapter. The total amount of variable manufacturing overhead changes based on production so it

has a quantity and price standard. Since direct material, direct labor, and variable manufacturing overhead have quantity and price standards, they are analyzed using the standard costs variance analysis method presented in this chapter.

The example of the NoTuggins dog harness is used throughout this chapter to illustrate standard costs and standard costs variances for product costs. Brad invented NoTuggins, a revolutionary dog harness that stops dogs from pulling when connected to a leash by humanely redistributing the dog's pulling force. Dogs are unable to move forward until they quit pulling. NoTuggins was featured as the most innovative new harness by the International Kennel Association. Brad sold 150,000 units of NoTuggins during the first year of operations. Although the product was selling well, product costs were higher than expected, translating into lower profits. Brad decided to conduct a standard costs variance analysis to see if he could isolate the issue, or issues. The standard costs to make one unit of NoTuggins and the actual production costs data for the period are presented in Exhibit 8-1 below.

***Exhibit 8-1 Standard costs to make one unit of NoTuggins and the actual production data***

Standard manufacturing costs			
	Quantity	Price per quantity	Standard per unit
Direct material (flat nylon cord)	4.2 feet	\$0.50	\$2.10
Direct labor	0.25 LH*	\$18.00	\$4.50
Variable manufacturing overhead**	0.25 LH**	\$3.00	\$0.75
Total variable cost per unit			<u>\$7.35</u>

\*LH = direct labor hours

\*\*variable overhead is applied based on direct labor hours

Actual manufacturing data	
Actual production was 150,000 units of NoTuggins	
600,000 feet of material costing \$330,000 was purchased and used	
45,000 direct labor hours were worked for a total cost of \$832,500	
Total variable manufacturing overhead incurred was \$121,500.	

Total manufacturing costs variance		
Standard cost projections ( $\$7.35 \times 150,000$ units)		\$1,102,500
Actual costs incurred:		
Direct material	330,000	
Direct labor	832,500	
Variable manufacturing overhead	121,500	1,284,000
Total variable manufacturing cost variance		<u>(\$181,500)</u>

## Standard costs

As shown in Exhibit 8-1, Brad projects that the standard variable cost to make one unit of product is \$7.35. NoTuggins requires one type of direct material, a flat nylon cord. He estimates that each unit should require 4.2 feet of flat nylon cord that costs \$0.50 per foot for total direct material costs per unit of \$2.10. Each unit should require 0.25 direct labor hours to assemble at an average rate of \$18 per hour for total

direct labor costs of \$4.50 per unit. Variable manufacturing overhead costs are applied to the product based on direct labor hours. The standard variable manufacturing overhead rate is \$3 per direct labor hour. Each unit should require 0.25 direct labor hours for total variable manufacturing overhead costs per unit of \$0.75. It is important to note that cost standards are established before the work is started. Production managers are responsible for controlling costs and meeting the target cost, which is \$7.35 per unit in this case.

## Actual manufacturing data

Actual manufacturing data are collected after the period under consideration is finished. Actual data includes the exact number of units produced during the period and the actual costs incurred. During the period, Brad produced 150,000 units of NoTuggins. The actual costs and quantities incurred for direct materials, direct labor, and variable manufacturing overhead are reported in Exhibit 8-1.

## Total variable manufacturing costs variance

Refer to the bottom section of Exhibit 8-1. At the beginning of the period, Brad projected that the standard cost to produce one unit should be \$7.35. During the period, he actually

produced 150,000 units. Per the standard, total variable production costs should have been \$1,102,500 (150,000 units x \$7.35). However, Brad actually incurred \$1,284,000 in variable manufacturing costs. Actual variable manufacturing costs incurred were \$181,500 over the budgeted or standard amount.

Knowing that variable manufacturing costs were \$181,500 over budget is helpful, but it doesn't isolate the production issue or issues. Therefore, the next step is to individually analyze each component of variable manufacturing costs. The total variable manufacturing costs variance is separated into direct materials variances, direct labor variances, and variable manufacturing overhead variances. Each of these variances are discussed in detail in the following sections.

## **Video Illustration 8-1:** **Standard costs for manufacturing costs**

Patty invented a virtually indestructible bicycle lock called Lastlock. The lock is lightweight, retractable, and fits easily in a jacket pocket. Sales of Lastlock skyrocketed when a local

celebrity posted about Lastlock on social media. While the sudden increase in sales demand was exciting, Patty was not expecting the sudden increase in production so she experienced a number of production issues. In particular, she ran out of the alloy used to make Lastlock and was forced to purchase a lower quality batch from a different supplier. The lower quality batch, however, was significantly cheaper than the normal alloy. Also, to meet demand she had to hire an additional fabricator. Although the new fabricator was less experienced, her pay rate per hour was lower. Since she paid less for the material and labor, Patty assumed that at the end of the period overall manufacturing costs would be lower than projected. However, manufacturing costs were higher than expected at the end of the period. Accordingly, Patty decided to perform a standard cost variance analysis on the variable manufacturing costs.

The standard quantity and price to make one unit of Lastlock are provided below. The actual costs and quantities are also provided.

***Exhibit 8-2 Using standard costs to***



### ***analyze manufacturing costs overview and video explanation***

	Quantity	Price per quantity	Standard per unit
Direct Material (metal alloy)	3 lbs.	\$1.20	\$3.60
Direct labor	0.5 LH*	\$18.00	\$9.00
Variable manufacturing overhead**	1.5 MH*	\$2.00	\$3.00
Total cost per unit			<u>\$15.60</u>

\*LH = labor hours; MH = machine hours

\*\*variable overhead is applied based on machine hours

#### **Actual manufacturing data**

Actual production was 1,800 units of Lastlock

6,100 lbs. of material costing \$6,710 was purchased and used

1,070 direct labor hours were worked for a total cost of \$17,120

2,800 machine hours were logged and total variable overhead was \$6,300

#### **Overall manufacturing variance**

Standard cost projections ( $\$15.60 \times 1,800$  units) \$28,080

Actual costs incurred

Direct material	\$6,710	
Direct labor	17,120	
Variable overhead	6,300	30,130
Total cost variance		<u>(\$2,050)</u>



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Check your understanding LO1



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## Direct materials variances LO2

Standard costs are established for all direct materials used in the manufacturing process. Direct materials include all materials that can be easily and economically traced to the production of a product. For example, the direct materials necessary to produce a wood desk might include wood and hardware. Indirect materials are not easily and economically traced to a particular product. Examples of indirect materials are items such as nails, screws, sandpaper, and glue. Indirect materials are included in the manufacturing overhead category, not the direct materials category.

At the highest level, standard costs variance analysis compares the standard costs and quantities projected with the amounts actually incurred. Standard costs and quantities are established for each direct material. These standards are compared to the actual quantities used and the actual price paid for each category of direct material. Any variances

between standard and actual costs are caused by a difference in quantity or a difference in price. Therefore, the total variance for direct materials is separated into the direct materials quantity variance and the direct materials price variance. The template provided in Exhibit 8-3 can be used to compute the total direct material variance, direct material quantity variance, and direct material price variance.

***Exhibit 8-3 Template to compute the total direct materials variance, direct materials quantity variance, and direct material price variance***

Direct Materials Variances				
	Quantity	X	Price	= Total
Standard	Standard quantity (per unit x actual units)	X	Standard price	= Standard material costs
Less actual	Actual quantity (total)	X	Actual price	= Actual material costs
= Variance	Quantity difference		Price difference	Total difference
Direct Materials Quantity Variance = Quantity difference X Standard price				
Direct Materials Price Variance = Price difference X Actual quantity				
Proof:	DM quantity variance		\$	
	Plus DM price variance			
	Equals total difference			

To illustrate standard costs variance analysis for direct materials, refer to the data for NoTuggins in Exhibit 8-1 above. NoTuggins requires one type of direct material, flat nylon cord. The direct material standards for one unit of NoTuggins are 4.2 feet of flat nylon cord that costs \$0.50 per foot for a total direct material cost per unit of \$2.10. During the period, 600,000 feet of flat nylon cord costing \$330,000 were purchased and used.

The direct material variances for NoTuggins are presented in Exhibit 8-4 below.

***Exhibit 8-4 Direct materials variances for NoTuggins***

Direct Materials Variances					
	Quantity	X	Price	=	Total
Standard	(4 2 ft. x 150,000) 630,000 feet	X	\$0.50	=	\$315,000
Less actual	600,000 feet	X	(\$330,000/600,000) \$0.55	=	\$330,000
= Variance	30,000 F		\$(0.05) U		\$(15,000) U
Direct Materials Quantity Variance = 30,000 F * \$0.50 = \$15,000 F					
Direct Materials Price Variance = \$0.05 U * 600,000 = \$30,000 U					
Proof:	DM quantity variance		\$15,000 F		
	Plus DM price variance		\$30,000 U		
	Equals total difference		\$15,000 U		

## Total direct material variance

The standard and actual amounts for direct materials quantities, prices, and totals are calculated in the top section of the direct materials variance template. This data comes from the accounting records. After the total direct materials variance is calculated in the top section, the amounts from the top section can be plugged into the formulas given in the next section to compute the direct materials quantity and price variances. All standard cost variances are calculated using the actual production quantity as the cost driver. The goal is to determine how much should have been incurred to produce the actual quantity of units produced and compare that to how much was actually incurred to produce the actual quantity of units produced.

The direct materials variances for NoTuggins are presented

in Exhibit 8-4. Refer to the total direct materials variance in the top section of the template. Total standard quantity is calculated as standard quantity per unit times actual production or 4.2 feet of flat nylon cord per unit times 150,000 units produced equals 630,000 feet of flat nylon cord. The standard cost per foot was established as \$0.50. Total direct material costs per the standard amounts allowed are the total standard quantity of 630,000 ft. times the standard price per foot of \$0.50 equals \$315,000. Per the standard cost formulas, Brad projected he should have paid \$315,000 for the direct materials necessary to produce 150,000 units.

The total amounts for direct materials actually purchased and used are reported on the following line. Actual amounts are pulled from the accounting records. The actual quantity purchased and used to produce 150,000 units was 600,000 feet of flat nylon cord costing \$330,000. The actual price of \$0.55 per unit is not given in the actual data presented in Exhibit 8-1. However, it can be calculated by taking the total purchase price and dividing it by the total number of feet purchased.

The total variances can be calculated in the last line of the top section of the template by subtracting the actual amounts from the standard amounts. The standard quantity allowed of 630,000 feet is subtracted from the actual quantity purchased and used of 600,000 feet, yielding a variance of 30,000 feet. Variances are considered favorable (F) or unfavorable (U). Variances are favorable if the standard amount is more than the actual amount. When using the template format presented

in this chapter, positive variances are favorable and negative variances are unfavorable. In the NoTuggins example, the total standard direct materials allowed was 630,000 feet. However, they were able to produce the 150,000 units using less material, which is favorable. If the actual amount exceeds the standard amount, the variance is unfavorable (U) indicating they used or paid more than the standard amount, which is unfavorable.

The total price per unit variance is the standard price per unit of \$0.50 less the actual price paid of \$0.55 equals the price variance per unit of \$(0.05) U. This is unfavorable because they actually spent more per unit than the standards allowed. Also, on the template, negative numbers are considered unfavorable.

The total direct materials variance is calculated as the total standard costs allowed for direct materials of \$315,000 less the actual amount paid of \$330,000 equal the total direct materials variance of \$(15,000) U. Overall, Brad spent \$15,000 more on direct materials than he projected.

The completed top section of the template contains all the numbers needed to compute the direct materials quantity and price variances. Students do not need to refer to the dataset to get additional data. The direct materials quantity and price variances are used to determine if the overall variance is a quantity issue, price issue, or both.

## Direct materials quantity variance

Refer to Exhibit 8-4. The direct materials quantity variance is calculated as the total direct materials quantity difference times the standard price per unit. The direct materials quantity difference is 30,000 F. Since the quantity difference is favorable, this variance will be favorable. The standard price per unit is \$0.50. The direct materials quantity variance is  $30,000 \text{ F} \times \$0.50 = \$15,000 \text{ F}$ .

This result is interpreted as the organization saved \$15,000 in direct materials costs by using less direct material per unit than they planned. It is important to remember that standards are the planned or projected amounts. Although this is a positive variance, it should still be investigated. It could mean that the direct materials quantity standard needs to be reduced to achieve an accurate standard variable cost per unit. Or, further investigation might reveal a production error in which the units were improperly sized, which is a significant quality control issue.

## Direct materials price variance

Refer to Exhibit 8-4. The direct materials price variance is calculated as the per unit price difference times the actual quantity purchased and used. The price difference is \$(0.05) U. Since the per unit price difference is unfavorable, this variance will be unfavorable. The actual quantity purchased and used



is 600,000 feet. Actual quantity is used in this calculation to determine the total price variance for the actual quantity purchased and used during the period. The direct materials price variance is  $\$(0.05) \text{ U} \times 600,000 = \$30,000 \text{ U}$ .

This result is interpreted as the organization paid \$30,000 more for materials used in production than they planned. All variances should be investigated. This direct materials price variance could indicate a purchasing issue, such as the purchasing department paying more than the agreed-upon amount (purchase order amount). Or the cause could be a supplier or sourcing issue in which the material can be sourced cheaper elsewhere. Another possibility is that the direct material price standard needs to be increased because prices have increased. Or, it could be caused by another issue.

## **Video Illustration 8-2:** **Computing direct materials variances**

Using the standard and actual data given for Lastlock and the direct materials variance template, compute the direct materials variances.

**Exhibit 8-5 Computing direct materials variances and video explanation**

Standard manufacturing costs			
	Quantity	Price per quantity	Standard per unit
Direct Material (metal alloy)	3 lbs.	\$1.20	\$3.60
Direct labor	0.5 LH*	\$18.00	\$9.00
Variable manufacturing overhead**	1.5 MH*	\$2.00	\$3.00
Total cost per unit			<u>\$15.60</u>

\*LH = labor hours; MH = machine hours

\*\*variable overhead is applied based on machine hours

Actual manufacturing data	
Actual production was 1,800 units of Lastlock	
6,100 lbs. of material costing \$6,710 was purchased and used	
1,070 direct labor hours were worked for a total cost of \$17,120	
<u>2,800 machine hours were logged and total variable overhead was \$6,300</u>	

Direct Materials Variances				
	Quantity	X	Price	= Total
Standard	Standard quantity (per unit x actual units)	X	Standard price	= Standard material costs
Less actual	Actual quantity (total)	X	Actual price	= Actual material costs
= Variance	Quantity difference		Price difference	Total difference
Direct Materials Quantity Variance = Quantity difference X Standard price				
Direct Materials Price Variance = Price difference X Actual quantity				
Proof:	DM quantity variance	\$		
	Plus DM price variance			
	Equals total difference			



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Check your understanding LO2



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## Direct labor variances LO3

Standard costs are established for all direct labor used in the manufacturing process. Direct labor is considered manufacturing labor costs that can be easily and economically traced to the production of the product. For example, the direct labor necessary to produce a wood desk might include the wages paid to the assembly line workers. Indirect labor is labor used in the production process that is not easily and economically traced to a particular product. Examples of indirect labor include wages paid to the production supervisor or quality control team. While they are a part of the production process, it would be difficult to trace these wages to the production of a single desk. Indirect labor is included in the manufacturing overhead category, not the direct labor category.

Standard costs and quantities are established for each type of direct labor. These standards are compared to the actual

number of direct labor hours worked and the actual rate paid for each type of direct labor. When discussing direct labor, price is referred to as rate, and quantity is referred to as efficiency. Variances between the standard and actual amounts are caused by a difference in efficiency or rate. The total direct labor variance is separated into the direct labor efficiency and direct labor rate variances.

A template to compute the total direct labor variance, direct labor efficiency variance, and direct labor rate variance is provided in Exhibit 8-6.

***Exhibit 8-6 Template to compute total direct labor variance, direct labor efficiency variance, and direct labor rate variance***

Direct Labor Variances				
	Quantity	X	Rate (price)	= Total
Standard	Standard quantity (per unit x actual units)	X	Standard rate	= Standard labor costs
Less actual	<u>Actual quantity (total)</u>	X	<u>Actual rate</u>	= <u>Actual labor costs</u>
= Variance	Quantity difference		Rate difference	Total difference
Direct Labor Efficiency Variance = Quantity difference X Standard rate				
Direct Labor Rate Variance = Rate difference X Actual quantity				
Proof:	DL efficiency variance		\$	
	Plus DL rate variance		_____	
	Equals total difference		_____	

To illustrate standard costs variance analysis for direct labor, refer to the data for NoTuggins in Exhibit 8-1 above. Each unit requires 0.25 direct labor hours at an average rate of \$18 per hour for a total direct labor cost of \$4.50 per unit. During the period, 45,000 direct labor hours were worked and \$832,500 was paid for direct labor wages.

The direct labor variances for NoTuggins are presented in Exhibit 8-7 below.

***Exhibit 8-7 Direct labor variances for NoTuggins***

Direct Labor Variances					
	Quantity	X	Rate (price)	=	Total
Standard	(0.25 LH x 150,000)	37,500	X	\$18.00	= \$675,000
Less actual	45,000	X	(\$832,500/45,000)	\$18.50	= \$832,500
= Variance	(7,500) U		\$(0.50) U		\$(157,500) U
Direct Labor Efficiency Variance = 7,500 U * \$18 = \$135,000 U					
Direct Labor Rate Variance = \$050 U * 45,000 = \$22,500 U					
Proof:	DL efficiency variance		\$135,000 U		
	Plus DL rate variance		\$22,500 U		
	Equals total difference		\$157,500 U		

# Total direct labor variance

The standard and actual amounts for direct labor hours, rates, and totals are calculated in the top section of the direct labor variance template. This data comes from the accounting records. Once the top section is complete, the amounts from the top section can be plugged into the formulas to compute the direct labor efficiency (quantity) and rate (price) variances. All standard cost variances are computed using the actual production quantity. The goal is to determine how much should have been incurred to produce the actual quantity of units produced and compare that to how much was actually incurred to produce the actual quantity of units produced.

The direct labor variances for NoTuggins are presented in Exhibit 8-7. Refer to the total direct labor variance in the top section of the template. Total standard quantity is calculated

as standard quantity per unit times actual production or 0.25 direct labor hours per unit times 150,000 units produced equals 37,500 direct labor hours. The standard labor rate per hour was established as \$18. Total direct labor costs per the standard amounts allowed are calculated as total standard quantity (37,500) times standard rate per hour (\$18) equals \$675,000. During the period, Brad projected he should pay \$675,000 for direct labor to produce 150,000 units.

The actual amounts incurred are reported on the following line. Actual amounts are pulled from the accounting records. During the period, 45,000 direct labor hours were worked to produce 150,000 units at an actual cost of \$832,500. The actual hourly rate is not given in the data presented in Exhibit 8-1. However, it can be calculated by dividing the total price paid for direct labor by the total number of hours worked,  $\$832,500 / 45,000 = \$18.50$  actual rate per hour.

The total direct labor variance can be calculated in the last line of the top section by subtracting the actual amounts from the standard amounts. The standard quantity allowed of 37,500 direct labor hours less the actual hours worked of 45,000 hours yields a variance of (7,500) direct labor hours. This variance is unfavorable because the actual hours worked exceed the standard hours allowed. On the template, negative numbers are considered unfavorable. The direct labor rate per hour variance is calculated as the projected standard direct labor rate of \$18 per hour, less the actual direct labor rate of \$18.50, which yields a \$(0.50) unfavorable per hour rate

variance. The total direct labor variance is the total standard labor costs allowed of \$675,000 less the actual amount paid for direct labor of \$832,500, which is \$(157,500) unfavorable. Overall, Brad spent \$157,500 more on direct labor than projected.

The completed top section of the template contains all the numbers needed to compute the direct labor efficiency (quantity) and direct labor rate (price) variances. Students do not need to refer to the dataset to get additional data. The direct labor efficiency and rate variances are used to determine if the overall direct labor variance is an efficiency issue, rate issue, or both.

## Direct labor efficiency variance

The direct labor efficiency variance is calculated as the total direct labor hours difference times the standard direct labor rate per hour. The quantity difference is (7,500) U. Since the difference is unfavorable, this variance will be unfavorable. The standard rate per hour is \$18. The direct labor efficiency variance is  $(7,500) \text{ U} \times \$18 = \$135,000$  unfavorable.

The organization spent \$135,000 for the direct labor hours that exceeded the standard number of hours allowed. As with any variance, this is the starting point for further investigation. An investigation may reveal that employees took longer than 0.25 hours to make each unit, which could mean additional training or another appropriate solution.



## Direct labor rate variance

The direct labor rate variance is calculated as the direct labor rate difference times the actual number of direct labor hours worked. The direct labor rate difference is \$(0.50) U. Since the difference is unfavorable, this variance will be unfavorable. The actual number of hours worked is 45,000 direct labor hours. The actual number of direct labor hours worked is used in this calculation to determine the total variance amount for the actual hours worked during the period. The direct labor rate variance is  $\$(0.50) \text{ U} \times 45,000 = \$22,500 \text{ U}$ .

Due to the higher than planned hourly rate, the organization paid \$22,500 more for direct labor than they planned. This variance should be investigated to determine if the actual wages paid for direct labor can be lowered in future periods or if the standard direct labor rate per hour needs to be adjusted. For example, an investigation could reveal that the company had to pay a higher rate to attract employees, so the standard hourly direct labor rate needs to be adjusted.

### **Video Illustration 8-3:** Computing direct labor

# variances

Using the standard and actual data given for Lastlock and the direct labor variance template, compute the direct labor variances.

***Exhibit 8-8 Computing direct labor variances and video explanation***

Standard manufacturing costs			
	Quantity	Price per quantity	Standard per unit
Direct Material (metal alloy)	3 lbs.	\$1.20	\$3.60
Direct labor	0.5 LH*	\$18.00	\$9.00
Variable manufacturing overhead**	1.5 MH*	\$2.00	\$3.00
Total cost per unit			<u>\$15.60</u>

\*LH = labor hours; MH = machine hours

\*\*variable overhead is applied based on machine hours

Actual manufacturing data
Actual production was 1,800 units of Lastlock
6,100 lbs. of material costing \$6,710 was purchased and used
1,070 direct labor hours were worked for a total cost of \$17,120
<u>2,800 machine hours were logged and total variable overhead was \$6,300</u>

Direct Labor Variances				
	Quantity	X	Rate (price)	= Total
Standard	Standard quantity (per unit x actual units)	X	Standard rate	= Standard labor costs
Less actual	Actual quantity (total)	X	Actual rate	= Actual labor costs
= Variance	Quantity difference		Rate difference	Total difference
Direct Labor Efficiency Variance = Quantity difference X Standard rate				
Direct Labor Rate Variance = Rate difference X Actual quantity				
Proof:	DL efficiency variance		\$	
	Plus DL rate variance			
	Equals total difference			



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## Variable manufacturing overhead variances LO4

Standard cost projections are established for the variable and fixed components of manufacturing overhead. Manufacturing overhead includes all costs incurred to manufacture a product that are not direct material or direct labor. Examples of manufacturing overhead are indirect materials, e.g., nails and glue; indirect labor, e.g., wages for the production supervisor or quality control; and all other production costs, e.g., costs incurred on the factory, such as rent, utilities, and insurance.

The fixed component of manufacturing overhead is comprised of overhead costs that stay the same in total regardless of the quantity produced or another cost driver. For example, rent expense for the production factory is the same

every month regardless of how many units are produced in the factory. Rent expense is considered a fixed cost. Within the relevant range of production, fixed costs do not have a quantity standard, only a price standard. Fixed manufacturing overhead is analyzed by comparing the standard amount allowed to the actual amount incurred.

A cost driver, typically the production units, drives the variable component of manufacturing overhead. As with any variable cost, the per unit cost is constant, but the total cost depends on the quantity produced or another cost driver. The focus of this section is variable manufacturing overhead since it has both a quantity and price standard.

As mentioned previously, standard rates and quantities are established for variable manufacturing overhead. When discussing variable manufacturing overhead, price is referred to as rate, and quantity is referred to as efficiency. These standards are compared to the actual quantities used and the actual rate paid for variable manufacturing overhead using the same processes applied in previous sections to analyze direct materials and direct labor. Any variance between the standard costs allowed and the actual costs incurred is caused by a difference in efficiency or a difference in rate. The total variance for variable manufacturing overhead is separated into the variable manufacturing overhead efficiency variance and the variable manufacturing overhead rate variance.

A template to compute the total variable manufacturing overhead variance, variable manufacturing overhead efficiency

variance, and variable manufacturing overhead rate variance is provided in Exhibit 8-9.

*Exhibit 8-9 Template to compute total variable manufacturing overhead variance, variable manufacturing overhead efficiency variance, and variable manufacturing overhead rate variance*

Variable Manufacturing Overhead Variances				
	Quantity	X	Rate (price)	= Total
Standard	Standard quantity (per unit x actual units)	X	Standard rate	= Standard variable overhead costs
Less actual	Actual quantity (total)	X	Actual rate	= Actual variable overhead costs
= Variance	Quantity difference		Rate difference	Total difference
Variable Overhead Efficiency Variance = Quantity difference X Standard rate				
Variable Overhead Rate Variance = Rate difference X Actual quantity				
Proof:	OH efficiency variance		\$	
	Plus OH rate variance			
	Equals total difference			

To illustrate standard costs variance analysis for variable manufacturing overhead, refer to the data for NoTuggins in Exhibit 8-1 above. Variable manufacturing overhead is applied based on direct labor hours. Per the standards, the variable manufacturing overhead rate is \$3 and each unit requires 0.25 direct labor hours. The total standard variable manufacturing overhead cost per unit is \$0.75. During the period, 45,000 direct labor hours were actually worked and actual variable manufacturing overhead of \$121,500 was incurred.

The variable manufacturing overhead variances for NoTuggins are presented in Exhibit 8-10 below.

*Exhibit 8-10 Variable manufacturing overhead variances for NoTuggins*

Variable Manufacturing Overhead Variances					
	Quantity	X	Rate (price)	=	Total
Standard	(0.25 LH x 150,000) 37,500	X	\$3	=	\$112,500
Less actual	45,000	X	(\$121,500/45,000) \$2.70	=	\$121,500
= Variance	(7,500) U		\$0.30 F		\$(9,000) U
Variable Overhead Efficiency Variance = 7,500 U * \$3 = \$22,500 U					
Variable Overhead Rate Variance = \$0.30 F x 45,000 = 13,500 F					
Proof:	OH efficiency variance		\$22,500 U		
	Plus OH rate variance		<u>\$13,500 F</u>		
	Equals total difference		\$9,000 U		

## Total variable manufacturing overhead variance

The standard and actual amounts for the variable manufacturing overhead cost driver (direct labor hours in this case), the overhead rate per unit of the cost driver, and total variable manufacturing overhead are calculated in the top section of the variable manufacturing overhead variance template. This data comes from the accounting records. Once the top section is complete, the amounts from the top section can be plugged into the formulas to compute the variable manufacturing overhead efficiency (quantity) and rate (price) variances. All standard cost variances are computed using the actual production quantity. The goal is to determine how much should have been incurred to produce the actual quantity of units produced and compare that to how much was actually incurred to produce the actual quantity of units produced.

The variable manufacturing overhead variances for NoTuggins are presented in Exhibit 8-10. Refer to the total

variable manufacturing overhead variance in the top section of the template. Total standard quantity is calculated as standard quantity of the cost driver per unit times actual production, or 0.25 direct labor hours per unit times 150,000 units produced equals 37,500 direct labor hours. The standard variable manufacturing overhead rate per direct labor hour was established as \$3. Total variable manufacturing overhead costs per the standard amounts allowed are calculated as the total standard quantity of 37,500 times the standard rate per hour of \$3 equals \$112,500. During the period, Brad projected he should pay \$112,500 for variable manufacturing overhead to produce 150,000 units.

The total actual amounts incurred are reported on the next line. Actual amounts are pulled from the accounting records. During the period, 45,000 direct labor hours were worked to produce 150,000 units. The actual amount of variable manufacturing overhead incurred was \$121,500. The actual overhead rate per hour is not given in the data presented in Exhibit 8-1. However, it can be calculated by taking the total price paid for variable manufacturing overhead and dividing it by the total number of hours worked,  $\$121,500 / 45,000 = \$2.70$  actual rate per hour.

The total variances can be calculated in the last line of the top section of the template by subtracting the actual amounts from the standard amounts projected. The standard quantity allowed is 37,500 hours less the actual hours worked of 45,000 hours equals a variance of (7,500) direct labor hours. This



variance is unfavorable because the actual hours worked exceed the standard hours allowed. The variable manufacturing overhead rate per hour variance is calculated as the projected standard variable manufacturing overhead rate of \$3 per hour less the actual variable manufacturing overhead rate incurred of \$2.70 equals a \$0.30 favorable per hour rate variance. The overall rate variance is favorable since the actual rate incurred was lower than the standard rate allowed. The total variable manufacturing overhead variance is the total standard variable manufacturing overhead costs allowed of \$112,500 less the actual amount paid for variable manufacturing overhead of \$121,500 equals \$(9,000) unfavorable. Brad spent \$9,000 more on variable manufacturing overhead than he projected.

The completed top section of the template contains all the numbers needed to compute the variable manufacturing overhead efficiency (quantity) and rate (price) variances. Students do not need to refer to the dataset to get additional data. The variable manufacturing overhead efficiency and rate variances are used to determine if the overall variance is an efficiency issue, rate issue, or both.

## Variable manufacturing overhead efficiency variance

The variable manufacturing overhead efficiency variance is calculated as the quantity difference times the standard overhead rate per hour. The quantity difference is (7,500)

unfavorable. Since the difference is unfavorable, this variance will be unfavorable. The standard overhead rate per hour is \$3. The variable manufacturing overhead efficiency variance is  $(7,500) \text{ U} \times \$3 = \$22,500$  unfavorable.

Variable manufacturing overhead is applied based on direct labor hours. Since direct labor hours are the cost driver for variable manufacturing overhead in this example, the variance is linked to the direct labor hours worked in excess of the standard labor hours allowed. This overage in direct labor hours means that \$22,500 of additional variable manufacturing overhead was incurred based on the standard amount applied per direct labor hour. Inefficient use of the cost driver used to apply variable manufacturing overhead typically results in additional overhead costs.

## Variable manufacturing overhead rate variance

The variable manufacturing overhead rate variance is calculated as the overhead rate difference times the actual number of labor hours worked. The rate difference is \$0.30 favorable. Since the difference is favorable, this variance will be favorable. The actual quantity is 45,000 direct labor hours. Actual quantity is used in this calculation to determine the overhead variance for the actual number of direct labor hours worked during the period. The variable manufacturing overhead rate variance is  $\$0.30 \text{ F} \times 45,000 = \$13,500 \text{ F}$ .

The favorable manufacturing overhead rate difference indicates that the organization paid \$13,500 less for variable manufacturing overhead than projected when you consider the difference in rate per hour over the actual number of hours worked. This variance should be investigated to determine if the savings will be ongoing or temporary.

### **Video Illustration 8-4:** Computing variable manufacturing overhead variances

Using the standard and actual data given for Lastlock and the variable manufacturing overhead variance template, compute the variable manufacturing overhead variances.

***Exhibit 8-11 Computing manufacturing overhead variances and video explanation***

Standard manufacturing costs			
	Quantity	Price per quantity	Standard per unit
Direct Material (metal alloy)	3 lbs.	\$1.20	\$3.60
Direct labor	0.5 LH*	\$18.00	\$9.00
Variable manufacturing overhead**	1.5 MH*	\$2.00	\$3.00
Total cost per unit			<u>\$15.60</u>

\*LH = labor hours; MH = machine hours

\*\*variable overhead is applied based on machine hours

Actual manufacturing data	
Actual production was 1,800 units of Lastlock	
6,100 lbs. of material costing \$6,710 was purchased and used	
1,070 direct labor hours were worked for a total cost of \$17,120	
2,800 machine hours were logged and total variable overhead was \$6,300	

Variable Manufacturing Overhead Variances				
	Quantity	X	Rate (price)	= Total
Standard	Standard quantity (per unit x actual units)	X	Standard rate	= Standard variable overhead costs
Less actual	Actual quantity (total)	X	Actual rate	= Actual variable overhead costs
= Variance	Quantity difference		Rate difference	Total difference
Variable Overhead Efficiency Variance = Quantity difference X Standard rate				
Variable Overhead Rate Variance = Rate difference X Actual quantity				
<b>Proof:</b>	OH efficiency variance		\$	
	Plus OH rate variance			
	Equals total difference			



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Check your understanding LO4



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## Standard costs variance analysis and evaluation

As demonstrated in this chapter, standard costs and variance analysis are tools used to project manufacturing product costs and evaluate production performance. Standard costs variance analysis is used to determine the variances between the standard amounts projected for manufacturing costs and the actual amounts incurred. It is important to remember that standards are the planned or projected amounts. Any variance between the standard amounts allowed and actual amounts incurred should be investigated.

Refer to Exhibit 8-1. At the end of the current operating cycle, Brad determined that the actual variable manufacturing costs incurred to produce 150,000 units of NoTuggins were \$181,500 more than the standard costs projected. A summary of the direct materials, direct labor, and variable

manufacturing overhead variances is provided in Exhibit 8-12. This standard costs variance analysis report is the starting point for further investigation and corrective action if appropriate.

***Exhibit 8-12 Standard costs variance analysis report for NoTuggins***

NoTuggins Standard Costs Variance Analysis Report			
Total variable manufacturing overhead variance			(\$181,500)
Direct material quantity variance	15,000	F	
Direct material price variance	(30,000)	U	
Direct labor efficiency variance	(135,000)	U	
Direct labor rate variance	(22,500)	U	
Variable overhead efficiency variance	(22,500)	U	
Variable overhead rate variance	13,500	F	(\$181,500)
			\$0

## Standard costs variance template

A template to compute the standard cost variances related to direct material, direct labor, and variable manufacturing overhead is presented in Exhibit 8-11.

***Exhibit 8-13 Template to compute direct material, direct labor, and manufacturing overhead variances***

Direct Materials Variances				
	Quantity	X	Price	= Total
Standard	Standard quantity (per unit x actual units)	X	Standard price	= Standard material costs
Less actual	Actual quantity (total)	X	Actual price	= Actual material costs
= Variance	Quantity difference		Price difference	Total difference
Direct Materials Quantity Variance = Quantity difference X Standard price				
Direct Materials Price Variance = Price difference X Actual quantity				
Proof:	DM quantity variance		\$	
	Plus DM price variance			
	Equals total difference			
Direct Labor Variances				
	Quantity	X	Rate (price)	= Total
Standard	Standard quantity (per unit x actual units)	X	Standard rate	= Standard labor costs
Less actual	Actual quantity (total)	X	Actual rate	= Actual labor costs
= Variance	Quantity difference		Rate difference	Total difference
Direct Labor Efficiency Variance = Quantity difference X Standard rate				
Direct Labor Rate Variance = Rate difference X Actual quantity				
Proof:	DL efficiency variance		\$	
	Plus DL rate variance			
	Equals total difference			
Variable Manufacturing Overhead Variances				
	Quantity	X	Rate (price)	= Total
Standard	Standard quantity (per unit x actual units)	X	Standard rate	= Standard variable overhead costs
Less actual	Actual quantity (total)	X	Actual rate	= Actual variable overhead costs
= Variance	Quantity difference		Rate difference	Total difference
Variable Overhead Efficiency Variance = Quantity difference X Standard rate				
Variable Overhead Rate Variance = Rate difference X Actual quantity				
Proof:	OH efficiency variance		\$	
	Plus OH rate variance			
	Equals total difference			

## Practice Video Problems

*The chapter concepts are applied to comprehensive business scenarios in the below Practice Video Problems.*



## Practice Video Problem 8-1: Computing direct materials variances LO2

Kitchen Co. is experiencing production problems with SuddyBuddy, its most profitable product. Management has requested standard cost variances in order to isolate the issue. Standard and actual manufacturing cost data for SuddyBuddy are provided below.

**Required 1:** Prepare the total direct materials variance, direct materials quantity variance, and direct materials price variance.

Standard manufacturing costs			
	Quantity	Price per quantity	Standard per unit
Direct Material (hemp fiber)	4 ounces	\$0.50	\$2.00
Direct labor	0.1 LH	\$18.00	\$1.80
Variable manufacturing overhead**	0.25 MH	\$3.00	\$0.75
Total cost per unit			<u>\$4.55</u>

\*LH = labor hours; MH = machine hours

\*\*variable overhead is applied based on machine hours

Actual manufacturing data	
Actual production of SuddyBuddy was 12,000 units	
46,000 ounces of material costing \$0.55 per ounce was purchased and used	
1,320 direct labor hours were worked for a total cost of \$24,420	
2,990 machine hours were logged and total variable overhead was \$8,671	

Direct Materials Variances				
	Quantity	X	Price	= Total
Standard	Standard quantity (per unit x actual units)	X	Standard price	= Standard material costs
Less actual	Actual quantity (total)	X	Actual price	= Actual material costs
= Variance	Quantity difference		Price difference	Total difference
Direct Materials Quantity Variance = Quantity difference X Standard price				
Direct Materials Price Variance = Price difference X Actual quantity				
Proof:	DM quantity variance	\$		
	Plus DM price variance			
	Equals total difference			



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## Practice Video Problem 8-2: Computing direct labor variances LO<sub>3</sub>

Kitchen Co. is experiencing production problems with SuddyBuddy, its most profitable product. Management has requested standard cost variances in order to isolate the issue. Standard and actual manufacturing cost data for SuddyBuddy are provided below.

**Required 1:** Prepare the total direct labor variance, direct labor efficiency variance, and direct labor rate variance.

Standard manufacturing costs			
	Quantity	Price per quantity	Standard per unit
Direct Material (hemp fiber)	4 ounces	\$0.50	\$2.00
Direct labor	0.1 LH	\$18.00	\$1.80
Variable manufacturing overhead**	0.25 MH	\$3.00	\$0.75
Total cost per unit			<u>\$4.55</u>
*LH = labor hours; MH = machine hours			
**variable overhead is applied based on machine hours			

Actual manufacturing data	
Actual production of SuddyBuddy was 12,000 units	
46,000 ounces of material costing \$0.55 per ounce was purchased and used	
1,320 direct labor hours were worked for a total cost of \$24,420	
2,990 machine hours were logged and total variable overhead was \$8,671	

Direct Labor Variances				
	Quantity	X	Rate (price)	= Total
Standard	Standard quantity (per unit x actual units)	X	Standard rate	= Standard labor costs
Less actual	Actual quantity (total)	X	Actual rate	= Actual labor costs
= Variance	Quantity difference		Rate difference	Total difference
Direct Labor Efficiency Variance = Quantity difference X Standard rate				
Direct Labor Rate Variance = Rate difference X Actual quantity				
Proof:	DL efficiency variance		\$	
	Plus DL rate variance			
	Equals total difference			



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### Practice Video Problem 8-3: Computing manufacturing overhead variances LO4

Kitchen Co. is experiencing production problems with SuddyBuddy, its most profitable product. Management has requested standard cost variances in order to isolate the issue. Standard and actual manufacturing cost data for SuddyBuddy are provided below.

**Required 1:** Prepare the total manufacturing overhead variance, manufacturing overhead

efficiency variance, and manufacturing overhead rate variance.

Standard manufacturing costs			
	Quantity	Price per quantity	Standard per unit
Direct Material (hemp fiber)	4 ounces	\$0.50	\$2.00
Direct labor	0.1 LH	\$18.00	\$1.80
Variable manufacturing overhead**	0.25 MH	\$3.00	\$0.75
Total cost per unit			\$4.55

\*LH = labor hours; MH = machine hours

\*\*variable overhead is applied based on machine hours

Actual manufacturing data	
Actual production of SuddyBuddy was 12,000 units	
46,000 ounces of material costing \$0.55 per ounce was purchased and used	
1,320 direct labor hours were worked for a total cost of \$24,420	
2,990 machine hours were logged and total variable overhead was \$8,671	

Variable Manufacturing Overhead Variances				
	Quantity	X	Rate (price)	= Total
Standard	Standard quantity (per unit x actual units)	X	Standard rate	= Standard variable overhead costs
Less actual	Actual quantity (total)	X	Actual rate	= Actual variable overhead costs
= Variance	Quantity difference		Rate difference	Total difference
Variable Overhead Efficiency Variance = Quantity difference X Standard rate				
Variable Overhead Rate Variance = Rate difference X Actual quantity				
Proof:	OH efficiency variance	\$		
	Plus OH rate variance			
	Equals total difference			



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## Review Questions

*Review questions reinforce the chapter content.*

### **Review 8-1**



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## **Review 8-2**



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## **Review 8-3**



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## Homework Questions

*Homework questions can be used for additional practice or can be assigned in an academic setting.*

*Full feedback is not available online. Homework questions can be assigned, with auto-grading and export, to specific learning management platforms, e.g., Canvas, Blackboard, etc. Contact the author for details.*

### **Homework 8-1**



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## Homework 8-2



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## Homework 8-3



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9.

# DECENTRALIZED PERFORMANCE EVALUATION

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## Learning Objectives LO

LO1 Describe the advantages and disadvantages of a decentralized organizational structure

L02 Describe responsibility centers and their performance evaluation

L03 Evaluate the performance of investment centers using profit margin ratio, asset turnover ratio, and return on investment ratio

L04 Describe the advantages and disadvantages of return on investment (ROI)

L05 Describe social return on investment (SROI)

L06 Compute residual income and identify its strengths and weaknesses

## Organizational structure L01

Organizational structure is defined as the manner in which authority, responsibility, and lines of communication are arranged within an organization. Organizational structure is typically considered more centralized or decentralized.

In a centralized organization, authority and responsibility are concentrated in the highest levels of management. The rest of the organization is responsible for following orders. A small, family-owned business is more likely to have a centralized structure where the owners make most of the business decisions. Smaller organizations with fewer managerial

employees usually have a more centralized organizational structure.

In a decentralized organization, lower levels of management have the authority to make decisions and also hold some degree of responsibility for their decisions. Examples of decentralized organizations are fast-food or retail store chains such as Chipotle or Walmart. In most chain stores, store managers have the authority to make decisions regarding the daily operations of their store or location. However, some decisions are made at the corporate level and pushed down to the store managers.

Very few organizations are considered entirely centralized or decentralized. Instead, most organizations fall somewhere on the centralized spectrum. Except in very small organizations, some authority and responsibility must be delegated to lower-level employees. For example, decision-making authority is more centralized in the military, but many decisions are delegated to military branches, commands, formations, and units.

The major advantages and disadvantages of decentralization are discussed in the next section. Then the types of responsibility centers found in a decentralized organization are defined. Performance evaluation is an essential component of the operational cycle when authority and responsibility are delegated to responsibility centers. The accounting tools used for performance evaluation depend on the type of responsibility center being evaluated. In the remaining

sections of this chapter, tools used for the performance evaluation of investment centers are presented.

## Advantages of decentralization

- Higher management can focus on more significant organizational issues if routine business decisions are delegated to lower-level management.
- Lower-level employees are more involved in day-to-day operations and usually have more information about routine business than higher-level employees.
- Organizations can respond to issues more quickly when authority is delegated.
- Lower-level employees feel more empowered, which can lead to increased job satisfaction.

## Disadvantages of decentralization

- Lower-level employees may make decisions without fully understanding the impact on the larger organization.
- The motivation of an employee may conflict with the objectives of the overall organization. For example, an employee might be concerned with getting resources for a particular department or for personal promotion. When authority is delegated to more employees the



potential for personal conflict increases.

Check your understanding LO1



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## Responsibility centers and performance evaluation LO2

Responsibility centers are individual segments within an organization to which authority and responsibility have been delegated. There are four main types of responsibility centers—revenue centers, cost centers, profit centers, and investment centers.

## Revenue centers

A revenue center is an organizational unit solely responsible for generating revenue for the organization. Managers of revenue centers usually have authority and responsibility over revenues or sales but little authority over costs, profits, or purchasing long-term, capital assets. The sales staff in a telemarketing organization is an example of a revenue center. Actual revenues or sale data are used to evaluate performance in a revenue center. Costs and investments in assets are not evaluated at this level. Performance evaluation for revenue centers typically involves comparing the actual revenue generated with revenue projections. Flexible budgeting is commonly used for performance evaluation in revenue centers. Flexible budgeting is presented in chapter 7 of this textbook.

## Cost centers

A cost center is an organizational unit that incurs costs but is not responsible for generating revenue or profit. Managers of cost centers usually have authority and responsibility for the costs associated with operating a particular segment within the organization. Managers of cost centers typically don't have responsibility for revenues, profits, or purchasing long-term, capital assets. Administrative departments within an organization, such as marketing, accounting, or human

resources, are examples of a cost centers. While these departments don't usually generate sales, they are responsible for the costs associated with daily departmental operations. In a cost center, the actual costs incurred are evaluated whereas revenue and investments in assets are not considered at this level. Performance evaluation for cost centers typically involves comparing the actual costs incurred with cost projections. Flexible budgeting and standard cost variance analysis, presented in chapters 7 and 8 respectively, are two examples of tools used for performance evaluation in cost centers.

## Profit centers

A profit center is an organizational unit responsible for generating profits for the organization. Profit is calculated as sales or revenues less the costs, also known as expenses, associated with generating the revenue. Managers of profit centers have responsibility for both revenues and costs. Managers of profit centers do not have responsibility for purchasing or investing in long-term, capital assets. Performance evaluation for profit centers typically involves comparing actual profits to projected profits. As with cost and revenue centers, flexible budgeting presented in chapter 7, is commonly used for performance evaluation in profit centers.

## Investment centers

The entire organization is considered an investment center. The organization may also have smaller investment centers embedded within the overall structure, such as product lines or geographic locations. Managers of investment centers usually have authority and responsibility for the revenues, costs, and investments in assets associated with the overall organization or a particular segment within the organization. The remainder of this chapter focuses on performance evaluation for investment centers.

Check your understanding LO2



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## Investment centers and performance evaluation LO<sub>3</sub>

Investment centers are responsible for generating revenues, controlling costs, and earning a profit on the organization's investment in operating assets. Operating assets are assets that are used during the normal course of business operations, such as buildings, equipment, furniture, vehicles, or technology. Non-operating assets are assets that are not used during the normal course of business operations and are commonly considered investment assets. Examples of non-operating assets include investments in other companies or undeveloped land purchased for future use.

The goals of performance evaluation for investment centers are to analyze a manager's ability to generate revenue, control costs, and maximize profitability on the organization's investment in operating assets. This section discusses four tools commonly used to evaluate the performance of investment centers: profit margin ratio, asset turnover ratio, return on investment ratio, and residual income. The example of Digital Designs is used to illustrate these tools.

Digital Designs, LLC creates custom digital technologies and advertising solutions for businesses operating in the online space, including websites, online storefronts, digital advertising campaigns, and social media assets. Dalia, the CEO, is evaluating the organization's overall performance.

The Income Statement and select data from the company's Balance Sheet are provided in Exhibit 9-1 below.

***Exhibit 9-1 Financial data for Digital Designs, LLC***

<b>Digital Designs, LLC</b>	
<b>Income Statement</b>	
<b>Year ended December 31, 20xx</b>	
Sales	\$840,000
Cost of goods sold	112,000
Gross margin	\$728,000
Wages and benefits	186,000
Operating expenses	390,600
Net operating income (EBIT)	\$151,400
Interest expense	30,000
Income tax expense	\$12,400
Net Income	\$109,000

<b>Digital Designs, LLC</b>		
<b>Select Balance Sheet Data</b>		
	Prior year balance	Current year balance
Assets		
Cash	\$190,000	\$196,600
Accounts receivable	42,000	45,000
Property, plant and equipment	984,000	936,000
Total operating assets	\$1,216,000	\$1,177,600
Investment in Media Mind, Inc.	24,000	27,000
Total assets	\$1,240,000	\$1,204,600

## Profit margin ratio

The profit margin ratio is a measure of profitability. This ratio calculates net operating income as a percentage of sales. Net operating income is typically used for this ratio, which is net income before interest expense and taxes, also commonly referred to as earnings before interest and taxes, or EBIT for short. This ratio measures a manager's ability to generate sales, control costs, and generate profits. The formula to calculate the profit margin ratio is provided in Exhibit 9-2.

### ***Exhibit 9-2 Profit margin ratio***

$$\text{Profit margin ratio} = \frac{\text{Net operating income}}{\text{Sales}}$$

Refer to the Digital Designs data in Exhibit 9-1. Net operating income and sales are reported on the Income Statement. The terms income and profit can be used interchangeably in this context. Net operating income represents the net profit earned from business operations before interest expense and income tax expense are deducted. Net operating income is commonly referred to as earnings before interest and taxes or EBIT. Profit margin is expressed as a percentage. Digital Design's profit margin is calculated as  $\$151,400 / \$840,000 = 18\%$  (rounded). Digital Designs returns 18% in net operating profit for every dollar of sales.

Managers should focus on increasing revenues while

decreasing costs to improve this ratio. The profit margin ratio is sufficient to evaluate profitability, which is a manager's ability to generate revenues and control costs. However, this ratio does not examine revenues or net operating income in relation to the organization's investment operating assets. Therefore, the asset turnover ratio is used to a manager's ability to generate revenues using the organization's operating assets.

## Asset turnover ratio

The asset turnover ratio is considered a measure of efficiency. This ratio measures how efficiently an organization is using its operating assets to generate sales. The ratio calculates sales as a percentage of average operating assets. Operating assets are defined as the assets used during the ordinary course of business operations but not those assets held for long-term investment or future use. This ratio uses an average of operating assets. For financial ratio analysis, averages are used to smooth out fluctuations caused by periodic changes in certain asset and equity accounts. For example, purchasing a large amount of inventory or new equipment just before the end-of-year financial data are reported could cause a temporary inflation in operating assets. Averages used for financial ratio analysis typically include two years or periods, the prior and current periods. The formula to calculate the asset turnover ratio is provided in Exhibit 9-3.

### ***Exhibit 9-3 Asset turnover ratio***



$$\text{Asset turnover ratio} = \frac{\text{Sales}}{\text{Average operating assets}}$$

Refer to the Digital Designs data in Exhibit 9-1 above. Sales are reported on the Income Statement, and assets are reported on the Balance Sheet. Sales are \$840,000. The investment in Media Minds, Inc. is considered a non-operating asset, so total assets are not used for this calculation. Data for operating assets from the beginning and end of the year, \$1,216,000 and \$1,177,600, respectively, are used to compute average operating assets. Average operating assets are  $(\$1,216,000 + \$1,177,600) / 2 = \$1,196,800$ . Asset turnover is commonly expressed as a multiple of times. Digital Design's asset turnover is calculated as  $\$840,000 / \$1,196,800 = 0.702$  (rounded) times. On every dollar invested in operating assets, Digital Designs returns 0.702 times that in sales dollars.

The asset turnover ratio measures how efficiently managers purchase the operating assets used by an organization. A business organization is a collection of assets and people. The selection of assets an organization can purchase is unlimited, so evaluating how efficiently managers make purchasing decisions is critical. The goal is to maximize spending on assets that generate revenues and minimize spending on non-essential assets that don't generate revenues.

To improve this ratio, managers should focus on increasing sales revenue and minimizing spending on non-essential assets that don't generate revenues. While the asset turnover ratio is sufficient to evaluate how efficiently an organization can use its

operating assets to generate sales revenue, it does not consider a manager's ability to control costs and generate profits.

## Return on investment (ROI) ratio

The return on investment (ROI) ratio is a measure of both profitability and efficiency. This ratio measures how efficiently an organization can use its operating assets to generate net profit or net operating income. It calculates net operating income as a percentage of average operating assets. Because of its simplicity and versatility, ROI is a widely used performance measure for entire organizations, investment centers within organizations, and specific projects or investments. The formula to calculate the ROI ratio is provided in Exhibit 9-4.

### ***Exhibit 9-4 Return on investment ratio***

$$\text{Return on investment (ROI) ratio} = \frac{\text{Net operating income}}{\text{Average operating assets}}$$

Refer to the Digital Designs data in Exhibit 9-1. Net operating income is reported on the Income Statement, and assets are reported on the Balance Sheet. Net operating income is \$151,400. To compute average operating assets data from the beginning and end of the year are given, \$1,216,000 and \$1,177,600, respectively. The investment in Media Minds, Inc. is considered a non-operating asset, so total assets are not used for this calculation. Average operating assets are  $(\$1,216,000 + 1,177,600) / 2 = \$1,196,800$ . ROI is commonly expressed as

a percentage. Digital Design's ROI is calculated as  $\$151,400 / 1,196,800 = 12.7\%$  (rounded). The company generates a 12.7% return in net operating income or profit for every dollar invested in operating assets.

The ROI ratio measures the return or profitability of an investment relative to its cost. As mentioned above, an organization is a collection of assets and people. At the organizational level, ROI measures the net profit generated by an organization's operating activities relative to its investment in operating assets. To improve this ratio, managers should focus on increasing sales revenue, decreasing costs, and selecting the optimal mix of operating assets.

## Relationship between ROI, profit margin, and asset turnover ratios

ROI, profit margin, and asset turnover are related. In mathematical terms, ROI equals profit margin times asset turnover as shown in Exhibit 9-5.

### *Exhibit 9-5 Relationship between ROI, profit margin, and asset turnover ratios*

$$\begin{array}{rclcl} \text{ROI} & = & \text{Profit margin} & \times & \text{Asset turnover} \\ \frac{\text{Net operating income}}{\text{Average operating assets}} & = & \frac{\text{Net operating income}}{\text{Sales}} & \times & \frac{\text{Sales}}{\text{Average operating assets}} \end{array}$$

ROI for Digital Designs can be calculated as profit margin

18% x asset turnover 0.702 = ROI 12.636% (slight difference due to rounding). The formula to demonstrate this relationship, is presented in Exhibit 9-6.

***Exhibit 9-6 Digital Designs ROI, profit margin, and asset turnover ratios***

$$\begin{array}{rcccl} \text{ROI} & = & \text{Profit} & \times & \text{Asset} \\ & & \text{margin} & & \text{turnover} \\ \hline \frac{151,400}{1,196,800} & = & \frac{151,400}{840,000} & \times & \frac{840,000}{1,196,800} \end{array}$$

## Using ROI to evaluate investments

ROI can also be used to evaluate the profitability of investments in specific projects relative to the projects' cost. To illustrate, assume that Digital Designs is considering purchasing a new rack of servers to store data onsite instead of outsourcing server space. Cost and revenue data for the proposed new server project are provided in Exhibit 9-7.

***Exhibit 9-7 Cost and revenue data for new server project***

<b><i>Investment in new server</i></b>	
Server equipment costs	\$27,000
Projected revenue	\$15,000
Projected expenses	\$12,000

When computing ROI for a specific investment or project, the project's cost and projected net operating income are used. The new server equipment costs \$27,000. The project's net operating income is projected revenue less expenses or \$15,000 – 12,000 = \$3,000. ROI for the new server project is  $\$3,000 / 27,000 = 11.1\%$  (rounded).

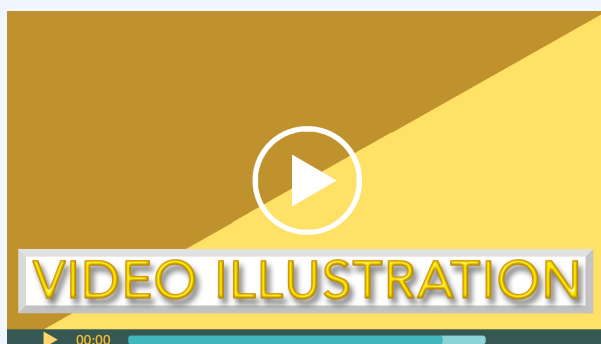
### **Video Illustration 9-1: Return on investment (ROI), profit margin, and asset turnover ratios**

Ashanti is the founder of a successful multi-state retail chain that specializes in office and home décor. She reported the following results for last month.

Compute her profit margin, asset turnover, and return on investment (ROI) ratios.

***Exhibit 9-8 Computing ROI, profit margin, and asset turnover ratios and video explanation***

$$\text{ROI} = \frac{\text{Net operating income}}{\text{Average operating assets}} = \frac{\text{Profit margin}}{\frac{\text{Net operating income}}{\text{Sales}}} \times \frac{\text{Asset turnover}}{\frac{\text{Sales}}{\text{Average operating assets}}}$$



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Check your understanding L03



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## Advantages and disadvantages of return on investment (ROI) LO4

The return on investment (ROI) ratio is widely used for performance evaluation in the business and financial sectors because it has significant advantages. Most importantly, ROI is easy to compute, and the required financial data is readily available. ROI measures an organization's profitability on its assets, encouraging the generation of maximum profits and the optimum use of assets. And ROI is a good measure for comparative analysis. ROI can be used to compare the efficiency and profitability between organizations, individual units within an organization, or specific projects or investments.

ROI also has disadvantages. A significant limitation is that ROI focuses exclusively on current profitability so long-term goals, social responsibility, and environmental benefits are often ignored. Focusing on short-term profits can incentivize some employees to make decisions that have short-term gains but are not beneficial to the organization, employees, or the environment in the long term. For example, managers may cut funds for employee training or product development because these costs are incurred immediately, whereas the benefit may not be realized until a future period. Another limitation is that organizations with a high ROI may reject profitable



investments with long-term benefits if accepting the investment lowers the current ROI.

To illustrate, refer to the data in Exhibit 9-9. Assume that Digital Designs requires a minimum new investment ROI of 10%. The current ROI for Digital Designs is 12.7%. The ROI for the new server project is 11.1%, which meets the minimum new investment ROI of 10%. Therefore, the server project could be considered an acceptable investment. However, since the ROI for the new server project is lower than the company's current ROI, this investment would decrease the company's ROI to 12.6%. If management is evaluated on ROI, they might reject the server project even though it meets the company's minimum requirement. If there are potential projects with higher ROIs, the server project might not be the best investment. However, the server project might be unduly rejected if investment possibilities with higher ROIs are unavailable or if the server project has long-term benefits.

***Exhibit 9-9 Digital Designs ROI comparison with server project***

Digital Designs (current)		Investment in Server Project		Digital Designs with new servers	
Net operating income	\$ 151,400	Net operating income	\$ 3,000	Net operating income	\$ 154,400
Average operating assets	\$1,196,800	Average operating asset	\$27,000	Average operating assets	\$1,223,800
ROI	12.7%	ROI	11.1%	ROI	12.6%

## **Video Illustration 9-2:** Computing return on investment (ROI) for an organization and a project within the organization and illustrating a disadvantage of ROI

NewAge Sound is a successful audio company. The company requires a minimum new investment ROI of 15%. Financial data for the company's most recent fiscal year is provided below. The company is considering investing in a new piece of sound equipment that can be used to securely transmit data within a small space. The equipment can be rented by event organizers to verify ticket data at events. Projected financial data for the new equipment is also provided below.

***Exhibit 9-9 Computing ROI for multiple scenarios and video explanation***

Company before investment		New sound equipment	
Sales	\$ 19,000,000	Sales	\$ 200,000
Operating expenses	\$ 17,500,000	Operating expenses	\$ 100,000
Average operating assets	\$ 8,000,000	Cost of equipment (asset)	\$ 600,000

Calculate the return on investment (ROI) for the company before the investment, the potential investment in the new equipment, and the company if the investment in the equipment is made.

ROI–company before investment

ROI–investment in new sound equipment

ROI–company with sound equipment



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Check your understanding LO4



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## Social return on investment (SROI) LO<sub>5</sub>

Social return on investment (SROI) is a relatively new tool used by organizations to quantify social responsibility and environmental benefits. As mentioned previously, one of the major disadvantages of traditional return on investment (ROI) is that it focuses almost exclusively on short-term profitability. Conventional ROI ignores social responsibility and environmental benefits. Accordingly, many organizations do not consider projects that create or maintain social value when ROI is the only performance measure. SROI is a measure that attempts to quantify social and environmental benefits. Organizations can use SROI to measure the value that their investments create for the community, society, or the environment.

One way to quantify a project's social return is assigning

monetary amounts to social benefits. This process is known as calculating a project's social impact value. Determining the social impact value is inherently problematic. Organizations and researchers are starting to introduce methodologies to quantify social impact value. Social impact value attempts to quantify the project's social outputs, outcomes, and impacts. However, placing a quantitative value on outcomes or impacts, such as cleaner water or deforestation reduction, presents challenges for organizations, accountants, and financial analysts. Once the social impact value is assigned, the below ratio can be used to compute SROI.

***Exhibit 9-10 Social return on investment ratio***

$$\text{Social return on investment (SROI)} = \frac{\text{Social impact value}}{\text{Initial investment}}$$

## **Video Illustration 9-3: An economic approach to social return on investment**

Financial economist Ralph Chami is an assistant director at the International Monetary Fund (IMF) and the cofounder of Blue Green Future

and Rebalance Earth. He's developed a novel way to tackle both climate change and biodiversity loss: namely, to reposition species such as whales and elephants as crucial allies in the quest to sequester carbon, secure climate-resilient ecosystems and generate income for local communities. Chami himself experienced the majesty of whales firsthand in the Sea of Cortez in 2017.

Chami advocates for integrating natural capital into our economy, bringing together investors, conservationists and policymakers. "We're seeking to build a new economic paradigm that is nature-positive and promises to deliver sustainable and shared prosperity to all," he says.



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## Check your understanding LO5



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## Residual income LO6

Residual income is a tool used to evaluate investment center



performance. Residual income is the amount of income earned above a certain required minimum return. Organizations establish their minimum required return by considering inputs such as the cost of capital and desired profitability. The formula to calculate residual income is provided in Exhibit 9-11.

***Exhibit 9-11 Residual income formula***

$$\text{Residual income} = \text{Net Operating income} - \left[ \text{Average operating assets} \times \text{Minimum rate of return} \right]$$

Residual income produces the dollar amount of net income above or below the required minimum return. Providing a dollar amount instead of a percentage is both an advantage and disadvantage of using residual income to evaluate performance. The advantage is that positive residual income indicates that a project produces more than the minimum required return, meaning the project should be considered. The disadvantage of evaluating a dollar amount is that it is difficult to determine the actual return percentage above or below the minimum required return.

Like ROI, residual income can be used to evaluate the overall organization, segments within the organization, or potential investments. To illustrate, refer to the Digital Designs data provided in Exhibit 9-12. Assume that Digital Designs requires a minimum rate of return of 10%.

***Exhibit 9-12 Data for Digital Designs to compute residual income***

<i>Digital Designs (current)</i>			<i>Investment in Server Project</i>		
Net operating income	\$	151,400	Net operating income	\$	3,000
Average operating assets	\$	1,196,800	Average operating assets	\$	27,000

Residual income for the organization is calculated as  $\$151,400 - (1,196,800 \times 10\%) = \$31,270$ .

Residual income for the investment in the server project is calculated as  $\$3,000 - (27,000 \times 10\%) = \$300$ .

Digital Designs is currently earning \$31,270 of residual net operating income above the minimum required threshold of 10%. The proposed investment in the new server project would provide \$300 of residual net operating income above the minimum required threshold of 10%. Residual income for the organization and the new server project is positive, meaning that both returns on investment exceed the minimum required return. Since the output is a dollar amount, this formula does not provide the exact percentage of return. The return on investment (ROI) ratio can be used to determine the actual return on investment percentage.

If residual income is negative, the net operating income provided by the organization or investment does not meet the minimum required return. Caution should be used when evaluating a negative residual income. A negative amount only shows that the organization or investment is not returning the minimum required return. A negative residual income does not always mean that the organization or investment is not producing any return on investment. For example, a projected investment that returned 9% of operating income on operating

assets would result in a negative residual income when a 10% threshold is used.

### **Video Illustration 9-3:** Computing residual income for an organization and a project within the organization

NewAge Sound is a successful audio company. The company requires a minimum ROI of 15% on new investments. Financial data for the company's most recent fiscal year is provided below. The company is considering investing in a new piece of sound equipment that can be used to securely transmit data within a small space. The equipment can be rented by event organizers to verify ticket data at events. Projected financial data for the new equipment is also provided below.

***Exhibit 9-12 Computing residual income for multiple scenarios and video explanation***

Company before investment		New sound equipment	
Sales	\$ 19,000,000	Sales	\$ 200,000
Operating expenses	\$ 17,500,000	Operating expenses	\$ 100,000
Average operating assets	\$ 8,000,000	Cost of equipment (asset)	\$ 600,000

Calculate the residual income for the company before the investment, the residual income for the investment, and the residual income after the investment

Residual income–company before investment

Residual income–investment in new sound  
equipment

Residual income–company with sound  
equipment



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Check your understanding LO6



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## Practice Video Problems

*The chapter concepts are applied to comprehensive business scenarios in the below Practice Video Problems.*

### Practice Video Problem 9-1: Profit margin, asset turnover, and ROI

Krishna Patel owns a local accounting and tax firm. She reported the following results for the most recent fiscal year.

Sales	\$ 1,000,000
Operating expenses	\$ 850,000
Average operating assets	\$ 910,000

**Required 1:** Compute profit margin, asset turnover, and return on investment (ROI)

Profit margin

Asset turnover

Return on investment (ROI)



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## **Practice Video Problem 9-2:** Computing return on investment (ROI) and residual income for an organization and a project within the organization

Lilo Alana is the owner of the Hawaiian Grill a new restaurant located in a suburb just south of the city. She is considering expanding her operations by purchasing a food truck so she can serve the downtown lunch crowd. Financial data for her most recent year of operations as



well as data for the new food truck is provided below. Lilo requires a 15% minimum return on investments.

Company before investment		Investment in food truck	
Sales	\$ 300,000	Sales	\$ 15,000
Operating expenses	\$ 225,000	Operating expenses	\$ 6,000
Average operating assets	\$ 250,000	Cost of equipment (asset)	\$ 36,000

**Required 1:** Calculate the return on investment (ROI) and residual income for the company before the investment and the ROI and residual income for the proposed food truck investment.

ROI and residual income company

ROI and residual income food truck investment



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## Review Questions

*Review questions reinforce the chapter content.*

### Review 9-1



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## Review 9-2



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## Review 9-3



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### Review 9-4



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### Review 9-5



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### Review 9-6



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## Homework

*Homework questions can be used for additional practice or can be assigned in an academic setting. Full feedback is not available online. Homework questions can be assigned, with auto-grading and export, to specific learning management platforms, e.g., Canvas, Blackboard, etc. Contact the author for details.*

### Homework 9-1



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### Homework 9-2



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### Homework 9-3



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## Homework 9-4



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## Homework 9-5



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## Homework 9-6



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10.

# DIFFERENTIAL DECISION MAKING

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## Learning Objectives LO

LO1 Define differential decision making

LO2 Identify relevant and irrelevant costs of differential decision making

LO3 Prepare the analysis for an add or drop a segment decision

LO4 Prepare the analysis for a make or buy decision

LO5 Prepare the analysis for a special order decision

LO6 Prepare the analysis for a sell or process further decision

# Differential decision making

## LO1

Informed decision making is required to effectively run an organization. Managers must decide what products or services to sell, what prices to charge, what assets to purchase, and how to maximize profits. In most cases, managers are choosing between at least two competing alternatives. Therefore,

effective managerial decision making aims to compare the costs and benefits of the alternatives and select the alternative that yields the most benefit to the organization.

When a manager is comparing the costs and benefits of competing alternatives, they only need to consider relevant financial data. Generally, managerial decisions are based on relevant costs or benefits. Relevant costs or benefits are defined as costs or benefits that differ between one or more alternatives. Differential decision making is the process of analyzing relevant costs and benefits to make managerial decisions.

This chapter focuses on using relevant costs to make specific managerial decisions. Identifying relevant costs and benefits for differential decision making is covered in the next section. Differential decision making tools for four common managerial decisions are covered in the remaining sections. Specifically, tools used to inform the following decisions are illustrated: adding or dropping a segment; making or buying (outsourcing); accepting or rejecting a special order; and selling or further processing a joint product.

Check your understanding LO1



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## Relevant and irrelevant costs of differential decision making LO<sub>2</sub>

Relevant costs or benefits are defined as costs or benefits that differ between alternatives. If a cost or benefit does not differ between alternatives, it is not considered relevant to the decision. If a cost or benefit differs between alternatives, it is considered relevant to the decision.

The theory underlying the use of relevant data is that costs or benefits that do not differ would not change regardless of which decision is made, so they are irrelevant. Since the costs are the same regardless, it is unnecessary to consider them when deciding between two or more alternatives. Irrelevant

costs or benefits are considered unavoidable, whereas relevant costs or benefits are considered avoidable.

To illustrate the concept of relevant costs, assume that Kendra is deciding if she wants to make dinner at home or go out to dinner. Kendra does not need to compile all of her personal financial information, e.g., income, rent, and other expense data, to make this decision. Her income and monthly rent payment are the same regardless of whether she makes the meal or goes out to eat. Since these costs are the same for both alternatives, they are irrelevant.

Only the costs and benefits that are different between the alternatives are relevant. Examples of costs that differ between the two alternatives are the cost of the food required to make the meal at home, the cost of the restaurant meal, and the cost of gas or parking necessary to go out to eat. If she decides to make the meal, she must purchase groceries. If she chooses to go out to eat, she does not need to buy the groceries to make the meal. This cost differs between the alternatives, so it is relevant to this decision. In other words, Kendra can avoid the cost of purchasing groceries if she decides to go out to dinner. Therefore, it is an avoidable cost. Avoidable costs are always relevant.

Sunk costs are not relevant to a decision. Sunk costs are costs that have already been incurred and, therefore, cannot be avoided. For example, assume that Kendra owns her automobile. The original cost of purchasing the automobile is considered a sunk cost when considering the cost of driving

to the restaurant. Any additional cost to operate the car, such as gas, would be relevant if she incurs the cost to drive to the restaurant but does not incur the cost to eat at home.

## Analyzing fixed costs for relevancy

Fixed costs are typically considered in differential decision making involving segments within an organization such as individual products, product lines, geographic locations, or departments. Fixed costs can be challenging to analyze since some fixed costs are generated by a particular segment, and some fixed costs are shared by multiple segments. Therefore, fixed costs are divided into two categories, traceable fixed costs and common fixed costs. Traceable and common fixed costs are discussed in detail in Chapter 5, Segment Income Reporting.

Traceable fixed costs are costs that can be traced directly to an organizational segment. Typically, traceable fixed costs can be avoided if the segment is eliminated. Traceable fixed costs that can be avoided are relevant to the decision.

Common fixed costs are fixed costs that are common to or shared by more than one organizational segment. Managers must analyze common fixed costs to determine if any portion of the cost can be eliminated under any of the potential alternatives. Common fixed costs are not relevant to a decision if they are not eliminated under any of the alternatives. Common fixed costs that cannot be eliminated are

unavoidable. On the other hand, common fixed costs are relevant to a decision if they can be eliminated or avoided.

For example, assume that a small drug store has two departments—prescription medications and over-the-counter medications. Both departments are housed in the same building. The cost of rent for the building is considered a common fixed cost since both departments exist in the same building. The cost for rent would not be eliminated if one of the departments is eliminated. Since the cost of rent is unavoidable regardless of what segments are housed within the building, it is not considered relevant to a decision about one of the segments.

Check your understanding LO2



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## Add or drop a segment LO<sub>3</sub>

Managers can use differential decision making tools to inform decisions about adding or dropping a segment within an organization. Examples of business segments include product lines, geographic locations, or departments. Organizations must evaluate the products and services they offer and determine the product mix or segment structure that best meets their objectives. Differential decision analysis, based on analyzing relevant costs, can be used to quantify the effects of changing the segment structure, such as adding or dropping a segment. Of course, both quantitative and qualitative factors must be considered for any decision.

The example of Shrooms, an organic mushroom farm, is used to illustrate the differential decision making tools



presented in this chapter. Shrooms grows organic mushrooms for the restaurant industry. Shrooms is a mid-sized, business-to-business supplier in the restaurant industry known for providing high-quality mushrooms at a reasonable cost. Shrooms offers two product lines, cremini mushrooms and shiitake mushrooms. Carlos, the owner of Shrooms, is concerned because the shiitake product line is losing money. The sales price for shiitake mushrooms is four times higher than cremini, so there is less demand. The cost incurred to grow both types of mushrooms is roughly equivalent. He grows and sells 500,000 pounds of cremini and 48,000 pounds of shiitake. He is considering dropping the shiitake product line. The segmented income statement for Shrooms is provided in Exhibit 10-1.

***Exhibit 10-1 Segmented Income Statement for Shrooms***

Shrooms Income Statement For Quarter 1, 20xx			
	Total Company	Product lines	
		Cremini	Shiitake
Sales	\$ 1,202,400	\$ 865,728	\$ 336,672
Variable expenses	360,720	216,432	144,288
Contribution margin	\$ 841,680	\$ 649,296	\$ 192,384
Fixed expenses:			
Building and maintenance	178,700	128,664	50,036
Selling and administrative	536,600	386,352	150,248
Net income	\$ 126,380	\$ 134,280	\$ (7,900)

At first glance, it might appear that Shrooms' net income would increase by \$7,900 if the shiitake product line were

dropped since this is the amount of net loss currently allocated to the shiitake product line. This conclusion would be in error. It does not consider that some the costs allocated to the shiitake product line may not be relevant to this decision. For example, the fixed costs allocated to the shiitake product line may not be eliminated if the product line is eliminated. As mentioned in the section above, costs must be analyzed to determine whether they are relevant or avoidable. Carlos collected additional data, presented below, about the decision to drop the shiitake product line.

- All revenue and variable expenses are traceable to the product lines and would be eliminated if the product line is eliminated.
- Fixed overhead is allocated to the product lines based on sales dollars. Cremini represents 72%, and shiitake represents 28% of total sales dollars. Accordingly, fixed expenses are allocated 72% and 28% to cremini and shiitake, respectively.
- Since the shiitake product line is small compared to the cremini line, none of the employees would be terminated if the shiitake product line is dropped. Also, none of the fixed overhead associated with buildings and maintenance would be reduced.
- The majority of selling and administrative expenses are incurred to sustain the organization. They are common expenses that would continue if the shiitake product line

is dropped. However, Carlos determined that \$15,025 of the selling and administration expenses are traceable to the shiitake product line. These expenses will be eliminated if the product line is dropped.

- If the shiitake product line is dropped, Carlos could grow and sell an additional 45,000 lbs. of cremini mushrooms, currently selling for \$1.70 per pound. Additional sales revenue would be  $45,000 \times \$1.70 = \$76,500$ . The contribution margin ratio for the cremini mushroom product line is 40%. The company would earn  $76,500 \times 40\% = \$30,600$  in additional contribution margin for the cremini product line.

The differential decision analysis for dropping a segment involves determining the effect that dropping the segment would have on net income by analyzing relevant revenue and cost data. Only relevant (avoidable) costs and revenues are considered. The analysis for dropping the shiitake product line is provided in Exhibit 10-2.

***Exhibit 10-2 Differential analysis to drop shiitake segment***

	Keep Shiitake	Drop Shiitake	Difference in net income
Sales shiitake	\$ 336,672	-	\$ (336,672)
Variable expenses shiitake	144,288	-	144,288
Contribution margin shiitake	\$ 192,384	-	\$ (192,384)
Fixed expenses:			
Building and maintenance	\$ 50,036	-	\$ -
Selling and administrative	150,248	15,025	15,025
Add. contribution margin cremini	-	30,600	30,600
Net income	\$ (7,900)		\$ (146,759)

Effect of dropping the shiitake product line	
Previous net income	\$ 126,380
Difference in net income	(146,759)
Adjusted net income	\$ (20,379)

Refer to Exhibit 10-2. Since sales, variable expenses, and contribution margin are traceable to the product lines, these would be eliminated if the shiitake product line is dropped. Accordingly, the net effect would be a \$(192,384) reduction in the overall contribution margin. Loss of contribution margin has a negative impact on net income.

None of the fixed expenses associated with buildings and maintenance would be reduced, so these costs are irrelevant. They are common fixed costs that will need to be absorbed by the cremini product line. Since these costs are not relevant or unavoidable, the difference in net income would be \$0.

Per the data, \$15,025 of the selling and administration expenses are traceable to the shiitake product line. These expenses will be eliminated if the product line is dropped.

Shrooms would save \$15,025 in fixed selling and administration expenses. Cost savings have a positive effect on net income. This means that the cremini product line would need to absorb the remaining \$135,223 ( $\$150,248 - \$15,025$ ) of fixed selling and administrative expenses currently allocated to the shiitake product line.

If the shiitake product line is dropped, Shrooms can grow and sell an additional 45,000 lbs. of cremini mushrooms. Shrooms will earn \$30,600 in additional contribution margin for the cremini product line. Additional contribution margin has a positive effect on net income.

The overall effect of dropping the shiitake product line would be a \$(146,759) decrease in net income. Shrooms' overall net income is given in Exhibit 10-1 as \$126,380. As demonstrated in Exhibit 10-2, Shrooms will go from \$126,380 in net income to \$(20,379) in net loss if the shiitake product line is dropped.

Shrooms' Income Statement without the shiitake product line is provided in Exhibit 10-3.

***Exhibit 10-3 Shrooms' Income Statement without the shiitake product line***

<b>Shrooms</b> <b>Income Statement</b> <b>(Cremini only product line)</b>			
	<b>Cremini Only</b>	<b>Original</b>	<b>Drop shiitake add 45,000 lbs cremini</b>
Sales	\$ 942,228	\$ 865,728	\$ 76,500
Variable expenses	262,332	216,432	45,900
Contribution margin	\$ 679,896	\$ 649,296	\$ 30,600
Fixed expenses:			
Building and maintenance	178,700	178,700	
Selling and administrative	521,575	536,600	(15,025)
Net income	\$ (20,379)		

This example illustrates the importance of using relevant revenue and cost data to make managerial decisions. In this case, the shiitake product line only appears unprofitable because of the way in which fixed costs are allocated to the product lines. The shiitake product line is a premium product line that earns a significant contribution margin. In this case, Carlos might consider reallocating the common fixed costs based on pounds of mushrooms produced instead of total sales dollars. Reallocating common fixed expenses based on pounds instead of percentage of sales dollars might produce segmented income statements that better reflect the profitability of the two product lines.

## Video Illustration 10-1: Add or drop a segment LO<sub>3</sub>

Hop’N’Burger is a local drive-thru restaurant that offers hamburgers and hot dogs. They have two product lines, hamburgers and hot dogs. According to the segmented income statement provided below, the hot dog product line lost \$(7,000) in the previous quarter. The manager is considering dropping the hot dog product line to focus on hamburgers. The manager collected the additional information presented below to aid in making this decision.

### ***Exhibit 10-4 Financial data for Hop’N’Burger***

Hop'N'Burger Income Statement For Quarter 1, 20xx			
	Total Company	Product lines	
		Hamburger	Hot dog
Sales	\$ 500,000	\$ 390,000	\$ 110,000
Variable expenses:			
Variable cost of goods sold	105,000	63,000	42,000
Other variable expenses	<u>60,000</u>	<u>45,000</u>	<u>15,000</u>
Contribution margin	\$ 335,000	\$ 282,000	\$ 53,000
Fixed expenses:			
Salaries	180,000	144,000	36,000
Building and maintenance	66,000	52,800	13,200
Advertising	<u>54,000</u>	<u>43,200</u>	<u>10,800</u>
Net income	\$ 35,000	\$ 42,000	\$ (7,000)

Additional information:

- 1.) The revenue and all of the variable expenses are traceable to the product lines. They would be eliminated if the product line was dropped.
- 2.) Salary expense is for the store manager and the hourly employees. None of the employees would be terminated if the hot dog product line was dropped.
- 3.) Building and maintenance represent the expenses related to the restaurant property including rent, insurance, and depreciation. None



of these costs would be eliminated if the hot dog product line was dropped.

4.) The majority of advertising expense is general and represents both product lines. However, \$5,000 of the advertising budget is spent to advertise the hot dog product line. This advertising would be eliminated if the hot dog product line was dropped.

Prepare a differential analysis to determine if the hot dog product line should be dropped.

***Exhibit 10-5 Differential analysis template for Hop’N’Burger, video explanation, and check figures***

	Keep hot dog	Drop hot dog	Difference
Sales	\$ 110,000		
Variable expenses:			
Variable cost of goods sold	42,000		
Other variable expenses	<u>15,000</u>	<u>          </u>	<u>          </u>
Contribution margin	\$ 53,000		
Fixed expenses:			
Salaries	36,000		
Building and maintenance	13,200		
Advertising	<u>10,800</u>	<u>          </u>	<u>          </u>
Net income	<u>\$ (7,000)</u>		

Effect of dropping the hot dog product line	
Previous net income	\$
Difference in net income	
Adjusted net income	



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Check figures:

Hop'N'Burger Income Statement (with hamburger product line only)		
Sales	\$ 390,000	
Variable expenses:		
Variable cost of goods sold	63,000	
Other variable expenses	45,000	
Contribution margin	\$ 282,000	* hamburger contribution margin only
Fixed expenses:		
Salaries	180,000	* would not be reduced
Building and maintenance	66,000	* would not be reduced
Advertising	49,000	* \$54,000 - \$5,000 eliminated hot dog ads
Net income	\$ (13,000)	* \$48,000 decrease in net income

### Check your understanding LO3



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## Make or buy (outsourcing) LO4

An organization can make a product or perform a function internally, or the organization can purchase the product or service from an external supplier. Evaluating this decision is traditionally known as a make or buy analysis. Make or buy decisions are considered differential decisions since only relevant costs and benefits are considered. While it is referred to as a make or buy decision, it is also used to analyze performing an activity internally versus outsourcing the activity to an outside supplier. For example, managers can use this tool to compare the costs of making a physical product versus buying the product from an external supplier. Managers can also compare the costs of performing an activity internally, such as payroll or customer service, versus outsourcing the activity to an external company.

The example of Shrooms, an organic mushroom farm, is continued to illustrate a make or buy decision. Currently, Shrooms is purchasing organic compost from an outside supplier. Carlos recently attended a workshop on making organic compost. He wants to determine if it is more profitable to buy the compost from an external supplier or make it on the farm. Carlos uses 7,200 cubic feet of compost each year. He purchases the compost from an outside supplier for \$18 per cubic foot. Carlos collected the data, presented below, related to the cost of making the compost on the farm.

- Carlos has an unused area on the farm that can be used to make the compost. He already owns the farming equipment and other tools required to make the compost. The farm's overhead, e.g., equipment, buildings, utilities, supplies, etc., is applied to the existing product lines—cremini and shiitake—based on pounds harvested. The current overhead rate is \$0.30 per pound. Carlos would not incur additional farming overhead costs if he decides to make the compost.
- The farm supervisor would be in charge of making the compost. The supervisor is paid a yearly salary of \$50,000, approximately \$24 per hour. The supervisor has enough time to assume the extra responsibility during regular working hours. The supervisor would not be paid for additional hours or overtime to make the compost.
- Making 7,200 cubic feet of compost requires 9,000 cubic feet of untreated wood chips that cost \$10.50 per cubic foot.
- Carlos estimates that indirect materials, e.g., nitrogen-rich green materials, will cost an additional \$2,100 per year.

The differential decision analysis for making or buying the compost involves analyzing relevant cost data and determining the most cost-effective alternative. Only relevant (avoidable) costs and benefits are considered. Carlos has the space,

equipment, and employee labor hours to make the compost. Therefore, making the compost on the farm would not increase the farm’s overhead or direct labor costs. Since these costs are the same whether he makes the compost or purchases it from an outsider supplier, they are irrelevant to this decision. The relevant costs are the untreated wood chips and indirect materials required to make the compost. The cost of purchasing the compost from an outside supplier is also relevant since it can be avoided if Carlos decides to make the compost. An analysis for making the compost versus buying it is provided in Exhibit 10-6. The cost savings for making the compost is projected to be \$33,000 per year.

***Exhibit 10-6 Differential analysis make or buy compost***

	Make 7,200 cubic ft compost	Buy 7,200 cubic ft compost	Difference
Wood chips (9,000 x \$10.50)	\$ 94,500		
Indirect materials (\$2,100 per year)	2,100		
Purchase from supplier (7,200 x \$18)		\$ 129,600	
Total	\$ 96,600	\$ 129,600	\$ 33,000

## Video Illustration 10-2: Make or buy (outsourcing) decision

### LO4

Jada developed an all-natural, human-grade dog food called Posh Pet. She is currently making the dog food in a small rented space. She was approached by a local co-packer. The co-packer offered to make Posh Pet for \$3.30 per unit. She currently sells 500 units per month. She collected the following information to aid in making this decision. Should she sign a contract to purchase Posh Pet from the co-packer?

#### ***Exhibit 10-7 Cost per unit of Posh Pet***

Cost per unit of Posh Pet		
Direct materials	\$	2.00
Direct labor		0.75
Manufacturing overhead		2.25
Cost per unit	\$	<u>5.00</u>

Additional information:

- 1.) Direct materials would be provided by the co-packer

- 2.) Jada has one employee that makes the dog food. If she outsources to a co-packer this employee would be terminated.
- 3.) All of the manufacturing overhead would be eliminated except the rent on the facility. Jada signed a two year lease on the space. If she outsources to a co-packer the space currently used to make the product would be converted to office space. She doesn't need the additional space and cannot use it for any other purpose. Of the monthly lease amount, \$1,000 per month is allocated to producing the product. The lease represents \$2.00 ( $\$1,000/500$  units) of the current overhead charge.

***Exhibit 10-8 Differential analysis template for Posh Pet and video explanation***

	Cost to make 500 units	Cost to buy 500 units	Difference
Direct materials			
Direct labor			
Manufacturing overhead			
Purchasing from co-packer			
Total			





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Check your understanding LO4



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## Special order LO5

A special order is a one-time order not connected to an organization's normal sales cycle. Special orders are generally not included in the organization's budgeted sales projections. Special orders arise outside of projected sales activities. For example, assume that an organization makes a product and sells it directly to retail customers. Further, that the organization receives a request to donate or provide its product at a discounted rate for a local fundraising event. This situation is considered a special order.

On the other hand, selling a product to a non-profit would not be a special order if the product is sold through normal sales channels. For example, assume that an organization prints promotional items for organizations, non-profits, and events. One of their customers is a non-profit organization. The non-profit customer purchases promotional items for a fundraiser

on the organization's website. This example is considered normal business operations and not a special order.

Differential decision making can be used to analyze the effects of accepting a special order. The example of Shrooms, an organic mushroom farm, is continued to illustrate a special order decision. A local farmer's market organizer contacted Carlos and asked him to participate in a fundraising event promoting healthy, local, sustainable foods. The organizer plans to sell promotional meal kits with all the ingredients to make a healthy meal at home. The organizer asked Carlos if he would grow a special batch of oyster mushrooms for the meal kits. They requested 250 pounds of oyster mushrooms for \$1.50 per pound. Carlos is interested in participating in the fundraiser if the special order price of \$1.50 per pound covers his cost to grow the mushrooms. Carlos collected the data, presented below, about the cost of growing the special order oyster mushrooms.

- A nominal amount of farm space is required to grow 250 lbs. of oyster mushrooms. Carlos has an unused area on the farm that can be used to grow the oyster mushrooms. He owns the farming equipment and other tools required to produce the mushrooms. The farm's overhead, e.g., equipment, buildings, utilities, supplies, etc., is applied to the existing product lines—cremini and shiitake—based on pounds harvested. The current overhead rate is \$0.30 per pound. Two-thirds (\$0.20) of

the farm overhead rate is fixed overhead and one-third (\$0.10) is variable overhead. The special order would not increase fixed overhead. However, \$0.10 of variable overhead would be incurred on each pound of oyster mushrooms grown.

- Carlos would have to pay contracted labor to harvest the mushrooms. Farm labor is paid per pound harvested. The current labor rate is \$1.05 per pound.
- Direct materials include seeds, compost, water, and packaging. Direct materials are estimated to be \$0.40 per pound.

Differential decision analysis can be used to determine the financial effect of accepting the special order. Only relevant (avoidable) costs and benefits are considered. The differential analysis for the fundraiser special order is provided in Exhibit 10-9. Direct material (\$0.40), direct labor (\$1.05), and variable farm overhead (\$0.10) are relevant costs. The fixed farm overhead (\$0.20) is irrelevant since the special order would not change the farm's fixed overhead costs. The oyster mushrooms would cost Carlos \$1.55 per pound to produce. The event organizer asked Carlos to provide 250 pounds for \$1.50 per pound. Carlos would incur a \$12.50 loss on the special order,  $250 \text{ lbs.} \times (\$1.50 \text{ special order sells price} - \$1.55 \text{ special order cost of goods sold}) = \$12.50$ . Carlos could turn down the special order request, accept the loss, or ask the event organizer to pay \$1.55 per pound to cover his costs.

***Exhibit 10-9 Differential analysis fundraiser special order***

Cost per lb oyster mushroom		
Direct materials	\$	0.40
Direct labor		1.05
Farming overhead		0.10
Cost per unit	\$	1.55

### Video Illustration 10-3: Special order decision LO5

Jada developed an all-natural, human-grade dog food called Posh Pet. She is currently making the dog food in a small rented space. Due to local wildfires, a local shelter asked if she could provide her dog food at cost to help with the influx of displaced animals. She currently sells 500 units per month and this request would not affect her normal sales. She wants to help the shelter and just cover the incremental costs associated with the special order. She collected the following information to aid in making this

decision. What is the per unit amount she needs to charge to cover her costs?

**Exhibit 10-2 Financial data for Posh Pet**

Cost per unit of Posh Pet		
Direct materials	\$	2.00
Direct labor		0.75
Manufacturing overhead		2.25
Cost per unit	\$	5.00

Additional information:

- 1.) All of the additional units would require direct material and direct labor.
- 2.) Of the manufacturing overhead, \$2.00 per unit is a fixed charge for rent on the facility. She has the space to make the order so the special order would have no effect on the rent. The remaining \$0.25 of manufacturing overhead is variable and would be incurred on each unit in the special order.

**Exhibit 10-2 Differential analysis template for Posh Pet and video explanation**

Special order cost per unit	
Direct materials	
Direct labor	
Manufacturing overhead	
Total	



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Check your understanding LO5



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## Sell or process further LO6

Some raw materials must be separated or refined in the process of manufacturing a final product. Secondary materials or by-products are sometimes created when the original raw material is separated or refined. A single raw material input that can be separated into one or more materials is known as a joint product. The point at which the original raw material input is separated into more than one output is known as the split-off point. For example, crude oil is considered a joint product. Several oil products, including gasoline, jet fuel, lubricants, petroleum jelly, and other chemicals, are extracted during the refinement process. Differential decision making can be used to analyze the effect of selling the by-products created at the



split-off point versus processing the by-products further before selling them.

Costs are classified as joint costs or additional processing costs when considering a sell or process further decision. Joint costs are costs incurred to process the raw material input to the split-off point. Secondary materials or by-products are created at the split-off point. The costs incurred to process the secondary materials after the split-off point are additional processing costs.

Joint costs are irrelevant when deciding to sell or process by-products further. Joint costs are considered sunk costs. Regardless if the by-product is discarded, sold as is, or processed further, the joint costs have already been incurred and are therefore unavoidable.

Additional processing costs are relevant to the decision to sell or process further because they are different between the alternatives. If the by-product is discarded or sold as is, additional processing costs are not incurred. However, additional processing costs are incurred if the by-product is processed further.

Differential decision making can be used to analyze the decision to sell a by-product as is or to process it further. The example of Shrooms, an organic mushroom farm, is continued to illustrate a sell or process further decision. Carlos projects that he can produce 500,000 lbs. of cremini and 48,000 lbs. of shiitake mushrooms in the upcoming fiscal year. Approximately 10% of both species of mushrooms will not

comply with commercial standards in terms of caliber, shape, or size. At harvest, Carlos projects that 50,000 lbs. of cremini and 4,800 lbs. of shiitake mushrooms will be irregular mushrooms. Irregular mushrooms cannot be sold through the company's regular sales channels. Carlos can sell the irregular mushrooms, as is, to a food co-packer that uses the mushrooms in a commercial soup product. Or, Carlos can process the irregular mushrooms into an organic dried blend and sell them to a vendor at the farmer's market. Carlos collected the data, presented below, related to this decision to sell the irregular mushrooms as is or process them into a dried mushroom blend.

- The retail prices for mushrooms that comply with commercial standards are \$1.92 per pound of cremini and \$7.20 per pound of shiitake.
- Both products have similar costs to grow, \$1.75 per pound. Product growing costs include direct materials \$0.40, direct labor \$1.05, and farm overhead \$0.30.
- The copacker will pay \$1.30 and \$5.00 per pound for the irregular cremini and shiitake mushrooms, respectively.
- Carlos can sell the organic dried blend mushrooms for \$4.50 per half-pound bag.
- The irregular mushrooms could be combined, dehydrated, and packaged to process the mushrooms into a dried mushroom blend. One pound of fresh mushrooms yields one-half pound of dried mushrooms.

The total of dried blend would be  $(50,000 + 4,800 \text{ lbs.}) / 2 = 27,400$  pounds. Carlos estimates it will cost an additional \$6,000 to dehydrate the dried blend. The dried blend would be packaged in half-pound bags. Packaging costs for the dried blend are \$1.20 per bag.

The retail prices for the commercially standard mushrooms are irrelevant since the irregular mushrooms cannot be sold through normal sales channels.

The product costs incurred to grow the mushrooms are considered joint costs. These costs are incurred to produce all the mushrooms. The irregular mushrooms are a by-product of the commercially standard mushroom harvest. The harvest is considered the split-off point.

The irregular mushrooms can be sold, as is, to the food copacker. This amount is relevant since this revenue is only realized if Shrooms sells the mushrooms to the copacker at harvest. The total sales value of the irregular mushrooms at the split-off point is  $(50,000 \times \$1.30) + (4,800 \times \$5.00) = \$89,000$ .

The dried mushroom blend sales price is relevant since this revenue is only realized if Carlos processes the irregular mushrooms into the dried blend. Carlos can produce 27,400 half-pound bags of the organic dried blend. The total sales value of the organic dried blend is  $27,400 \text{ bags} \times \$4.50 = \$123,750$ .

The cost of processing the irregular mushrooms into the

organic dried blend is also relevant. Total additional processing costs are  $\$6,000 + (27,500 \text{ bags} \times \$1.20) = \$39,000$ .

The differential analysis for the decision to sell or process the irregular mushrooms is provided in Exhibit 10-10. Shrooms would lose \$4,250 in revenue by processing the mushrooms into the dried blend. The most profitable alternative is to sell the unprocessed mushrooms to the copacker.

***Exhibit 10-10 Differential analysis sell or process irregular mushrooms***

Irregular mushrooms	
Sales value if processed further	\$ 123,750
Less additional processing costs	39,000
Net revenue from processing	\$ 84,750
Less sales value at split-off point	89,000
Effect of processing further	\$ (4,250)

## Video Illustration 10-4: Sell or process further decision LO6

CheezeChef is a local cheese manufacturer that specializes in small-batch, artisanal cheeses.

During the cheese making process whole milk is separated into curds and whey. Curds are the solids that are used to make the most cheeses. Whey is the liquid left after the solids are removed. Whey is rich in nutrients. The milk costs \$2.40 per gallon. It costs CheezeChef \$0.90 to separate the curds and whey.

CheezeChef is considering processing the whey into ricotta cheese or selling it to a local company that extracts protein from the whey. The local company offered to pay \$2.60 per gallon of whey. Or, CheezeChef can process one gallon of whey to make one pound of ricotta cheese. It would cost \$1.80 to process the whey into ricotta. They could sell the ricotta for \$4 per pound. Should CheezeChef sell the whey at the split-off point or process it further into ricotta cheese?

Joint costs (not relevant)

***Exhibit 10-2 Differential analysis template for CheezeChef and video explanation***

Sell or process further	
Sales value if processed further	
Less additional processing costs	_____
Net revenue from processing	_____
Less sales value at split-off point	_____
Effect of processing further	_____



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Check your understanding LO6



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## Practice Video Problems

*The chapter concepts are applied to comprehensive business scenarios in the below Practice Video Problems.*

### Practice Video Problem 10-1: Add or drop a segment LO<sub>3</sub>

Kia's Salon offers two services, hair styling and nails. According to the segmented income

statement presented below, the nails product line lost \$(5,050) in the previous quarter. The manager is considering dropping the nails product line to focus on hair styling. The manager collected the additional information presented below to aid in making this decision.

Kia's Salon Income Statement For Quarter 1, 20xx			
	Total Company	Product lines	
		Hair	Nails
Sales	\$ 300,000	\$ 255,000	\$ 45,000
Variable expenses:			
Variable cost of goods sold	85,000	68,000	17,000
Other variable expenses	5,000	3,750	1,250
Contribution margin	\$ 210,000	\$ 183,250	\$ 26,750
Fixed expenses:			
Administrative expenses	102,000	81,600	20,400
Building and maintenance	36,000	28,800	7,200
Advertising	21,000	16,800	4,200
Net income	\$ 51,000	\$ 56,050	\$ (5,050)

#### Additional information:

- 1.) The revenue and all of the variable expenses are traceable to the product lines. They would be eliminated if the product line was dropped.
- 2.) Administrative expenses include salaries and general administrative expenses. Of the \$20,400



allocated to the nails product line, \$18,000 represents the salary for the nail technician and scheduler. Her position would be eliminated if the nails product line is dropped. The remaining expenses are general expenses and would not be eliminated.

3.) Building and maintenance represent the expenses related to the salon property including rent, insurance, and depreciation. None of these costs would be eliminated if the nails product line was dropped.

4.) The entire \$4,200 of the advertising budget is spent to advertise the nails product line. This advertising would be eliminated if the nails product line was dropped.

**Required:** Prepare a differential decision making analysis to determine if the nails product line should be dropped.

	Keep nails	Drop nails	Difference
Sales	\$ 45,000		
Variable expenses:			
Variable cost of goods sold	17,000		
Other variable expenses	1,250		
Contribution margin	\$ 26,750		
Fixed expenses:			
Administrative expenses	20,400		
Building and maintenance	7,200		
Advertising	4,200		
Net income	\$ (5,050)		

Effect of dropping the nails product line	
Previous net income	\$
Difference in net income	
Adjusted net income	



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## Practice Video Problem 10-2: Make or buy (outsourcing) decision LO4

Ali's Grooming currently processes the company's payroll in house. She received a quote from a local CPA firm to process her payroll for \$75 per week. Currently, Ali's bookkeeper enters the data into a payroll module within the company's accounting software. It costs an extra \$2,500 per year to purchase the payroll module with the accounting software package. The accounting software creates the paychecks as well as the related entries for payroll taxes and benefits. The bookkeeper spends about 4 hours per week processing payroll and handling payroll related tasks. The bookkeeper makes \$20 per hour. The bookkeeper would still work her normal 40 hours per week even if the payroll function was outsourced. The bookkeeper currently does not have enough work to require overtime hours.

**Required:** Prepare a differential decision



specializes in growing organic, non-GMO produce. Their largest product in terms of revenue is wheat flour. It costs approximately \$2.70 to grow one bushel of wheat. The wheat is milled on the farm to create flour. It costs \$0.90 per bushel to mill the wheat and produce wheat flour.

Two by-products of the milling process are bran and germ meal. Each year they generate approximately 4,000 pounds of bran and 8,000 pounds of germ meal. Healthy Farms can sell the bran and germ meal as is to a local farmer for livestock feed and get \$2 per pound. Or, Healthy farms can process the bran into a fiber supplement that sells for \$3.00 per pound for an additional \$4,200 in processing and packaging costs. And they can process the germ meal into a health food supplement that sells for \$2.75 per pound for an additional \$4,700 in processing and packaging costs.

**Required:** Prepare a differential decision making analysis to determine if the bran and germ meal should be sold as is or processed further.

Bran	
Sales value if processed further	
Less additional processing costs	_____
Net revenue from processing	
Less sales value at split-off point	_____
Effect of processing further	_____

Germ meal	
Sales value if processed further	
Less additional processing costs	_____
Net revenue from processing	
Less sales value at split-off point	_____
Effect of processing further	_____



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## Review Questions

*Review questions reinforce the chapter content.*



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## Homework Questions

*Homework questions can be used for additional practice or can be assigned in an academic setting.*

*Full feedback is not available online. Homework questions can be assigned, with auto-grading and export, to specific learning management platforms, e.g., Canvas, Blackboard, etc. Contact the author for details.*



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**11.**

# CAPITAL BUDGETING DECISION MAKING

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## Learning Objectives LO

LO1 Determine the payback period for an investment

L02 Compute the simple rate of return for an investment

L03 Apply the time value of money concept by computing the present value of a sum of money

L04 Compute the internal rate of return for an investment

L05 Evaluate the acceptability of an investment project using the net present value method

L06 Analyze capital budgeting decision making methods

## Capital budgeting decision making

Managers are responsible for many decisions, some with short-term and others with long-term financial consequences. Projects and investments with long-term financial consequences are referred to as capital projects. Therefore, capital budgeting refers to the process of planning projects or making decisions that have a long-term effect on the organization. Examples of capital projects include investments in long-term assets such as vehicles, machines, facilities, or

equipment; launching new products or services; and expanding operations.

Capital budgeting decision making is a critical managerial skill. Most organizations have limited resources and more potential capital projects than they can fund. For this reason, managers must be able to evaluate the alternatives and select the project that offers the most benefit to the organization. The ability to choose appropriate capital investments is an essential component of an organization's long-term financial health and stability.

This chapter discusses four methods for making capital budgeting decisions—the payback period method, the simple rate of return method, the internal rate of return method, and the net present value method.

## Payback period LO1

### Payback period

The payback period is the length of time that it takes for a project to recover the initial cost from the net cash inflows generated by the project. The payback period is expressed in years. The formula to compute the payback period considers the investment required and the annual net cash inflow from the investment.

## Investment required

The required investment is the cost of the project less the trade-in or salvage value received for any assets exchanged in the transaction. For example, assume that Jill decides to purchase a new car for \$12,000. She receives \$3,000 for trading in her old car. The required investment in the new car is  $\$12,000 - \$3,000 = \$9,000$ .

## Annual net cash inflow

Annual net cash inflow is the net cash inflows and cash outflows yielded by the investment. Cash inflows have a positive effect on cash, and cash outflows have a negative effect on cash. Revenue and cost savings are cash inflows, whereas expenses and costs are cash outflows. When considering an investment that generates revenue and costs, the annual net cash inflow is cash revenue less cash expenses. For an investment that generates cost savings and costs, the annual net cash inflow is cost savings less cash expenses.

It is important to note that net cash inflow is not the same as net operating income, although they are similar. Net cash inflow only includes cash revenues, cost savings, and cash expenses. Net operating income includes some non-cash expenses like depreciation expense. While depreciation is an expense, it is not a cash payment. Instead, it is the expense used to allocate the cost of a long-term asset over a period of time. Since the payback method uses annual net cash inflow,



depreciation is not considered for this calculation. If net operating income is given, depreciation expense must be added back to arrive at annual net cash inflow.

When annual net cash inflow is the same every year, the formula in Exhibit 11-1 is used to compute the payback period.

***Exhibit 11-1 Payback period formula***

$$\text{Payback period} = (\text{investment required} / \text{annual net cash inflows})$$

The payback period method is often used as an investment screening tool rather than a final selection tool. The advantage of the payback period method is that it can be used to screen several competing projects quickly. For example, some organizations prefer to invest in projects in which the investment is recovered within a specified period, such as 3 to 5 years. This tool can be used to identify investments that meet specific payback criteria.

The example of Ancient Cities Tours is used to illustrate the capital budgeting decision making tools presented in this chapter. Ancient Cities Tours offers complete tour packages to historically significant Mayan, Aztec, and Inca sites in Latin America. The company is headquartered in Peru. The company owns the headquarters building and the equipment—tour bus, riverboat, and van—used for tours

originating from the Peru location. Maya is the owner-operator of Ancient Cities Tours.

Maya is considering replacing the company’s tour bus with an updated model. She narrowed her search to two models designed to handle the Peruvian landscape, the Diamond LX and the VIP Express. The Diamond LX is a standard-size tour bus. It costs less to purchase and operate but accommodates fewer passengers (35 seats). The VIP Express is an oversized model. It costs more to purchase and operate but accommodates more passengers (57 seats).

Ancient Cities Tours schedules 12 tours per year from the Peru location. The company averages 35 paid guests per tour at an average revenue of \$520 per guest for the bus portion of the tour. If Maya purchases the Diamond LX (35 seats), the tours would be limited to 35 paid guests per tour due to seat capacity. The VIP Express (57 seats) can accommodate additional guests. If Maya purchases the VIP Express, she estimates that she can book an average of 42 guest per tour. Additional data about both models is given in Exhibit 11-2.

***Exhibit 11-2 Data for tour bus investment alternatives***

Tour Bus Investment Alternatives		
	Diamond LX	VIP Express
Purchase price	\$ 690,000	\$ 810,000
Estimated tour guests	420 per year	504 per year
Estimated useful life	12 years	10 years
Annual depreciation expense	\$ 53,000	\$ 71,700
Annual cash operating costs	\$ 92,400	\$ 113,400
Salvage value	\$ 54,000	\$ 93,000

Net Operating Income		
	Diamond LX	VIP Express
Revenue	\$ 218,400	\$ 262,080
Depreciation expense	53,000	71,700
Cash operating expenses	92,400	113,400
Net operating income from investment	<u>\$ 73,000</u>	<u>\$ 76,980</u>

Refer to the data in Exhibit 11-2 for Ancient Cities Tours. The payback period is calculated as the investment required divided by the annual net cash inflow from the project. The data in Exhibit 11-2 gives net operating income, which includes depreciation expense. Depreciation expense is a non-cash expense. When net operating income is provided, depreciation expense is added back to arrive at net cash inflow. Net cash inflows for the Diamond LX and VIP Express are \$126,000 (\$73,000 + 53,000) and \$148,680 (\$76,980 + 71,700), respectively.

The Diamond LX model's payback period is  $\$690,000 / 126,000 = 5.48$  years.

The VIP Express model's payback period is  $\$810,000 / 148,680 = 5.45$  years.

Maya will recover the costs of both investments in approximately 5.5 years. As a general rule, a shorter payback period is preferable.

While the payback period method is easy to use, its disadvantages are significant. First, this method does not consider the actual profitability of a project. And second, this method does not consider the time value of money. The time

value of money concept states that money available today is inherently worth more than an identical amount of money available in the future. The time value of money is explored in more detail later in this chapter.

Check your understanding LO1



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## Simple rate of return LO2

The simple rate of return method is a straightforward method used to compute an approximate rate of return for an investment or project. The formula to calculate the simple rate of return includes the investment required for the project and

the annual net operating income or cost savings resulting from the project.

## Investment required

The required investment is the project's cost less the trade-in or salvage value received for any assets exchanged in the transaction. The investment required is the same input used to compute the payback period. Recall the example in which Jill purchases a new car for \$12,000. She receives \$3,000 for trading in her old car. The required investment in the new car is  $\$12,000 - \$3,000 = \$9,000$ .

## Annual net operating income

Annual net operating income represents the investment's revenues less its expenses. Since this method uses annual net operating income, depreciation expense is included in the calculation. If annual net cash flow is given, depreciation expense must be calculated and subtracted from net annual cash flow to arrive at net operating income.

The formula to compute the simple rate of return is presented in Exhibit 11-3.

### ***Exhibit 11-3 Simple rate of return formula***

$$\text{Simple Rate of Return} = \frac{\text{Annual net operating income}}{\text{Investment required}}$$

The simple rate of return method is often used as an investment screening tool rather than a final selection tool. The advantage of this method is that it can be used to screen several competing projects quickly. For example, some organizations prefer to invest in projects with a minimum rate of return. This tool can identify the investments that meet a specific minimum rate of return.

Refer to the data in Exhibit 11-2 for Ancient Cities Tours. The simple rate of return is calculated as the project's annual net operating income divided by the investment required. The investment required and annual net operating income are provided in Exhibit 11-2.

The Diamond LX model's simple rate of return is  $\$73,000 / \$690,000 = 10.6\%$

The VIP Express model's simple rate of return is  $\$76,980 / \$810,000 = 9.5\%$

A higher simple rate of return is preferable. The simple rate of return for the Diamond LX model is 1.1% higher than the VIP Express model. While this is good information, especially during the initial screening phase, the simple rate of return method has limitations. Like the payback period, this method does not consider the time value of money. Another limitation is that the simple rate of return method does not consider the project's useful life. And finally, this method can only be applied to investments that yield consistent operating income over the project's life.

## Video Illustration 11-1: Payback period and simple rate of return illustrated LO1

Isabella owns a small machine shop that develops prototypes for metal products. She would like to purchase a new machine capable of creating custom steel tools. She is considering two different models.

The A model would cost \$420,000, generate \$260,000 in annual cash revenues, and \$120,000 in annual cash operating costs. The A model has a 10-year useful life.

The B model would cost \$360,000, generate \$180,000 in annual cash revenues, and \$60,000 in annual cash operating cost. The B model has an 8-year useful life.

Compute the payback period and simple rate of return for both machines.

***Exhibit 11-4 Template to compute payback period, simple rate of return, and video explanation.***

	Payback Period	Simple rate of return
A model		
B model		



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Check your understanding LO2





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## Time value of money LO<sub>3</sub>

The time value of money concept states that money available today is inherently worth more than an identical amount of money available in the future. For example, \$1,000,000 paid today is intrinsically worth more than \$1,000,000 payable at the end of the year. There are two financial reasons for this.

The first factor is the concept of inflation. Inflation is an economic concept that measures the general increase in prices and the resulting decline in the purchasing value of money over a period of time. Inflation typically occurs gradually over a long period of time, so it is often ignored in capital budgeting decisions.

The second reason, interest or return on investment, is relevant to capital budgeting decisions. Money today is worth

more than money in the future because it can be used today to generate interest or a return. Money available today can be invested in an interest-bearing investment or an organizational project yielding a return on that investment. For example, assume that \$1,000,000 is available today and can be invested in a savings account yielding 3% interest. In this case, \$1,000,000 today becomes  $\$1,000,000 \times 1.03 = \$1,030,000$  one year from now. Or, a business could invest \$1,000,000 in a new product that yields a 15% return. The \$1,000,000 investment today would be worth \$1,150,000 one year from now.

Since the formula to calculate interest is constant (principal  $\times$  rate  $\times$  time), mathematical tables, known as present value and future value tables, have been developed to determine the discount factors for many different interest or return rates and time periods. The discount factors provided in the tables cover two types of present value calculations, lump sum and annuity.

## Present value of a lump sum

The present value of a lump sum, often referred to as the present value of 1, is the present value of a single cash flow at some future point. For example, a company will receive \$10,000 when they sell a machine in 10 years. This is a single cash flow of \$10,000 that happens one time 10 years from now.

## Present value of an ordinary annuity

An annuity is a series of equal payments over multiple periods. An ordinary annuity is a series of payments in which the cash flows begin at the end of the time period. An annuity due is a series of payments in which the cash flows begin at the beginning of the time period. For example, assume a judicial settlement ordered annual payments of \$100,000 per year for 5 years. The first payment will be disbursed one year from the settlement date. This settlement is an ordinary annuity. The undiscounted cash value of the settlement is \$500,000 (5 payments x \$100,000). However, because of the time value of money concept, the settlement is not valued at \$500,000 since it is not fully payable now. The cash received in the second year is worth less than the cash received in the first year. And the cash received in the fifth year is worth less than the cash received in the first four years.

The present value of a lump sum and the present value of an ordinary annuity discount tables are provided in Appendix A: Present Value Tables. The discount factor provided in the tables can be used to easily determine the present value of a future lump sum or ordinary annuity amount. To find the present value, the future amount is multiplied by the discount factor for the corresponding interest rate and time period.

Check your understanding LO3



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## Internal rate of return LO4

The internal rate of return (IRR) method is similar to the simple rate of return with one significant difference. The IRR method takes into consideration the time value of money. This method calculates the discounted rate of return of an investment over the useful life of the investment. The formula to calculate IRR includes the investment required for the project and the annual net cash inflow from the project.

## Investment required

The required investment is the project's cost less the trade-in or salvage value received for any assets exchanged in the transaction. The investment required is the same input used for the payback period and the simple rate of return. Recall the example in which Jill purchases a new car for \$12,000. She receives \$3,000 for trading in her old car. The required investment in the new car is  $\$12,000 - \$3,000 = \$9,000$ .

## Annual net cash inflow

Annual net cash inflow is the net cash inflow yielded by the investment. Annual net cash inflow is also used for the payback period method. It is important to note that both revenue and cost savings are considered cash inflows. When considering an investment generating revenues and costs, annual net cash inflow is the cash revenue less cash costs. Since this method uses annual net cash inflow, depreciation expense is not considered for this calculation. If net income is given, depreciation expense must be added back to arrive at annual net cash inflow. When considering an investment generating cost savings and costs, annual net cash inflow is the cost savings less cash costs.

The formula to compute the discount factor used for the internal rate of return method is presented in Exhibit 11-5.

***Exhibit 11-5 Present value of annuity discount factor formula***

$$\text{Present value of annuity discount factor} = \frac{\text{Investment required}}{\text{Annual net cash inflow}}$$

The formula in Exhibit 11-5 produces the investment's discount factor. The discount factor is used to find the investment's internal rate of return. To find the rate of return, locate the row matching the useful life of the project on the present value of an annuity discount table (Appendix A: Present Value Tables). Scan the useful life row to locate the number that is closest to the discount factor provided by the formula. The corresponding interest rate is the investment's IRR.

The advantage of the internal rate of return over the payback method or the simple rate of return method is that IRR considers the time value of money. The major disadvantage is that IRR only works for investments with a single cash investment at the beginning and constant cash flows over the life of the investment. Many capital budgeting projects require multiple investments at different times during the project and produce uneven cash flows over the life of the investment.

Refer to the data in Exhibit 11-2 for Ancient Cities Tours. Computing the IRR is a two-step process. The first step is to use the formula to find the present value of an annuity

discount factor. This formula is the same as the payback period formula. The present value of an annuity discount factor is calculated as the investment required divided by the annual net cash inflow from the project. The data in Exhibit 11-2 gives net operating income, which includes depreciation expense. Depreciation expense is a non-cash expense. When net operating income is given, depreciation expense is added back to arrive at net cash inflow. Net cash inflows for the Diamond LX and VIP Express are \$126,000 (\$73,000 + 53,000) and \$148,680 (\$76,980 + 71,700), respectively.

Diamond LX model's present value of an annuity discount factor is  $\$690,000 / 126,000 = 5.48$ .

VIP Express model's present value of an annuity discount factor is  $\$810,000 / 148,680 = 5.45$ .

The second step is to locate the discount factor on the present value of an annuity discount table (Appendix A: Present Value Tables) in the row matching the project's useful life. The corresponding rate of return is the internal rate of return. The useful lives are given in Exhibit 11-2 as 12 years for the Diamond LX and 10 years for the VIP Express.

For the Diamond LX model, the discount factor closest to 5.48 on row 12 (years useful life) is 5.421. This corresponds with a 15% internal rate of return.

For the VIP Express model, the discount factor closest to 5.45 on row 10 (years useful life) is 5.426. This corresponds with a 13% internal rate of return.

A higher internal rate of return is preferable. The IRR for

the Diamond LX model is 2% higher than the VIP Express model. As demonstrated in the preceding section, the simple rate of return for the Diamond LX model is 1.1% higher than the VIP Express model. The IRR is more accurate than the simple rate of return because it considers the time value of money as well as the useful life of the projects.

However, the internal rate of return method has limitations. A significant limitation is that this method assumes that the revenue and expenses generated by the investment are constant over the project's life. Additionally, this method only considers the initial investment and the annual net cash inflows. This method does not consider other cash inflows or cash outflows, such as any salvage value for the project at the end of its useful life.

## **Video Illustration 11-2:**

### Internal rate of return LO4

Paula is thinking about replacing her stitching machine. A new machine would cost \$130,000. She would receive \$6,000 for trading in her old machine. The new machine would generate \$52,000 in annual revenue and \$27,000 in annual cash expenses. The new machine has an 8 year useful life.



What is the internal rate of return for the new stitching machine?



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Check your understanding L04



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## Net present value method (NPV) LO5

The net present value method compares the present value of a project's cash inflows to the present value of its cash outflows at a predetermined discount rate. The discount rate is the minimum rate of return established by the organization. All the cash inflows and outflows from an investment are discounted at this rate. Discounted cash inflows are positive, and discounted cash outflows are negative. The discounted cash flows are then netted together to produce the investment's net present value.

Like the internal rate of return method, the net present value method considers the time value of money. Unlike the internal rate of return method, the net present value method

can be used to evaluate investments where multiple cash investments are required, or the project has uneven cash flows over the life of the investment.

## Positive net present value

A positive net present value means that the return on the investment is greater than the discount rate. Or that the investment yields a higher return than the discount rate used in the analysis. For example, if the net present value is positive and the discount rate is 12%, the project returns more than 12%. Although this tool does not provide the exact return, a positive value means that the return is more than 12%.

## Zero net present value

A zero net present value means that the return on the investment equals the discount rate. A zero net present value does not mean the investment has a zero return. The cash flows were discounted at a specific rate so the investment returns exactly that rate. For example, if the net present value is zero and the discount rate used is 12%, the project returns exactly 12%.

## Negative net present value

A negative net present value means that the return on the investment is less than the discount rate. Or that the investment yields a lower return than the discount rate. This does not mean that the investment does not generate a return. Instead, it means that the return is less than the discount rate. For example, if the net present value is negative and the discount rate is 12%, the project returns less than 12%. Although this tool does not provide the exact return, a negative value means that the return is less than 12%.

Refer to the data in Exhibit 11-2 for Ancient Cities Tours. Assume that the discount rate for Ancient Cities Tours is 10%. The net present value method calculates the present value for all cash flows associated with the two models. The net present values for the tour bus alternatives are provided in Exhibit 11-6.

***Exhibit 11-6 Net present values for the tour bus alternatives***

Year(s) A	Cash inflow (outflow) B	Present value factor C	Present value (B X C)
<b>Diamond LX</b>			
Now	(690,000)	1	(690,000)
Years 1-12	126,000	6.814	858,564
12	54,000	0.319	17,226
			<b>\$185,790</b>
<b>VIP Express</b>			
Now	(810,000)	1	(810,000)
Years 1-10	148,680	6.145	913,639
10	93,000	0.386	35,898
			<b>\$139,537</b>

Refer to the data in Exhibit 11-6.

Column B lists the cash inflows and outflows for the project or investment. Cash inflows are positive, and cash outflows are negative.

Column A is for the year or years in which the cash inflow or outflow occurs. There are three options for this column. Now is used for cash inflows or outflows that happen immediately. An annuity is a series of equal payments entered as years x to x. A lump sum is a single receipt or cash payment in the future entered as a single year.

Column C is for the present value factor from the present value tables (Appendix A: Present Value Tables). Use the present value of an annuity chart for a series of payments, e.g., years x to x. Use the present value of a lump sum chart for a single lump sum payment.

Column D is the present value of the cash inflow or outflow (column B x column C).

The Diamond LX and VIP Express models have the same types of cash inflows/outflows—investment required, annual net cash inflows, and the salvage value at the end of the useful life. The discount rate for Ancient Cities Tours is 10%.

The original investment represents an immediate cash outflow. The year is now since it will be spent immediately. The discount factor for an immediate cash inflow or outflow is 1 since the time value of an amount today is 100%. Or, \$1 today is worth \$1.

The annual net cash inflows are positive since this is the net cash received from the investment. The useful life for the Diamond LX and VIP Express models are 12 and 10 years, respectively. The annual net cash inflows are a series of cash receipts. Accordingly, the discount factor is selected from the present value of an ordinary annuity table. The Diamond LX discount factor is 6.814 taken from row 12, 10% column. The VIP Express discount factor is 6.145 taken from row 10, 10% column.

Salvage value is the residual value of an investment or asset at the end of its useful life. It represents the amount the organization can realize if they sell or trade the asset at the end of its useful life. For example, Maya estimates that she can sell the Diamond LX for \$54,000 in 12 years and the VIP Express for \$93,000 in 10 years. Salvage value is a cash inflow, so it is positive. Since this is a lump sum cash inflow at the

end of the asset's useful life, the discount factor is selected from the present value of a lump sum table. The Diamond LX discount factor is 0.319 taken from row 12, 10% column. The VIP Express discount factor is 0.386 taken from row 10, 10% column.

The present value of each cash inflow and outflow is calculated in column D (column B x column C). The investment's net present value is the sum of the present value for the cash inflows and outflows. Both models have a positive net present value, meaning they return over 10%. A zero net present value would mean the model returned precisely 10%. And a negative net present value means the models did not return 10%. It is important to note that a negative net present value does not always mean the project has a negative return. Instead, it indicates that the project does not return the discount rate used for the analysis. In this example, the net cash inflows from the Diamond LX model have a slightly higher net present value than the net cash inflows from the VIP Express model.

## Video Illustration 11-3: Net present value method LO5

Jen Labs is considering the purchase of a new lab machine to test blood samples for specific viruses. The machine costs \$372,000. The machine has a useful life of 6 years. The machine will require a \$50,000 general maintenance service in year 3. If they purchase this machine, they estimate that they will run 1,500 blood tests per year. They can charge \$120 per blood test. The machine will require \$81,000 per year in operating costs. At the end of the six years, the machine has a \$24,000 trade-in value. Jen Labs requires a minimum return of 10% on all investments.

Compute the net present value of this investment using Appendix A: Present Value Tables.

***Exhibit 11-7 Template to compute net present value and video explanation.***



Year(s) A	Cash inflow (outflow) B	Present value factor C	Present value (B X C)



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Check your understanding L05



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## Analyzing capital budgeting decision making methods L06

The capital budgeting decision making methods introduced in this chapter are used to analyze capital purchases or investments. A summary of the analysis for Ancient Cities Tours is presented in Exhibit 11-8. The Diamond LX model has a higher simple rate of return, internal rate of return, and net present value. The payment periods for both models are essentially the same. Based solely on this analysis, the Diamond LX is the better alternative.

***Exhibit 11-8 Summary Ancient Cities Tours capital budgeting decision making methods using original data***

	<b>Diamond LX</b>	<b>VIP Express</b>
Payback period	5.48	5.45
Simple rate of return	10.6%	9.5%
Internal rate of return	15%	13.00%
Net present value	\$185,790	\$139,537

It is important to emphasize that the analysis in Exhibit 11-8 is based on the estimates and projections given in the original data in Exhibit 11-2. Assume that the manufacturer provided each model's estimated useful life. Maya determined that both models could be used for 12 years. Changing this assumption will affect the simple rate of return, internal rate of return, and net present value results. A summary of the results using a 12-year useful life for both models is presented in Exhibit 11-9. The VIP Express is the better alternative when a 12-year useful life is used for both models.

***Exhibit 11-9 Summary Ancient Cities Tours capital budgeting decision making methods assuming 12-year useful life.***

	<b>Diamond LX</b>	<b>VIP Express</b>
Payback period	5.48	5.45
Simple rate of return	10.6%	11.0%
IRR Factor	5.48	5.45
Internal rate of return	15%	15%
Net present value	\$185,790	\$232,773

As demonstrated, the capital budgeting decision making methods presented in this chapter are practical tools for evaluating capital projects or investments. The results, however, depend on the accuracy and quality of the estimates and projection data inputted into the methods.

## Practice Video Problems

*The chapter concepts are applied to comprehensive business scenarios in the below Practice Video Problems.*

### **Practice Video Problem 11-1:** Payback period, simple rate of return, and internal rate of return LO1, LO2, LO3

Holly Rich is considering becoming an independent contractor for a national rideshare company as a second job. Her current car is older and not reliable enough to use for the business. She is considering purchasing a newer car to use in the business. A reliable used car would cost

\$19,000. The dealer offered her \$1,000 trade-in value on her old car. The trade-in will be applied to the purchase of the new car. The car will have a 5-year useful life. She estimates that she can provide 40 rides per week and work 50 weeks per year. She earns an average of \$9 per ride. Her cash expenses average \$6.50 per ride. Annual depreciation on the car would be \$3,800 per year.

**Required:** Compute the payback period, simple rate of return, and internal rate of return for this investment.

Payback period

Simple rate of return

Internal rate of return



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## Practice Video Problem 11-2:

### Net present value method

#### LO6

The manager of Quick Print, Inc. wants to replace an outdated, large-format analog printer. She has narrowed the decision down to two digital models, the standard commercial model or the premium commercial model. The required minimum rate of return on all investments is 12%.

The standard model costs \$72,000 and has a useful life of 6 years. The standard model

requires maintenance service in year 2 and year 4 at a cost of \$2,100 per service. Annual revenue is estimated to be \$36,000 and annual cash operating expenses are estimated to be \$12,000. The salvage value is estimated to be \$7,200.

The premium model cost \$93,000 and has a useful life of 8 years. The premium model requires maintenance service in year 2, year 4, and year 6 at a cost of \$2,100 per service. This copier can be used to provide more services than the standard model so annual revenue is estimated to be \$52,000 and annual cash operating expenses are estimated to be \$21,000. The salvage value is estimated to be \$5,200.

**Required:** Compute the net present value for both copiers using Appendix A: Present Value Tables.

Net present value calculation table			
Year(s)	Cash inflow/(outflow)	Present value factor	Present value
A	B	C	(B X C)
Standard copier			
Premium copier			



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## Review Questions

*Review questions reinforce the chapter content.*



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LO5: Evaluate the acceptability of an investment project using the net present value method

## Homework Questions

*Homework questions can be used for additional practice or can be assigned in an academic setting.*

*Full feedback is not available online. Homework questions can be assigned, with auto-grading and export, to specific learning management platforms, e.g., Canvas, Blackboard, etc. Contact the author for details.*



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LO5: Evaluate the acceptability of an investment project using the net present value method



# APPENDIX A: PRESENT VALUE TABLES

Table: Present value of a lump sum

	1%	2%	3%	4%	5%	6%	8%	10%	12%	13%	14%	15%	16%	17%	18%	19%	20%
1	0.990	0.980	0.971	0.962	0.952	0.943	0.926	0.909	0.893	0.885	0.877	0.870	0.862	0.855	0.847	0.840	0.833
2	0.980	0.961	0.943	0.925	0.907	0.890	0.857	0.827	0.797	0.783	0.769	0.756	0.743	0.731	0.718	0.706	0.694
3	0.971	0.942	0.915	0.889	0.864	0.840	0.794	0.751	0.712	0.693	0.675	0.658	0.641	0.624	0.609	0.593	0.579
4	0.961	0.924	0.889	0.855	0.823	0.792	0.735	0.683	0.636	0.613	0.592	0.572	0.552	0.534	0.516	0.499	0.482
5	0.952	0.906	0.863	0.822	0.784	0.747	0.681	0.621	0.567	0.543	0.519	0.497	0.476	0.456	0.437	0.419	0.402
6	0.942	0.888	0.838	0.790	0.746	0.705	0.630	0.565	0.507	0.480	0.456	0.432	0.410	0.390	0.370	0.352	0.335
7	0.933	0.871	0.813	0.760	0.711	0.665	0.584	0.513	0.452	0.425	0.400	0.376	0.354	0.333	0.314	0.296	0.279
8	0.924	0.854	0.789	0.731	0.677	0.627	0.540	0.467	0.404	0.376	0.351	0.327	0.305	0.285	0.266	0.249	0.233
9	0.914	0.837	0.766	0.703	0.645	0.592	0.500	0.424	0.361	0.333	0.308	0.284	0.263	0.243	0.225	0.209	0.194
10	0.905	0.820	0.744	0.676	0.614	0.558	0.463	0.386	0.322	0.295	0.270	0.247	0.227	0.208	0.191	0.176	0.162
11	0.896	0.804	0.722	0.650	0.585	0.527	0.429	0.351	0.288	0.261	0.237	0.215	0.195	0.178	0.162	0.148	0.135
12	0.888	0.789	0.701	0.625	0.557	0.497	0.397	0.319	0.257	0.231	0.208	0.187	0.168	0.152	0.137	0.124	0.112
13	0.879	0.773	0.681	0.601	0.530	0.469	0.368	0.290	0.229	0.204	0.182	0.163	0.145	0.130	0.116	0.104	0.093
14	0.870	0.758	0.661	0.578	0.505	0.442	0.341	0.263	0.205	0.181	0.160	0.141	0.125	0.111	0.099	0.088	0.078
15	0.861	0.743	0.642	0.555	0.481	0.417	0.315	0.239	0.183	0.160	0.140	0.123	0.108	0.095	0.084	0.074	0.065

Table: Present value of an ordinary annuity

	1%	2%	3%	4%	5%	6%	8%	10%	12%	13%	14%	15%	16%	17%	18%	19%	20%
1	0.990	0.980	0.971	0.962	0.952	0.943	0.926	0.909	0.893	0.885	0.877	0.870	0.862	0.855	0.847	0.840	0.833
2	1.970	1.942	1.914	1.886	1.859	1.833	1.783	1.736	1.691	1.668	1.647	1.626	1.605	1.585	1.566	1.547	1.528
3	2.941	2.884	2.829	2.775	2.723	2.673	2.577	2.487	2.402	2.361	2.322	2.283	2.246	2.210	2.174	2.140	2.106
4	3.902	3.808	3.717	3.630	3.546	3.465	3.312	3.170	3.037	2.974	2.914	2.855	2.798	2.743	2.690	2.639	2.589
5	4.853	4.714	4.580	4.452	4.330	4.212	3.993	3.791	3.605	3.517	3.433	3.352	3.274	3.199	3.127	3.058	2.991
6	5.796	5.601	5.417	5.242	5.076	4.917	4.623	4.355	4.111	3.998	3.889	3.784	3.685	3.589	3.498	3.410	3.326
7	6.728	6.472	6.230	6.002	5.786	5.582	5.206	4.868	4.564	4.423	4.288	4.160	4.039	3.922	3.812	3.706	3.605
8	7.652	7.326	7.020	6.733	6.463	6.210	5.747	5.335	4.968	4.799	4.639	4.487	4.344	4.207	4.078	3.954	3.837
9	8.566	8.162	7.786	7.435	7.108	6.802	6.247	5.759	5.328	5.132	4.946	4.772	4.607	4.451	4.303	4.163	4.031
10	9.471	8.983	8.530	8.111	7.722	7.360	6.710	6.145	5.650	5.426	5.216	5.019	4.833	4.659	4.494	4.339	4.192
11	10.368	9.787	9.253	8.761	8.306	7.887	7.139	6.495	5.938	5.687	5.453	5.234	5.029	4.836	4.656	4.486	4.327
12	11.255	10.575	9.954	9.385	8.863	8.384	7.536	6.814	6.194	5.918	5.660	5.421	5.197	4.988	4.793	4.611	4.439
13	12.134	11.348	10.635	9.966	9.394	8.853	7.904	7.103	6.424	6.122	5.842	5.583	5.342	5.118	4.910	4.715	4.533
14	13.004	12.106	11.296	10.563	9.899	9.295	8.244	7.367	6.628	6.302	6.002	5.724	5.468	5.299	5.008	4.802	4.611
15	13.865	12.849	11.938	11.118	10.380	9.712	8.560	7.606	6.811	6.462	6.142	5.847	5.575	5.324	5.092	4.876	4.675

# GLOSSARY

## Glossary

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### Activity driver

An activity driver is an activity that causes the incurrence of the variable cost. Common activity drivers are units of sales, units of production, direct labor hours worked, or machine hours used.

### Activity variances

Activity variances are the difference between the planning budget and the flexible budget. Activity variances are solely the result of changing the activity level from the planning quantity used for the planning budget to the actual quantity used for the flexible budget.

### Allocation base

An allocation base or cost driver is a production activity that drives costs such as direct labor hours, machine hours, direct labor dollars, or direct material dollars.



## Asset

Assets are items that an organization owns that have future value to the organization.

## Break even

Break even is the point at which net operating income equals zero. An organization breaks even when its sales revenue covers total costs--both variable and fixed.

## Breakeven

Breakeven is the point at which net operating income equals zero, when sales revenue covers total costs--both variable and fixed.

## Budget

A detailed financial plan for future time periods.

## Budgeted income statement

The budgeted income statement reports the organization's profitability during a specific period.

## Common fixed costs

Common fixed costs are costs that are common to, or shared by, all organizational segments.

## Contribution margin

Contribution margin is calculated as Sales less Variable Expenses. It represents the margin an organization can make or lose as the number of units sold increases or decreases.

## Contribution margin income statement

An income statement reports an organization's sales revenue less its expenses (costs) for specified period of time. On a contribution margin income statement, costs are classified as variable or fixed.

## Contribution margin ratio

The contribution margin ratio is calculated as Contribution Margin divided by Sales. It represents the percentage of margin you can make or lose as the number of units sold increases or decreases.

## Cost behavior

Cost behavior is how a cost reacts to changes in production, usage, or sales quantity. Cost behavior is classified as variable, fixed, or mixed.

## Cost classification

Cost classification is the process of separating costs into different categories.

## Cost formula

A cost formula is used to predict the expected cost for a specific expenditure.

## Cost of Goods Sold

Cost of Goods Sold is the expense account used to report the costs associated with purchasing or manufacturing the inventory sold.

## Cost structure

Cost structure is the type and proportion of fixed and variable costs in relation to the organization's total costs.

## Cost volume profit (CVP) analysis

Cost volume profit (CVP) analysis is a tool used to estimate how profits are affected by the following five factors: 1.) selling prices, 2.) sales volume, 3.) unit variable costs, 4) total fixed costs, or 5.) mix of products sold.

## Direct labor

Direct labor is manufacturing labor costs that can be easily and economically traced to the production of the product.

## Direct materials

Direct materials are raw materials costs that can be easily and economically traced to the production of the product.

## Direct materials purchases budget

The direct materials purchases budget estimates the amount of raw materials purchases needed to produce the units scheduled for production plus the desired level of raw materials ending inventory.

## Expense

An expense is a cost of operations that a company incurs to generate revenue. Generally, the benefit of the cost is used in the same period in which the corresponding revenue is reported.

## Financial accounting

Financial accounting is concerned with classifying,

recording, and reporting financial transactions in a formal accounting system

### Finished Goods account

The Finished Goods inventory account is where finished inventory is reported at the cost to produce—direct material, direct labor, and manufacturing overhead—until it is sold.

### Fixed cost

Fixed cost is the same cost in total regardless of the quantity produced, used, or sold but the per-unit cost changes depending on the quantity produced, used, or sold.

### Flexible budget

A flexible budget is the planning budget reforecasted using the actual level of activity instead of the planned level of activity. The flexible budget uses the same cost formulas as the planning budget but is prepared using the actual sales quantity as the cost driver.

### Flexible budget variances

Flexible budget variances are the discrepancies found when comparing the planning budget, flexible budget, and actual operating results.

## Gross profit

Gross profit is sales revenue less the cost of the goods sold.

## High-low method

The high-low method is used to estimate the variable and fixed components of a mixed cost. The difference between the highest use observation and the lowest use observation is considered the variable portion of the cost.

## Income statement

An income statement also referred to as a profit and loss statement, reports an organization's revenue and expenses for a specified period of time.

## Indirect labor costs

Indirect labor costs are manufacturing labor costs that cannot be easily and economically traced to the production of the product, e.g. the production supervisor's salary or quality control.

## Indirect materials

Indirect materials are raw materials that cannot be easily and economically traced to the production of the product, e.g. glue, nails, sandpaper, towels, etc.

## Job cost sheet

A standard job cost sheet records all direct material, direct labor, and manufacturing overhead costs applied to a job.

## Job-order costing

Job-order costing is an accounting system used to assign costs to the products or services that an organization produces.

## Liability

A liability is a present obligation for an organization to provide cash or some other service in the future. Examples of common liability accounts include, Accounts Payable, Salaries Payable, or Taxes Payable.

## Managerial accounting

Managerial accounting is concerned with classifying, analyzing, and reporting data for internal decision making.

## Manufacturing business

A manufacturing business is a business entity that uses raw materials, parts, or other components to make a finished good.

## Manufacturing overhead

Manufacturing overhead are all other indirect costs associated with manufacturing the product that are not direct material or direct labor.

## Manufacturing Overhead account

The Manufacturing Overhead inventory account is used to record actual manufacturing overhead costs incurred to produce a product.

## Manufacturing overhead budget

The manufacturing overhead budget calculates the total manufacturing overhead that will be incurred to satisfy production.

## Master budget

A master budget consists of a set of interrelated but independent budgets that articulate the organization's sales, production, profit, and financial position for a specified time period.

## Merchandising business

A merchandising business is a business entity that purchases finished inventory products from the business that manufactures the inventory with the intent to resale



it and make a profit. A merchandiser makes a profit by marking up the inventory and selling it at a higher price to its customers

### Mixed cost

Mixed cost is a cost that has both a variable and a fixed component.

### Multiple predetermined manufacturing overhead rates

When multiple predetermined manufacturing overhead rates are used, manufacturing overhead costs are allocated to specific departments or processes and then applied to jobs using an allocation base or cost driver that drives the overhead costs for that department or process.

### Net operating income

The formula to compute net operating income, sometimes referred to as net income or net profit, is the organization's revenues less its expenses.

### Organization-wide predetermined manufacturing overhead rate

An organization-wide predetermined manufacturing overhead rate is computed by dividing the total estimated manufacturing overhead amount by the total estimated allocation base or cost driver.

## Organizational segment

An organizational segment is a part or activity within an organization about which managers would like cost, revenue, or profit data. Organizational segments can include divisions, individual stores, geographic regions, customers, or product lines.

## Performance evaluation

Performance evaluation occurs at the end of the budget cycle and is the process of comparing the budgeted estimates to the actual results.

## Period costs

Period costs are all other costs not associated with purchasing or producing inventory for resale but are necessary for sustaining the organization, selling the inventory, and servicing customers.

## Planning budget

A planning budget is a detailed financial plan for future time periods.

## Predetermined manufacturing overhead rate

Estimated overhead rate used to uniformly apply estimated manufacturing overhead to the jobs in process

during a specified period of time using some type of allocation base or cost driver, such as direct labor hours, direct material dollars, or machine hours.

## Product costs

Product costs are all costs associated with purchasing or producing inventory for resale.

## Production budget

The production budget estimates the number of units that need to be produced to 1) meet sales demand and 2) maintain the desired level of finished goods inventory on hand.

## Raw Materials account

The Raw Materials inventory account is used to record the costs for all raw materials—direct and indirect—purchased to manufacture a product.

## Relevant range of production

The relevant range of production is the range between a minimum and a maximum production activity where certain revenue and expense levels can be expected to occur.

## Revenue and spending variances

Revenue and spending variances are the difference between the flexible budget and the actual financial results. Revenue and spending variances are used to evaluate how well the organization did at achieving revenue, cost, and profit targets.

## Revenue formula

A revenue formula is used to predict expected revenue for a given level of sales activity.

## Sales budget

The sales budget details the estimated sales quantity, sales price per unit, and total sales revenue.

## Sales revenue

Sales revenue is the income received by a company from its sales of goods or the provision of services.

## Scatter plot chart

A scatter plot shows if a linear relationship exists between two sets of data.

## Segment margin

The segment margin is calculated as the sales revenue traceable to an organizational segment less the variable costs traceable to an organizational segment.

## Segmented income reporting

Segmented income reporting traces sales revenue, variable costs, and fixed costs to the organizational segments responsible for generating the sales revenue or costs.

## Segmented income statements

Segmented income statements allocate revenue and cost to the identified segments within an organization and report the profitability of each segment.

## Selling and administrative expenses budget

Budget used to project selling and administrative expenses (S&A expenses) or period expenses.

## Standard cost

Standard costs are cost targets used to make financial projections and evaluate performance.

## Standards

Standards are cost or revenue targets used to make financial projections and evaluate performance.

## Target profit

Target profit is the point at which net operating income equals a specified amount. Target profit is calculated when an organization needs to know the quantity of sales required to cover total costs and earn a certain net profit.

## Traceable fixed costs

Traceable fixed costs are costs that can be traced directly to an organizational segment.

## Traditional income statement

An income statement reports an organization's sales revenue less its expenses (costs) for specified period of time. On a traditional income statement, costs are classified as product or period.

## Variable costs

Variable costs are the same cost per unit but the total cost depends on the quantity produced, used, or sold.

## Variance

A variance is any discrepancy found when two or more items are compared.

## Work in Process account

Work in Process (WIP) is the inventory account where product costs including direct material, direct labor, and manufacturing overhead are accumulated while the jobs are in the manufacturing process.