PRINCIPLES OF MANAGERIAL ACCOUNTING 2

HACC, Central Pennsylvania's Community College

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Principles of Managerial Accounting 2

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14: Preface

Preface

Brief, Focused, Essential

Students want to learn accounting in the most efficient way possible, balancing coursework with personal schedules. They tend to focus on their studies in short intense segments between jobs, classes, and family commitments. Meanwhile, the accounting industry has endured dramatic shifts since the collapse of Enron and WorldCom, causing a renewed focus on ethical behavior in accounting.

Core Themes

This book is aimed squarely at the new learning styles evident in today's students and addresses accounting industry changes as well. Accordingly, three core themes lie at the foundation of this text:

1. **Focused.** Students want to be as efficient as possible in their learning. This book adopts a concise, jargon-free, and easy-to-understand approach. Key concepts are provided in short segments with bullet points and step-by-step instructions to simplify concepts. A thoughtful, stepwise approach helps students avoid distractions and focuses attention on the big picture.
2. **Reinforcement.** Review Problems at the end of each major section offer practical opportunities for students to apply what they have learned. These Review Problems allow students to immediately reinforce what they have learned and are provided within the body of the chapter along with the solutions.
3. **Relevance.** Students perform better when they can answer the "why" question. Why is managerial accounting important? Meaningful references to companies throughout the chapters help students tie the concepts presented in each chapter to real organizations.

In addition, realistic managerial scenarios present an issue that must be addressed by the management accountant. These pique student interest and are designed to show how issues can be resolved using the concepts presented in the chapter.

Finally, Business in Action features in this text link managerial decision making to real business decisions.

Other Key Features

- **A focus on decision making.** This book focuses on the essential managerial accounting concepts used within organizations for decision-making purposes and covers these concepts in 13 straightforward and concise chapters. Knowing that the majority of students taking managerial accounting at the introductory level are general business majors and will not become accountants, this text was written to help students make informed business decisions using managerial accounting concepts.
- **Thorough end-of-chapter coverage.** The Exercises, Problems, and Cases were developed to give student a wide range of reinforcement at different levels of complexity and to help build critical thinking skills.
- **Ethics coverage.** The importance of ethics is evident from the outset since the book begins with an entire segment on ethical issues facing the accounting industry. This segment includes the Institute of Management Accountants' revised standards of ethical conduct and describes professional codes of conduct provided by the American Institute of Certified Public Accountants, Financial Executives International, and International Federation of Accountants. Ethics questions and cases are included throughout the text.
- **Group projects.** The accounting industry and business in general have made it clear employees must be able to work effectively and efficiently in groups. In addition, studies show students learn concepts more effectively when working in groups. To reinforce this idea, we have included group projects throughout the book.
- **Spreadsheet applications.** Computer Application features and End-of-Chapter Exercises emphasize the importance of using Excel spreadsheets for analytical purposes.

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1: How Is Job Costing Used to Track Production Costs?

Since the concepts of costs and their definitions have been covered in Principles of Managerial Accounting 1, we jump right into the specific systems designed to track and account for these costs.

Chapter 1 How Is Job Costing Used to Track Production Costs?

Dan Stevens recently started Custom Furniture Company, a manufacturing company that specializes in building custom wood tables for individuals and organizations. Each table is unique and built to customer specifications for use in homes (coffee tables and dining room tables) and offices (boardroom and meeting room tables). The sales price of each table varies significantly, from $1,000 to more than $30,000.

When Dan received the company's income statement for May, he was surprised by the lack of profits. Because sales prices are based on a markup of estimated costs, Dan is questioning the accuracy of his estimates. He approaches Leslie, the full-time accountant for Custom Furniture Company, to get more information.

Dan:
Leslie, last month's income statement shows we are struggling to make a decent profit. I'm not sure why this is happening, especially since we price our furniture 70 percent above estimated production costs.

Leslie:
Basing prices on estimated costs is a good approach, but it only works if your estimates are accurate. Have you compared the actual cost of each table with your original estimates?

Dan:
No, but I like the idea. Where do I start?

Leslie:
We use a job cost accounting system that tracks costs for each table you produce. I can pull together the information for you. How far back do you want to go?

Dan:
Let's start by looking at actual product costs for the three costliest tables produced in May. It would be helpful to break these costs out for direct materials, direct labor, and manufacturing overhead. I would also like to see the gross profit generated by each table.

Leslie:
No problem, I'll have the information for you by the end of the day.

We use Custom Furniture Company as an example throughout the chapter to explain how a job costing system works and to provide information that will address Dan's concerns.

1.1 Differentiating Job Costing from Process Costing

Learning Objectives

1. Distinguish between job costing and process costing.

Question: Financial accounting classes cover how merchandising companies, such as Sears and Lowe's , account for the cost of the goods that they purchase from a supplier and later sell to a customer. These companies simply record the cost of the purchase in an inventory account and account for any returns and allowances, discounts, and shipping costs. Once the merchandise is sold, the related inventory costs are transferred to cost of goods sold. However, manufacturing companies are different. How do manufacturing companies account for inventory at different stages of production?

Answer: Manufacturing companies like Custom Furniture Company, **Ford**, and **IBM** don't have it quite as easy as merchandising companies. They must account for the materials, labor, and other manufacturing costs that go into building the product. The process of accounting for manufacturing costs depends on which costing system a company uses—job costing or process costing.

Job Costing

Question: We define a **job** *as an activity that produces a unique product—one that can be easily distinguished from other products. For example, building a custom home is a job because the home is unique and easy to distinguish from other homes. An accounting firm's provision of tax services to a client is another example of a job. How does a job costing system help companies that produce unique products or jobs?*

Answer: A job costing system records revenues and costs for each job. Because each job at Custom Furniture Company results in a unique product and has different material and labor requirements, the company uses a job costing system.

Tracking revenues and costs for each job is important for several reasons:

- Like Dan at Custom Furniture, managers want to assess the accuracy of cost estimates. This is particularly important when prices are based on estimated costs.
- Managers want to review actual revenues and costs for each job to see if the job is profitable.
- Managers want to compare actual costs with estimated costs throughout a project so they can identify unexpected changes as early in the project as possible. For example, if the cost of mahogany wood increases by 50 percent, Custom Furniture might renegotiate the price of a mahogany table with the customer. If it's too late to renegotiate the price of a current job, the cost increase could be built into the pricing of future jobs.

Process Costing

Question: Job costing may work for builders of custom furniture and tax professionals, but does job costing make sense for a company that produces soft drinks? Imagine trying to track costs for each can of soda produced. A job costing system would not be appropriate for this type of company. A different costing system, called process costing, would be a better fit. Which types of companies use this type of system?

Answer: Companies that produce identical units of product in batches using a consistent process track costs with a process costing systemA costing system used by companies that produce identical units of product in batches employing a consistent process.. Table 1.1 "Job Costing Versus Process Costing" lists some products and services that require the use of process costing versus job costing. This chapter focuses on job costing. We explore process costing further in Chapter 3 "How Is Process Costing Used to Track Production Costs?".

Table 1.1 Job Costing Versus Process Costing

Job Costing	Process Costing
Custom homes	Oil
Custom vans	Chemicals
House painting services	Paint
Movies	Lumber
Airplanes	Milk
Bridges	Pencils
Legal services	Paper

Key Takeaway

- Job costing systems record revenues and costs for unique products; ones that can be easily distinguished from other products. Process costing systems record revenues and costs for batches of identical units of product. When deciding whether to use a job

costing or process costing system, we must understand a company's products and production processes.

Check Yourself

Identify whether each company listed in the following would use job costing or process costing.

1. **Coca-Cola Company**
2. **Kelly Moore Paint**
3. **Volkswagen**—custom campers
4. **Universal Studios**—movie division
5. **Chevron Corporation**
6. **Michelin**
7. **Boeing Co.**
8. **Ernst & Young**—tax division

Solution

1. Process costing
2. Process costing
3. Job costing
4. Job costing
5. Process costing
6. Process costing
7. Job costing
8. Job costing

1.2 How a Job Costing System Works

Learning Objective

1. Understand how direct materials and direct labor costs are assigned to jobs.

Question: Now that we know a job costing system records revenues and costs for each unique job, we can determine whether this type of system would be appropriate at Custom Furniture Company. Recall that Custom Furniture produces high-quality custom wood tables that are sold for between $1,000 and $30,000. A job costing system is a perfect fit for this type of company. How would Custom Furniture Company use a job costing system to track production costs?

Answer: We use financial information for the month of May at Custom Furniture Company to illustrate how a job costing system works. Refer to Principles of Managerial Accounting 1, as needed, for a refresher on manufacturing cost terms and how the three different inventory accounts are used by manufacturing companies. Let's start our example with the purchase of raw materials.

Purchasing Raw Materials

Question: Recall that raw materials are the items necessary to build a product. For Custom Furniture Company, this includes items such as wood, brackets, screws, nails, glue, lacquer, and sandpaper. How do we record the purchase of raw materials?

Answer: The accountants at Custom Furniture record the cost of raw materials purchased in the raw materials inventory account. Assume Custom Furniture Company purchased $4,500 in raw materials on May 2. All purchases are on account. The journal entry to reflect this transaction is as follows:

May 2	Raw materials inventory	4,500	
	Accounts payable		4,500

This purchase of raw materials is further illustrated in the T-accounts shown in the following. Assume the beginning balance for raw material inventory is $25,000. Beginning balances are only provided for inventory accounts since the focus of this chapter is on manufacturing costs that flow through these accounts.

Raw Materials Inventory			
Beg. bal.	25,000		
(May 2)	4,500		

Accounts Payable			
		Beg. bal.	XX
		4,500	(May 2)

Principles of financial accounting texts discuss the rules for double-entry accounting in detail. Recall that the following account categories are *increased* with a *debit* (and are therefore decreased with a credit): assets, dividends, and expenses. Conversely, the following account categories are *increased* with a *credit* (and decreased with a debit): liabilities, stockholders' equity, and revenues. Also note that the individual transactions shown throughout this chapter represent one example of many similar transactions that occurred throughout the month of May. A summary of activity for the entire month of May is presented later in the chapter.

Assigning Direct Material Costs to Jobs

Question: The next step is to move raw materials from the storeroom to production. How does the company track this information, and how is this transaction recorded in the general journal?

Answer: A materials requisition form tracks materials taken out of raw materials inventory and placed in production. This form specifies the type, quantity, and cost of materials being requested, as well as the number of the job in which the materials will be used. Figure 1.2 "Materials Requisition Form for Custom Furniture Company" shows a materials requisition form that Custom Furniture Company used to transfer $370 in direct materials out of raw materials inventory into production.

Figure 1.2 Materials Requisition Form for Custom Furniture Company

Date May 3 Materials Requisition No. 205
Job Number Charged 50

Quantity	Item Number	Description	Total Cost
40 feet	C230	Cherry wood planks	$240
25 feet	M120	Mahogany trim	$130
Total			$370

Supervisor's Signature _____

The journal entry to reflect this transfer is as follows:

May 3	WIP inventory Raw materials inventory	370	 370

This flow of direct materials from one account to another is further illustrated in the T-accounts that follow. Assume the beginning balance for work-in-process inventory is $35,000.

Raw Materials Inventory				WIP Inventory			
Beg. bal.	25,000			Beg. bal.	35,000		
(May 2)	4,500	370	(May 3) →	(May 3)	370		

Using a Job Cost Sheet

Question: The next step is to post the information shown on the materials requisition form to the appropriate job cost sheet. Because the work-in-process (WIP) inventory account tracks manufacturing costs in total, a separate subsidiary ledger is necessary to track manufacturing costs for each job. The total of all WIP inventory subsidiary ledgers matches the WIP inventory account shown on the balance sheet. What does a WIP inventory subsidiary ledger look like, and how is it used?

Answer: The WIP inventory subsidiary ledger typically comprises many individual *job cost sheets*. A job cost sheet simply accumulates manufacturing costs incurred for each job. Figure 1.3 “Job Cost Sheet for Custom Furniture Company” shows a job cost sheet for Custom Furniture Company. Notice how the materials requisition in Figure 1.2 “Materials Requisition Form for Custom Furniture Company” is a line item in the job cost sheet for job 50.

Figure 1.3 Job Cost Sheet for Custom Furniture Company

Job Cost Sheet for Job No. 50

Customer Diana Sanchez
Description Cherry wood dining room table with mahogany trim

Date Started May 3
Date Completed

Date	Direct Materials* Req. No	Cost	Direct Labor Timesheet No.	Hrs.	Rate	Cost	Manufacturing Overhead $30 per direct labor hour
5/3	205	$370					

Summary of Costs:

Direct Materials	$
Direct Labor	
Mfg. Overhead	
Total Cost	$

*$370 comes from the total in Figure 1.2 “Materials Requisition Form for Custom Furniture Company”.

Assigning Direct Labor Costs to Jobs

Question: Recall that direct labor is defined as workers who convert materials into a finished product and whose time is easily traced to the product or job. Manufacturing companies, such as Custom Furniture Company, must keep track of the hours each worker spends on any given job. How do companies track this information, and how is this information recorded in the general journal?

Answer: Workers use a timesheet to track the hours spent on each job. The timesheet is often called a *time card*, *time ticket*, or *job ticket*. The worker is responsible for completing the timesheet, including the date, job number, and hours worked on each job. In today’s automated environment this tracking may involve signing in on a computer terminal or swiping a id card to start using a machine or punching in a code into that machine.

Figure 1.4 “Timesheet for Custom Furniture Company” provides an example of a timesheet used at Custom Furniture Company to track direct labor costs of $120 related to jobs 50 and 51 for Tim Wallace. The journal entry to reflect this is as follows:

May 4	WIP inventory	120	
	Wages payable		120

Recording these direct labor costs is further illustrated in the T-accounts that follow. Again, beginning balances are only provided for inventory accounts since the focus of this chapter is on manufacturing costs that flow through these accounts.

WIP Inventory			Wages Payable		
Beg. bal.	35,000			Beg. bal.	XX
(May 3)	370			120	(May 4)
(May 4)	120				

Figure 1.4 Timesheet for Custom Furniture Company

Name Tim Wallace Timesheet No. 311
Date May 4

Job Number	Hours	Rate	Total Cost
50	6	$15	$ 90
51	2	15	$ 30
Total			$120

Supervisor's Signature _____

The next step is to post the information shown on the timesheet to the appropriate job cost sheet, just as we did with direct materials. This is done for job 50 in Figure 1.5 "Direct Labor Costs for Custom Furniture Company's Job 50".

Figure 1.5 Direct Labor Costs for Custom Furniture Company's Job 50

Job Cost Sheet for Job No. 50

Customer Diana Sanchez Date Started May 3
Description Cherry wood dining room table with mahogany trim Date Completed _____

	Direct Materials		Direct Labor*				Manufacturing Overhead
Date	Req. No	Cost	Timesheet No.	Hrs.	Rate	Cost	$30 per direct labor hour
5/3	205	$370					
5/4			311	6	$15	$90	

Summary of Costs:

Direct Materials	$
Direct Labor	
Mfg. Overhead	
Total Cost	$

*Direct labor information carried over from Figure 1.4 “Timesheet for Custom Furniture Company”.

Key Takeaways

- A materials requisition form tracks materials taken out of raw materials inventory and placed in production. It identifies the job in which the materials will be used. A timesheet tracks the hours that workers spend on each job. The information from both the materials requisition forms and timesheets is recorded on each job cost sheet. A job cost sheet accumulates manufacturing costs for each job and serves as a subsidiary ledger for the work-in-process inventory account.

Check Yourself

1. Provide the journal entry to record each of the following transactions:
    1. Raw materials totaling $40,000 are purchased on account.
    2. Direct materials totaling $5,000 are requisitioned and placed into production.
    3. Timesheets submitted by employees reflect direct labor costs of $2,000, to be paid the next week.
2. Which of the previously stated entries must also be recorded on the appropriate job cost sheet? Why?

Solutions

1.

Raw materials inventory	40,000	
Accounts payable		40,000

2.

Work in process inventory	5,000	
Raw materials inventory		5,000

3.

WIP inventory	2,000	
Wages payable		2,000

4. Entries **b** and **c** must be recorded on the appropriate job cost sheet. Direct materials (entry **b**) and direct labor (entry **c**) are by definition easily traceable to the job and therefore must be recorded on the job cost sheet when the cost is incurred.

1.3 Assigning Manufacturing Overhead Costs to Jobs

Learning Objectives

1. Understand how manufacturing overhead costs are assigned to jobs.

Question: We have discussed how to assign direct material and direct labor costs to jobs using a materials requisition form, timesheet, and job cost sheet. The third manufacturing cost—manufacturing overhead—requires a little more work. How do companies assign manufacturing overhead costs, such as factory rent and factory utilities, to individual jobs?

Answer: Recall that manufacturing overhead consists of all costs related to the production process other than direct materials and direct labor. Because manufacturing overhead costs are difficult to trace to specific jobs, the amount allocated to each job is based on an estimate. The process of creating this estimate requires the calculation of a predetermined rate.

Using a Predetermined Overhead Rate

The goal is to allocate manufacturing overhead costs to jobs based on some common activity, such as direct labor hours, machine hours, or direct labor costs. The activity used to allocate manufacturing overhead costs to jobs is called an allocation base. Once the allocation base is selected, a predetermined overhead rate can be established. The predetermined overhead rate is calculated prior to the year in which it is used in allocating manufacturing overhead costs to jobs.

Calculating the Predetermined Overhead Rate

Question: How is the predetermined overhead rate calculated?

Answer: We calculate the predetermined overhead rate as follows, using estimates for the coming year:

Key Equation

Predetermined overhead rate=Estimated overhead costs* divided by Estimated activity in allocation base**

*The numerator requires an estimate of all overhead costs for the year, such as indirect materials, indirect labor, and other indirect costs associated with the factory. Custom Furniture Company estimates annual overhead costs to be $1,140,000 based on actual overhead costs last year.

**The denominator requires an estimate of activity in the allocation base for the year. Custom Furniture uses direct labor hours as the allocation base and expects its direct labor workforce to record 38,000 direct labor hours for the year.

The predetermined overhead rate calculation for Custom Furniture is as follows:

Predetermined overhead rate=$1,140,000 estimated overhead costs / 38,000 estimated direct labor hours=$30 per direct labor hour

Thus each job will be assigned $30 in overhead costs for every direct labor hour charged to the job. The assignment of overhead costs to jobs based on a predetermined overhead rate is called overhead applied. Remember that overhead applied does *not* represent actual overhead costs incurred by the job—nor does it represent direct labor or direct material costs. Instead, overhead applied represents a portion of estimated overhead costs that is assigned to a particular job.

Question: Now that we know how to calculate the predetermined overhead rate, the next step is to use this rate to apply overhead to jobs. How do companies use the predetermined overhead rate to apply overhead to jobs, and how is this information recorded in the general journal?

Answer: As shown on the timesheet in Figure 1.4 “Timesheet for Custom Furniture Company”, Tim Wallace charged six hours to job 50. Because manufacturing overhead is applied at a rate of $30 per direct labor hour, $180 (= $30 × 6 hours) in overhead is applied to job 50. The journal entry to reflect this is as follows:

May 4	WIP inventory	180	
	Manufacturing overhead		180

Recording the application of overhead costs to a job is further illustrated in the T-accounts that follow.

Manufacturing Overhead			WIP Inventory		
	180	(May 4)	Beg. bal.	35,000	
			(May 3)	370	
			(May 4)	120	
			(May 4)	180	

When this journal entry is recorded, we also record overhead applied on the appropriate job cost sheet, just as we did with direct materials and direct labor. Figure 1.6 "Overhead Applied for Custom Furniture Company's Job 50" shows the manufacturing overhead applied based on the six hours worked by Tim Wallace. Notice that total manufacturing costs as of May 4 for job 50 are summarized at the bottom of the job cost sheet.

Figure 1.6 Overhead Applied for Custom Furniture Company's Job 50

Job Cost Sheet for Job No. 50

Customer Diana Sanchez
Description Cherry wood dining room table with mahogany trim

Date Started May 3
Date Completed

	Direct Materials		Direct Labor				Manufacturing Overhead
Date	Req. No	Cost	Timesheet No.	Hrs.	Rate	Cost	$30 per direct labor hour
5/3	205	$370					
5/4			311	6	$15	$90	$180*

Summary of Costs:

Direct Materials	$	370
Direct Labor		90
Mfg. Overhead		180
Total Cost	$	640

Overhead applied

*$180 = $30 per direct labor hour × 6 direct labor hours.

Selecting an Allocation Base

Question: Although we used direct labor hours as the allocation base for Custom Furniture Company's predetermined overhead rate, organizations use various other types of allocation bases. The most common allocation bases are direct labor hours, direct labor costs, and machine hours. What factors do companies consider when deciding on an allocation base?

Answer: Companies typically look at the following two items when determining which allocation base to use:

1. **Link to overhead costs.** The goal is to find an allocation base that drives overhead costs, often called a cost driver. For example, if a company's production process is labor intensive (i.e., it requires a large labor force), overhead costs are likely driven by direct labor hours or direct labor costs. The more direct labor hours worked, the higher the overhead costs incurred. Thus direct labor hours or direct labor costs would be used as the allocation base.

If a company's production process is highly mechanized (i.e., it relies on machinery more than on labor), overhead costs are likely driven by machine hours. The more machine hours used, the higher the overhead costs incurred. Thus machine hours would be used as the allocation base.

It may make more sense to use several allocation bases and several overhead rates to allocate overhead to jobs. This approach, called *activity-based costing*, is discussed in depth in Chapter 2 "How Does an Organization Use Activity-Based Costing to Allocate Overhead Costs?".

2. **Ease of measurement.** An allocation base should not only be linked to overhead costs; it should also be measurable. The three most common allocation bases—direct labor hours, direct labor costs, and machine hours—are relatively easy to measure. Direct labor hours and direct labor costs can be measured by using a timesheet, as discussed earlier, so using either of these as a base for allocating overhead is quite simple. Machine hours can also be easily measured by placing an hour meter on each machine if one does not already exist.

Why Use a Predetermined Overhead Rate?

Question: The use of a predetermined overhead rate rather than actual data to apply overhead to jobs is called normal costing *. Most companies prefer normal costing over assigning actual overhead costs to jobs. Why do most companies prefer to use normal costing?*

Answer: Companies use normal costing for several reasons:

- Actual overhead costs can fluctuate from month to month, causing high amounts of overhead to be charged to jobs during high-cost periods. For example, utility costs might be higher during cold winter months and hot summer months than in the fall and spring seasons. Maintenance costs might be higher during slow periods. Normal costing averages these costs out over the course of a year.
- Actual overhead cost data are typically only available at the end of the month, quarter, or year. Managers prefer to know the cost of a job when it is completed—and in some cases during production—rather than waiting until the end of the period.
- The price charged to customers is often negotiated based on cost. A predetermined overhead rate is helpful when estimating costs.
- Bookkeeping is simplified by using a predetermined overhead rate. One rate is used to record overhead costs rather than tabulating actual overhead costs at the end of the reporting period and going back to assign the costs to jobs.

Using a Manufacturing Overhead Account

Question: Using a predetermined overhead rate to apply overhead costs to jobs requires the use of a manufacturing overhead account. How is the manufacturing overhead account used to record transactions?

Answer: The manufacturing overhead account tracks the following two pieces of information:

First, the manufacturing overhead account tracks actual overhead costs incurred. Recall that manufacturing overhead costs include all production costs other than direct labor and direct materials. The actual manufacturing overhead costs incurred in a period are recorded as debits in the manufacturing overhead account. For example, assume Custom Furniture Company places $4,200 in indirect materials into production on May 10. The journal entry to reflect this is as follows:

May 10	Manufacturing overhead	4,200	
	Raw materials inventory		4,200

Other examples of actual manufacturing overhead costs include factory utilities, machine maintenance, and factory supervisor salaries. All these costs are recorded as debits in the manufacturing overhead account when incurred.

Second, the manufacturing overhead account tracks overhead costs applied to jobs. The overhead costs applied to jobs using a predetermined overhead rate are recorded as credits in the manufacturing overhead account. You saw an example of this earlier when $180 in overhead was applied to job 50 for Custom Furniture Company. We repeat the entry here.

May 4	WIP inventory Manufacturing overhead	180	 180

The following T-account summarizes how overhead costs flow through the manufacturing overhead account:

Manufacturing Overhead	
(debit) Actual overhead costs incurred	*(credit)* Overhead costs applied to jobs

The manufacturing overhead account is classified as a clearing account. A clearing account is used to hold financial data temporarily and is closed out at the end of the period before preparing financial statements.

Underapplied and Overapplied Overhead

Question: Because manufacturing overhead costs are applied to jobs based on an estimated predetermined overhead rate, overhead applied (credit side of manufacturing overhead) rarely equals actual overhead costs incurred (debit side of manufacturing overhead). What terms are used to describe the difference between actual overhead costs incurred during a period and overhead applied during a period?

Answer: Two terms are used to describe this difference—*underapplied overhead* and *overapplied overhead*.

Underapplied overhead occurs when actual overhead costs (debits) are *higher* than overhead applied to jobs (credits). The T-account that follows provides an example of underapplied overhead. Note that the manufacturing overhead account has a *debit* balance when overhead is underapplied because fewer costs were applied to jobs than were actually incurred.

Manufacturing Overhead	
(debit) Actual overhead costs incurred $5,000	*(credit)* Overhead costs applied to jobs $3,000
$2,000 balance	

Overapplied overhead occurs when actual overhead costs (debits) are *lower* than overhead applied to jobs (credits). The T-account that follows provides an example of overapplied overhead. Note that the manufacturing overhead account has a *credit* balance when overhead is overapplied because more costs were applied to jobs than were actually incurred.

Manufacturing Overhead	
(debit)	*(credit)*
Actual overhead costs incurred	Overhead costs applied to jobs
$6,000	$9,000
	$3,000 balance

Business in Action 1.1

Source: Photo courtesy of prayitno, http://www.flickr.com/photos/34128007@N04/5293183651/.

Job Costing at **Boeing**

Boeing Company is the world's leading aerospace company and the largest manufacturer of commercial jetliners and military aircraft combined. **Boeing** provides products and services to customers in 150 countries and employs 165,000 people throughout the world.

Since most of **Boeing's** products are unique and costly, the company likely uses job costing to track costs associated with each product it manufactures. For example, the costly direct materials that go into each jetliner produced are tracked using a job cost sheet. Direct labor and manufacturing overhead costs (think huge production facilities!) are also assigned to each jetliner. This careful tracking of production costs for each jetliner provides management with important cost information that is used to assess production efficiency and profitability. Management can answer questions, such as "How much did direct materials cost?," "How much overhead was allocated to each jetliner?," or "What was the total production cost for each jetliner?" This is important information when it comes time to negotiate the sales price of a jetliner with a potential buyer like **United Airlines** or **Southwest Airlines**.

Source: **Boeing**, "Home Page," http://www.boeing.com.

Closing the Manufacturing Overhead Account

Question: Since the manufacturing overhead account is a clearing account, it must be closed at the end of the period. How do we close the manufacturing overhead account?

Answer: Most companies simply close the manufacturing overhead account balance to the cost of goods sold account. For example, if there is a $2,000 debit balance in manufacturing overhead at the end of the period, the journal entry to close the *underapplied* overhead is as follows:

Cost of goods sold	2,000	
Manufacturing overhead		2,000

If manufacturing overhead has a $3,000 credit balance at the end of the period, the journal entry to close the *overapplied* overhead is as follows:

Manufacturing overhead	3,000	
Cost of goods sold		3,000

Alternative Approach to Closing the Manufacturing Overhead Account

Question: Although most companies close the manufacturing overhead account to cost of goods sold, this is typically only done when the amount is immaterial (immaterial is a common accounting term used to describe an amount that is small relative to a company's size). The term material describes a relatively large amount. How do we close the manufacturing overhead account when the amount is material?

Answer: If the amount is material, it should be closed to three different accounts—work-in-process (WIP) inventory, finished goods inventory, and cost of goods sold—in proportion to the account balances in these accounts.

For example, suppose a company has $2,000 in underapplied overhead (debit balance in manufacturing overhead) and that the three account balances are as follows:

Account	Amount	Percent of Total
WIP inventory	$ 6,000	60%
Finished goods inventory	3,000	30%
Cost of goods sold	1,000	10%
Total	$10,000	100%

The $2,000 is closed to each of the three accounts based on their respective percentages. Thus $1,200 is apportioned to WIP inventory (= $2,000 × 60 percent), $600 goes to finished goods inventory (= $2,000 × 30 percent), and $200 goes to cost of goods sold (= $2,000 × 10 percent). The journal entry to close the $2,000 underapplied overhead debit balance in manufacturing overhead is as follows:

WIP inventory	1,200	
Finished goods inventory	600	
Cost of goods sold	200	
Manufacturing overhead		2,000

Although this approach is not as common as simply closing the manufacturing overhead account balance to cost of goods sold, companies do this when the amount is relatively significant.

Key Takeaways

- Most companies use a normal costing system to track product costs. Normal costing tracks actual direct material costs and actual direct labor costs for each job and charges manufacturing overhead to jobs using a predetermined overhead rate. The predetermined overhead rate is calculated as follows:

  Predetermined overhead rate=Estimated overhead costs / Estimated activity in allocation base

- A manufacturing overhead account is used to track actual overhead costs (debits) and applied overhead (credits). This account is typically closed to cost of goods sold at the end of the period.

Exercises

1. Chan Company estimates that annual manufacturing overhead costs will be $500,000. Chan allocates overhead to jobs based on machine hours, and it expects that 100,000 machine hours will be required for the year. Calculate the predetermined overhead rate.
2. Why might Chan Company use machine hours as the overhead allocation base?
3. Chan Company received a bill totaling $3,700 for machine parts used in maintaining factory equipment. The bill will be paid next month. Make the journal entry to record this transaction.
4. Job 153 used a total of 2,000 machine hours. Make the journal entry to record manufacturing overhead applied to job 153. What other document will include this amount?
5. Assume Chan Company incurs actual manufacturing overhead costs of $470,000 and applies overhead of $510,000 for the year. Account balances are as follows: WIP inventory, $25,000; finished goods inventory, $25,000; and cost of goods sold, $50,000.

   1. Is overhead overapplied or underapplied? Explain your answer.
   2. Make the journal entry to close the manufacturing overhead account assuming the balance is immaterial.
   3. Make the journal entry to close the manufacturing overhead account assuming the balance is material.

Solutions

1. The predetermined overhead rate is calculated as follows:

   Predetermined overhead rate=Estimated overhead costs / Estimated activity in allocation base=$500,000 estimated overhead costs / 100,000 machine hours= $5 per machine hour

2. If Chan's production process is highly mechanized, overhead costs are likely driven by machine use. The more machine hours used, the higher the overhead costs incurred. Thus there is a link between machine hours and overhead costs, and using machine hours as an allocation base is preferable.

   Machine hours are also easily tracked, making implementation relatively simple.

3.

Manufacturing overhead	3,700	
Accounts payable		3,700

4. A total of $10,000 (= $5 per machine hour rate × 2,000 machine hours) will be applied to job 153 and recorded in the journal as follows:

WIP inventory	10,000	
Manufacturing overhead		10,000

This amount will also be recorded on the job cost sheet for Job 153.

1. Overhead is *overapplied* because actual overhead costs are lower than overhead applied to jobs. Also, the manufacturing overhead account has a credit balance.

Manufacturing overhead	40,000	
Cost of goods sold		40,000

2.

Manufacturing overhead	40,000	
WIP inventory		10,000*
Finished goods inventory		10,000*
Cost of goods sold		20,000*

3.

*Amounts are calculated as follows. Allocation amount = percent of total × the overapplied balance of $40,000.

Account	Account Balance	Percent of Total	Allocation Amount
WIP inventory	$ 25,000	25%	$ 10,000
Finished goods inventory	25,000	25%	10,000
Cost of goods sold	50,000	50%	20,000
Total	$ 100,000	100%	$ 40,000

1.4 Job Costing in Service Organizations

Learning Objectives

1. Apply job costing methods to service organizations.

Question: Although this chapter has focused on job costing in a manufacturing setting, many service organizations use job costing as well. Electricians, accountants, and auto mechanics are examples of service providers that use job costing. Electricians track costs by project (e.g., a new building or a kitchen remodel), accountants track costs by client (e.g., an individual or a corporation), and auto mechanics track costs by job (e.g., replacing a drive belt on a company truck). How does job costing work in a service company setting?

Answer: Job costing in service organizations is the same as in manufacturing organizations, except that service organizations tend to use fewer materials. There are also minor differences in the accounts that these types of organizations use, as shown in Table 1.2

"Accounts Used in Service Organizations and Manufacturing Organizations".

Table 1.2 Accounts Used in Service Organizations and Manufacturing Organizations

Manufacturing Organization Account Name	Service Organization Account Name	Financial Statement
Raw materials inventory	Parts inventory or supplies	Balance sheet (asset)
Work-in-process inventory	Work in process*	Balance sheet (asset)
Finished goods	(Not applicable)	Balance sheet (asset)
Cost of goods sold	Cost of services (or other expense accounts)	Income statement (expense)
Manufacturing overhead	Overhead (or service overhead)	None (clearing account)
*Some service companies do not use a work-in-process account but instead simply charge costs directly to expense accounts.		

Service organizations use a job cost sheet like the one discussed earlier to track direct materials, direct labor, and overhead.

Direct Materials

Question: How do service organizations track direct materials using job costing?

Answer: Many service organizations do not track direct materials for each job because the cost of the materials is negligible. For example, accountants and attorneys use low-cost materials, such as binders and paper. These materials, often called supplies, are included in overhead rather than tracked by job.

Some service organizations track direct materials for each job because the cost of the materials is significant. Consider auto mechanics, who track the parts needed to perform repairs for each job, or electricians, who track the materials needed to wire a new building. Materials may be requisitioned from parts inventory or supplies, similar to raw materials inventory in a manufacturing setting, or may be purchased directly from a supplier, depending on the nature of the business. The process of recording this information in the journal and job cost sheet is exactly the same as for a manufacturing company (refer back to Figure 1.3 "Job Cost Sheet for Custom Furniture Company" for an example).

Direct Labor

Question: How do service organizations track direct labor using job costing?

Answer: Direct labor tends to be the most significant cost for service organizations. The process of tracking labor using a timesheet and recording labor costs in the journal and job cost sheet is exactly the same as for a manufacturing company (refer back to Figure 1.4 "Timesheet for Custom Furniture Company" and Figure 1.5 "Direct Labor Costs for Custom Furniture Company's Job 50" for examples).

Overhead

Question: Like manufacturing companies, service organizations often use a predetermined overhead rate to apply overhead. What allocation bases are most commonly used by service organizations to apply overhead costs to jobs?

Answer: Because overhead is typically driven by direct labor hours in a service organization, direct labor hours or direct labor cost is the most common allocation base. Again, the process of recording this information in the journal and job cost sheet is exactly the same as for a manufacturing company (refer back to Figure 1.6 "Overhead Applied for Custom Furniture Company's Job 50" for an example).

Business in Action 1.2

Job Costing at Movie Studios

Studios that produce costly movies, such as **20th Century Fox**, **Universal Studios**, and **Warner Brothers**, incur a variety of costs that are tracked using a job costing system. For example, the production of a Harry Potter movie requires direct labor in the form of actors, directors, editors, and the film crew. The direct materials category includes costumes, extensive sets, and props. Overhead

costs include items such as depreciation of film production equipment, utilities in the editing studio, and executive salaries for those overseeing the production of several films concurrently.

Determining the production costs of movies and related profitability is important for this industry since actors, directors, and others involved in the film are often compensated based on a percentage of profits. Disagreements sometimes arise between studios and actors regarding the accuracy of costs for movies, particularly in the area of overhead. Some studios have been accused of allocating too much overhead to individual films to drive down the reported profitability of each film, thereby reducing the amount owed to those receiving a portion of the profits.

Key Takeaways

- Job costing systems in service organizations are similar to those used by manufacturing companies. However, service organizations use fewer materials than manufacturing organizations, the account names they use are slightly different, and they often track costs by customer rather than by product.

Check Yourself

Describe the similarities and differences in how service companies and manufacturing companies account for direct materials, direct labor, and overhead.

Solutions

The similarities and differences in how service companies and manufacturing companies account for direct materials, direct labor, and overhead are as follows:

- **Direct materials.** The cost of direct materials for many service companies, such as accounting and law firms, is insignificant. These companies therefore do not track direct materials for each job. However, service companies that use costly materials, such as an auto repair shop, do track direct materials for each job. Because direct materials tend to be costly for manufacturing firms, these firms typically track direct materials for each job.
- **Direct labor.** Because direct labor tends to be the most significant cost for service companies, these companies track costs by job using a timesheet and job cost sheet, just as manufacturing companies do.
- **Overhead.** Service and manufacturing firms track overhead costs in a similar way. Both often use a predetermined overhead rate to charge overhead costs to jobs. Because overhead is typically driven by direct labor hours in a service company, direct labor hours are often used as the allocation base. The process of recording overhead costs in the journal and job cost sheet is the same for both types of firms.

2.5 Chapter Wrap-Up: Summary of Cost Flows at Custom Furniture Company

Learning Objective

1. Use a job costing system to track costs and evaluate profitability for each job.

Question: The goal of this section is to pull it all together for Custom Furniture Company. We begin by looking at revenue and cost information for May, including manufacturing and nonmanufacturing costs. Why is it important for companies like Custom Furniture Company to correctly classify and record costs such as direct materials (e.g., wood used for each table), salaries of administrative personnel, and rent on the factory?

Answer: Companies must be able to evaluate the profitability of each job and on a broader scale, evaluate the overall profitability of the company. This requires that all manufacturing and nonmanufacturing costs be classified and recorded correctly in the general journal. The following information shows how to accomplish this with transactions for the month of May at Custom Furniture Company.

Revenue and Cost Information for Custom Furniture Company

Question: How are the typical transactions for a manufacturing company recorded in the general journal?

Answer: Below are Custom Furniture Company's journal entries for May. "Custom Furniture Company's T-Accounts" presents the same information in T-account format. (Note that each entry shows the total dollar amount for the month rather than individual transaction amounts.) If you understand how to make an entry summarized in total, you know how to make each individual (perhaps daily) entry. Beginning balances for raw materials inventory ($25,000), work-in-process inventory ($35,000), and finished goods inventory ($90,000) are shown in the T-accounts in Figure 2.8 "Custom Furniture Company's T-Accounts".

1. Raw materials were purchased during the month for $15,000 on account.

Raw Materials Inventory	15,000	
Accounts Payable		15,000

2. Raw materials totaling $21,000 were placed in production; $3,000 for indirect materials (such as glue, screws, and nails) and $18,000 for direct materials (such as wood and hardware).

WIP Inventory*	18,000	
Manufacturing Overhead	3,000	
Raw Materials Inventory		21,000

3. Timesheets from the direct labor workforce show total costs of $40,000, to be paid next month.

WIP Inventory*	40,000	
Wages Payable		40,000

4. Production supervisors and other indirect labor working in the factory are owed wages totaling $27,000.

Manufacturing Overhead	27,000	
Wages Payable		27,000

5. The following costs related to the factory were incurred: building depreciation, $29,000; insurance, $11,000 (originally recorded as prepaid insurance); utilities, $4,000 (to be paid next month), and maintenance costs, $22,000 (paid immediately).

Manufacturing Overhead	66,000	
Accumulated Depreciation, Building		29,000
Prepaid Insurance		11,000
Accounts Payable		4,000
Cash		22,000

6. Manufacturing overhead is applied at a rate of $30 per direct labor hour. A total of 3,000 direct labor hours were recorded for the month. Thus, manufacturing overhead totaling $90,000 was applied to jobs (= $30 × 3,000).

WIP Inventory*	90,000	
Manufacturing Overhead		90,000

7. The following selling costs were incurred: wages of $5,000 (to be paid next month); building rent of $3,000 (originally recorded as prepaid rent); and advertising totaling $10,000 (to be paid next month).

Wages Expense (selling)	5,000	
Rent Expense (selling)	3,000	
Advertising Expense (selling)	10,000	
Wages Payable		5,000
Prepaid Rent		3,000
Accounts Payable		10,000

8. The following general and administrative (G&A) costs were incurred: wages of $13,000 (to be paid next month), equipment depreciation of $6,000, and building rent of $7,000 (originally recorded as prepaid rent).

Wages Expense (G&A)	13,000	
Depreciation Expense (G&A)	6,000	
Rent Expense (G&A)	7,000	
Wages Payable		13,000
Accumulated Depreciation, Equipment		6,000
Prepaid Rent		7,000

9. Goods costing $155,000 (per the job cost sheets) were completed and transferred out of WIP Inventory.

*All debit amounts to work-in-process inventory are also recorded on the appropriate job cost sheets.

Custom Furniture Company's T-Accounts

Cash*

(10)	90,000	22,000	(5)

Accounts Receivable*

(10)	100,000		

Prepaid Insurance*

		11,000	(5)

Prepaid Rent*

		3,000	(7)
		7,000	(8)

Raw Materials Inventory

beg. bal.	25,000		
(1)	15,000	21,000	(2)
end. bal.	19,000		

WIP Inventory

beg. bal.	35,000		
(2)	18,000	155,000	(9)
(3)	40,000		
(6)	90,000		
end bal.	28,000		

Finished Goods Inventory

beg. bal.	90,000		
(9)	155,000	129,000	(11)
end bal.	116,000		

Accum. Depreciation, Building*

		29,000	(5)

Accum. Depreciation, Equip.*

		6,000	(8)

Accounts Payable*

		15,000	(1)
		14,000	(5)
		10,000	(7)

Wages Payable*

		40,000	(3)
		27,000	(4)
		5,000	(7)
		13,000	(8)

Manufacturing Overhead

(2)	3,000		
(4)	27,000	90,000	(6)
(5)	66,000	6,000	(12)
end bal.	0		

Sales

		190,000	(10)
		190,000	end bal.

Cost of Goods Sold

(11)	129,000		
(12)	6,000		
end bal.	135,000		

Wages Expense (selling)

(7)	5,000		
end bal.	5,000		

Advertising Expense (selling)

(7)	10,000		
end bal.	10,000		

Rent Expense (selling)

(7)	3,000		
end bal.	3,000		

Wages Expense (G&A)

(8)	13,000		
end bal.	13,000		

Depreciation Expense (G&A)

(8)	6,000		
end bal.	6,000		

Rent Expense (G&A)

(8)	7,000		
end bal.	7,000		

*Beginning and ending balances are only provided for inventory accounts since the focus of this chapter is on manufacturing costs that flow through the inventory accounts.

Question: Now that the information for the month of May has been recorded for Custom Furniture Company, we need to summarize this information to evaluate the profitability of the company and the profitability of jobs. How profitable was Custom Furniture for the month of May?

Answer: Custom Furniture Company's income statement for the month of May, shown in Figure 1.7 "Custom Furniture Company's Income Statement", indicates the company had operating profit of $11,000. This information comes directly from the T-accounts shown in "Custom Furniture Company's T-Accounts".

Figure 1.7 Custom Furniture Company's Income Statement

Custom Furniture Company
Income Statement
Month Ended May 31

Sales		$190,000
Cost of goods sold before adjustment for underapplied overhead	$129,000	
Adjustment for underapplied overhead*	6,000	
Cost of goods sold		135,000
Gross profit		$ 55,000
Less operating (nonmanufacturing) expenses:		
Selling		18,000
General and administrative		26,000
Operating profit		$ 11,000

*See entry **12** in "Custom Furniture Company's Journal Entries for May" and "Custom Furniture Company's T-Accounts" for this adjustment. This represents the amount of overhead underapplied to jobs and closed out to cost of goods sold at the end of May. An alternative presentation is to simply show the cost of goods sold amount of $135,000 directly under sales.

Analysis of Job Profitability at Custom Furniture Company

Recall from the beginning of the chapter that Dan Stevens, the owner of Custom Furniture Company, is concerned about the company's profitability. Although Dan prices his furniture at 70 percent above estimated production costs, the company had only $11,000 in profits for the month of May, as shown in Figure 1.7 "Custom Furniture Company's Income Statement". Dan asked Leslie (the accountant) to look into the accuracy of his estimates by reviewing actual production costs for the three costliest tables produced in May. As you read Leslie's comments, be sure to look at the income statement in Figure 1.7 "Custom Furniture Company's Income Statement" and the job cost estimates and actual results in Figure 1.8 "Job Cost Estimates Versus Actual Results for Custom Furniture Company".

Figure 1.8 Job Cost Estimates Versus Actual Results for Custom Furniture Company

	Job 40		Job 44		Job 45	
	Estimate	Actual[a]	Estimate	Actual[a]	Estimate	Actual[a]
Sales price[b]	$ 18,360	$ 18,360	$ 27,030	$ 27,030	$ 13,260	$ 13,260
Direct materials	$ 1,500	$ 3,500	$ 2,800	$ 3,800	$ 1,100	$ 2,500
Direct labor	3,300	3,800	4,500	4,700	2,400	2,300
Manufacturing overhead	6,000	6,200	8,600	8,900	4,300	4,100
Total production costs	$ 10,800	$ 13,500	$ 15,900	$ 17,400	$ 7,800	$ 8,900
Gross profit	$ 7,560	$ 4,860	$ 11,130	$ 9,630	$ 5,460	$ 4,360
Gross profit as percent of total production cost[c]	70%	36%	70%	55%	70%	49%[d]

[a] Product costs are from the job cost sheet, and the sales price is based on the original bid.

[b] Based on 70 percent markup of estimated total production costs. For example, job 40's sales price of $18,360 = $10,800 × 170 percent.

[c] Equals gross profit divided by total production costs. Company target is 70 percent.

[d] Rounded.

Leslie:
Dan, I have the production cost information you requested.

Dan:
Great! What did you find out?

Leslie:
Well, first I looked at the income statement for May. If you establish prices based on a 70 percent markup of production costs, then sales revenue should be 170 percent of cost of goods sold, and the resulting gross profit should be 70 percent of cost of goods sold.

Dan:
Sounds reasonable. Are we anywhere near these numbers?

Leslie:
Not really. Cost of goods sold for May total $135,000, so sales should be closer to $229,500 (that would be $135,000 times 170 percent), and gross profit should be closer to $94,500, which is $135,000 times 70 percent. As you can see on the income statement, we didn't get very close to these numbers.

Dan:
Do you have any idea why?

Leslie:
I pulled together production cost information from our job costing system for the three highest-cost tables produced in May as you requested.

Dan:
And?

Leslie:
I compared the job cost sheet information for each item with your original estimates, and here's what I found. It looks as if the

problem is with direct materials. All three jobs show that direct material costs were significantly higher than you estimated. Direct labor and manufacturing overhead costs were pretty close.

Dan:
Wow, I'm surprised that direct material costs were so high. I'll have to check into this further. I do recall wood costs increasing over the last couple of months, but not to this extent.

Leslie:
There are lots of potential causes for the increase in direct materials. Perhaps materials were wasted as a result of machine problems or because of inexperienced employees.

Dan:
Let's try to nail down why my estimates are so far off so I can do a better job of estimating costs in the future.

Leslie:
Good idea—I'll look into the direct materials costs and get back to you later this week.

Question: Figure 1.8 "Job Cost Estimates Versus Actual Results for Custom Furniture Company" provides an in depth view of the costs associated with each job and the resulting profitability. How does this information help Custom Furniture Company plan for the future?

Answer: This information helps managers assess the profitability of individual jobs. Custom Furniture Company was able to identify areas of concern by comparing information from job cost sheets with Dan's estimates. Dan and Leslie will have to do more research to find the cause of the high material costs. If changes cannot be made to the production process to reduce these costs, Dan may have to consider revising his estimates and raising prices on future jobs. The goal is to provide enough information for the company to make informed decisions about areas of concern, such as direct materials costs, and how much to charge for future jobs.

Key Takeaways

- Job costing systems can do more than simply track the costs of each job. Companies also use these systems to track revenue and the resulting profit for each job.
- A job costing system can be used to identify areas of concern by comparing the cost estimate prepared before starting the job with information on the completed job cost sheet. This type of analysis often leads to changes in the production process and revised estimates for future jobs.

Check Yourself

Farm Equipment, Inc., produces tractors and other farm machinery. Each piece of equipment is built to customer specifications. During May, its first month of operations, Farm Equipment, Inc., began working on three customer orders: jobs 1, 2, and 3. The following transactions occurred during May:

1. Purchased production materials on account totaling $450,000
2. Processed material requisitions for the following items:

Job 1 direct materials	$ 77,600
Job 2 direct materials	38,600
Job 3 direct materials	45,000
Indirect materials	87,000
Total	$ 248,200

3. Processed timesheets showing the following:

Job 1 direct labor (700 hours)	$ 14,800
Job 2 direct labor (550 hours)	11,800
Job 3 direct labor (300 hours)	6,500
Indirect labor	9,700
Total	$ 42,800

4. Applied overhead using a predetermined rate of 160 percent of direct labor cost
5. Completed job 1 and transferred it to finished goods
6. Delivered job 1 to the customer and billed her $140,000. (Hint: Two entries are required—one for the cost of the goods and another for the revenue.)

Required:

1. Calculate the production costs incurred in May for each of the three jobs.
2. Make the appropriate journal entry for each item described previously. Assume all payments will be made next month. (Hint: Use earlier examples as a guide)
3. How much gross profit did Farm Equipment, Inc., earn from the sale of job 1?
4. Assuming selling costs totaled $4,000 and general and administrative costs totaled $11,000 in May, prepare an income statement for Farm Equipment, Inc., for the month. (Assume there is no adjustment to cost of goods sold for underapplied or overapplied overhead.)

Solutions

1.

	Job 1	Job 2	Job 3	Total
Direct materials	$ 77,600	$ 38,600	$ 45,000	$161,200
Direct labor	14,800	11,800	6,500	33,100
Manufacturing overhead (160% × direct labor cost)	23,680	18,880	10,400	52,960
Total cost	$116,080	$ 69,280	$ 61,900	$247,260

2.

Raw materials inventory	450,000	
Accounts payable		450,000

WIP inventory	161,200*	
Manufacturing overhead	87,000	
Raw materials inventory		248,200

*$161,200 comes from the total for direct materials in part **a**.

WIP inventory	33,100*	
Manufacturing overhead	9,700	
Wages payable		42,800

*$33,100 comes from the total for direct labor in part **a**.

WIP inventory	52,960*	
Manufacturing overhead		52,960

*$52,960 comes from the total for manufacturing overhead in part **a**.

Finished goods inventory	116,080	
WIP inventory		116,080

Cost of goods sold	116,080	
Finished goods inventory		116,080

Accounts receivable	140,000	
Sales		140,000

3. Farm Equipment, Inc., made $23,920 in gross profit from the sale of job 1 ($23,920 = $140,000 revenue – $116,080 cost).

Farm Equipment, Inc.
Income Statement
Month Ended May 31

Sales	$140,000
Cost of goods sold	116,080
Gross profit	$ 23,920
Less operating (nonmanufacturing) expenses:	
Selling	4,000
General and administrative	11,000
Operating profit	$ 8,920

4.

End-of-Chapter Exercises

Questions

1. Describe the characteristics of companies likely to use a job costing system. Explain how these characteristics differ from companies likely to use a process costing system.
2. What information is included on the materials requisition form?
3. What is the purpose of a job cost sheet? Describe the information typically included on a job cost sheet.
4. What information is included on a timesheet?
5. What is the purpose of using a predetermined overhead rate?
6. Explain why **Boeing** likely uses a job costing system. How does the information that comes from a job costing system help **Boeing** make better decisions?
7. What is a *normal costing system*, and why do companies tend to use a normal costing system to apply overhead to jobs rather than using actual overhead costs?
8. Describe the two important factors in selecting an overhead allocation base.
9. What cost information is recorded on the debit side of the manufacturing overhead account, and what information is recorded on the credit side?
10. When is manufacturing overhead underapplied? When is it overapplied?
11. What two options are available when closing the manufacturing overhead account at the end of the period, depending on the significance of the balance?
12. How might a job costing system used by a service organization differ from a job costing system used by a manufacturing organization?
13. Why is it important for movie studios to have accurate costs for each movie produced?
14. How does a job costing system help a company evaluate the profitability of jobs?

Brief Exercises

15. **Product Costs at Custom Furniture Company.** Refer to the dialogue between Dan and Leslie at Custom Furniture Company that appears at the beginning of the chapter. What is Dan concerned about, and how did Leslie propose to help?

16. **Job Costing Versus Process Costing.** Indicate whether each of the firms listed in the following would use job costing or process costing.

    1. Oil refinery
    2. Builder of pools
    3. Cereal producer
    4. Legal firm
    5. Upholstery repair shop
    6. Sport drink producer
    7. Toner cartridge producer
    8. Landscape design firm

17. **Job Costing Versus Process Costing.** Indicate whether each of the firms listed in the following would use job costing or process costing.

    1. Custom home builder
    2. Dairy farm
    3. Surgical unit of hospital
    4. Candy bar producer
    5. Auto body repair shop
    6. Producer of basketballs
    7. Producer of T-shirts
    8. Plumber

18. **Recording Purchase and Transfer of Raw Materials in T-Accounts.** The following transactions occurred during the month of October:

October 5	Raw materials totaling $15,000 were purchased on account.
October 8	Direct materials totaling $6,000 were placed in production.
October 10	Indirect materials totaling $1,000 were placed in production.

    Required:

    1. Set up T-accounts for raw materials inventory, work-in-process inventory, manufacturing overhead, and accounts payable.
    2. Use the T-accounts established in part **a** to record the transactions for October.

19. **Calculating Predetermined Overhead Rate.** Manufacturing overhead costs totaling $1,000,000 are expected for this coming year. The company also expects to use 20,000 in direct labor hours. Calculate the predetermined overhead rate and provide a one-sentence description of how the rate will be used in a job costing system.

20. **Service Organization Accounts.** Provide the account name commonly used by service companies for each of the following accounts used in a manufacturing environment.

    1. Raw materials inventory
    2. Work-in-process inventory
    3. Finished goods inventory
    4. Cost of goods sold
    5. Manufacturing overhead

21. **Evaluating Profitability of Jobs.** Refer to the job cost information in “Job Cost Estimates Versus Actual Results for Custom Furniture Company”. Why is Custom Furniture Company comparing estimated product costs to actual product costs for each of the three jobs? Briefly summarize the results of this comparison.

Exercises:

22. **Raw Materials Inventory Journal Entries.** The balance in Sedona Company's raw materials inventory account was $110,000 at the beginning of September. Raw materials purchased during the month totaled $50,000. Sedona used $17,000 in direct materials and $8,000 in indirect materials for the month.

    Required:

    1. Prepare separate journal entries to record the following items:
        1. Raw materials purchased for the month, assuming all purchases were on account
        2. The transfer of *direct* materials into production
        3. The transfer of *indirect* materials into production
    2. Prepare a T-account for raw materials inventory and include the beginning balance for September. Post the appropriate items from the journal entries in part **a** to this account, and calculate the ending balance in raw materials inventory.

23. **Work-in-Process Inventory Journal Entries.** The balance in Reid Company's work-in-process inventory account was $300,000 at the beginning of March. Manufacturing costs for the month are as follows:

Direct materials	$ 40,000
Direct labor	$ 70,000
Manufacturing overhead applied	$200,000
Cost of goods manufactured	$290,000

    Required:

    1. Prepare separate journal entries to record the following items. (Hint: Use examples above as a guide.)
        1. Direct materials placed in production for the month
        2. Direct labor used during the month, assuming employees will be paid next month
        3. Manufacturing overhead applied for the month
        4. Transfer of cost of goods manufactured to finished goods
    2. Prepare a T-account for Work-in-process inventory and include the beginning balance for March. Post the appropriate items from the journal entries in part **a** to this account, and calculate the ending balance in work-in-process inventory.

24. **Cost of Goods Sold Journal Entries.** The balance in Blue Oak Company's finished goods inventory account was $25,000 at the beginning of September. Cost of goods manufactured for the month totaled $17,000, and cost of goods sold totaled $14,000.

    Required:

    1. Prepare separate journal entries to record the following items. (Hint: Use examples above as a guide.)
        1. Cost of goods manufactured for the month
        2. Cost of goods sold for the month
    2. Prepare a T-account for finished goods inventory and include the beginning balance for September. Post the appropriate items from the journal entries in part **a** to this account, and calculate the ending balance in finished goods inventory.

25. **Income Statement (with cost of goods sold adjustment).** Rambler Company had the following activity for the year ended

December 31.

Sales revenue	$2,050,000
Selling expenses	$ 575,000
General and administrative expenses	$ 330,000
Cost of goods sold (before adjustment)	$ 700,000
Underapplied overhead	$ 23,000

Required:

Prepare an income statement for year ended December 31.

26. **Manufacturing Overhead Allocation Base and Calculating the Cost of Jobs.** Pyramid Company expects to incur $3,000,000 in manufacturing overhead costs this year. During the year, it expects to use 40,000 direct labor hours at a cost of $600,000 and 80,000 machine hours.

Required:

1. Prepare a predetermined overhead rate based on direct labor hours, direct labor cost, and machine hours.
2. Why might Pyramid Company prefer to use machine hours to allocate manufacturing overhead?
3. Using each of the predetermined overhead rates calculated in part **a** and the data that follows for job 128, determine the cost of job 128.

Direct materials	$6,000
Direct labor	$4,000 (200 hours at $15 per hour) + (100 hours at $10 per hour)
Machine time	700 hours

Problems

27. Actual and Applied Manufacturing Overhead. Marine Products, Inc., incurred the following actual overhead costs for the month of June.

Indirect materials	$20,000
Indirect labor	$18,000
Rent	$ 3,000
Equipment depreciation	$ 6,500

Overhead is applied based on a predetermined rate of $12 per machine hour, and 5,100 machine hours were used during June.

Required:

1. Prepare a journal entry to record actual overhead costs for June. Assume that labor costs will be paid next month and that rent was prepaid.
2. Prepare a journal entry to record manufacturing overhead applied to jobs during June.
3. Create a T-account for manufacturing overhead, post the appropriate information from parts **a** and **b** to this account, and calculate the ending balance.

Is manufacturing overhead overapplied or underapplied? Using the balance in the manufacturing overhead account calculated in part **c**, prepare the journal entry to close manufacturing overhead to cost of goods sold.

28. Actual and Applied Manufacturing Overhead. Quincy Company incurred the following actual overhead costs for the month of February.

Indirect materials	$335,000
Indirect labor	$275,000
Factory depreciation	$ 18,000
Factory utilities	$ 9,500

Overhead is applied based on a predetermined rate of $2 per direct labor dollar (200 percent of direct labor cost), and direct labor costs were $300,000 for the month.

Required:

1. Prepare a journal entry to record actual overhead costs for February. Assume indirect labor costs and utilities will be paid next month.
2. Prepare a journal entry to record manufacturing overhead applied to jobs during February.
3. Create a T-account for manufacturing overhead, post the appropriate information from parts **a** and **b** to this account, and calculate the ending balance.
4. Is manufacturing overhead overapplied or underapplied? Using the balance in the manufacturing overhead account calculated in part **c**, prepare the journal entry to close manufacturing overhead to cost of goods sold.

29. Calculating the Cost of Jobs, Making Journal Entries, and Preparing an Income Statement. Racing Bikes, Inc., produces custom bicycles for professional racers. Each bike is built to customer specifications. During July, its first month of operations, Racing Bikes began production of four customer orders—jobs 1 through 4. The following transactions occurred during July.

1. Purchased bike parts totaling $14,400
2. Processed material requisitions for the following items:

Job 1, direct materials	$ 2,800
Job 2, direct materials	1,250
Job 3, direct materials	1,550
Job 4, direct materials	780
Indirect materials	1,075
Total	$ 7,455

3. Processed timesheets showing the following:

Job 1, direct labor (30 hours)	$ 500
Job 2, direct labor (25 hours)	430
Job 3, direct labor (28 hours)	465
Job 4, direct labor (15 hours)	210
Indirect labor	985
Total	$ 2,590

4. Applied overhead using a predetermined rate of $30 per direct labor hour
5. Completed and transferred to finished goods jobs 1, 2, and 3

6. Delivered jobs 1 and 2 to customers, billing them $6,000 for job 1 and $3,500 for job 2 (Hint: Two entries are required—one for the cost of the goods and another for the revenue.)

Required:

1. Calculate the production costs incurred in July for each of the four jobs.
2. Make the appropriate journal entry for each transaction described previously (**1** through **6**). Assume all payments will be made next month. (Hint: Use examples as a guide.)
3. How much gross profit did Racing Bikes, Inc., earn from the sale of job 2?
4. Assume selling costs totaled $1,000 and that general and administrative costs totaled $2,200. Prepare an income statement for Racing Bikes for the month of July. (Assume there is no adjustment to cost of goods sold for underapplied or overapplied overhead.)

30. Calculating the Cost of Jobs, Making Journal Entries, and Preparing an Income Statement. Classic Boats, Inc., produces custom wood boats. Each boat is built to customer specifications. During April, its first month of operations, Classic Boats began production of three customer orders—jobs 1 through 3. The following transactions occurred during April.

1. Purchased production materials totaling $225,000

2. Processed material requisitions for the following items:

Job 1, direct materials	$ 38,800
Job 2, direct materials	19,300
Job 3, direct materials	22,500
Indirect materials	43,500
Total	$ 124,100

3. Processed timesheets showing the following:

Job 1, direct labor (350 hours)	$ 7,400
Job 2, direct labor (275 hours)	5,900
Job 3, direct labor (150 hours)	3,250
Indirect labor	4,850
Total	$ 21,400

4. Applied overhead using a predetermined rate of 160 percent of direct labor cost
5. Completed job 1 and transferred it to finished goods
6. Delivered job 1 to the customer and billed her $70,000. (Hint: Two entries are required—one for the cost of the goods and another for the revenue.)

Required:

1. Calculate the production costs incurred in April for each of the three jobs.
2. Make the appropriate journal entry for each of the six transactions described previously. Assume all payments will be made next month. (Hint: Use examples as a guide.)
3. How much gross profit did Classic Boats earn from the sale of job 1?
4. Assume selling costs totaled $2,000 and general and administrative costs totaled $5,500. Prepare an income statement for Classic Boats for the month of April. (Assume there is no adjustment to cost of goods sold for underapplied or overapplied

overhead.)

31 Calculating the Cost of Jobs and Making Journal Entries for a Service Company. Management Consulting, Inc., provides consulting services and began operations on September 1. It began jobs 1 through 4 during the first half of September. The following transactions occurred during that time.

1. Purchased supplies on account totaling $6,000
2. Used supplies totaling $3,200 for various jobs
3. Processed timesheets showing the following:

Job 1, direct labor (200 hours)	$ 6,000
Job 2, direct labor (240 hours)	6,800
Job 3, direct labor (40 hours)	2,200
Job 4, direct labor (15 hours)	350
Indirect labor	3,600
Total	$ 18,950

4. Applied overhead using a predetermined rate of 120 percent of direct labor cost
5. Completed jobs 1 and 2 and billed the customers $20,000 and $21,000, respectively. (Hint: Two entries are required—one for the cost of services and another for revenue.)

Required:

1. Calculate the costs incurred in September for each of the four jobs.
2. Make the appropriate journal entry for each item described previously. Assume all payments will be made next month. (Hint: Use examples as a guide.)
3. How much gross profit did Management Consulting, Inc., earn from job 1 and job 2?

What is the amount in work in process at the end of the first half of September?

32. Closing Manufacturing Overhead: Two Approaches. Placer Company incurred actual manufacturing overhead costs of $260,000 during the year ended December 31, 2012. A total of $350,000 in overhead was applied to jobs. At December 31, 2012, work-in-process inventory totals $100,000, and finished goods inventory totals $300,000. Cost of goods sold before adjustments totals $600,000 for the year.

Required:

1. Is overhead underapplied or overapplied?
2. Close the manufacturing overhead account, assuming the balance is immaterial.
3. Close the manufacturing overhead account, assuming the amount is material.

One Step Further: Skill-Building Cases

33. Ethics: Shifting Hours Using Job Costing. Shawney Accountancy Corporation provides accounting services. It uses a job costing system to track each client's revenues and costs. The firm is currently working on two jobs. The first job, preparing tax returns for Bantem Corporation, was bid at $25,000 and had budgeted costs of $18,000. The second job, performing a review of internal controls for Maxum Company, was bid at 50 percent above actual costs. The following conversation took place between Kelly (a manager) and Ron (senior staff working for Kelly).

Kelly:
Ron, I just reviewed timesheets for the two jobs we're working on, and it appears we are quickly approaching the budget of $18,000 for the Bantem job.

Ron:
Yes, we're having trouble completing the Bantem job in the hours budgeted.

Kelly:
This is the first year on the Bantem job, and budgeting for first-year clients is always difficult.

Ron:
I'm sure we can retain this job next year with a little bump in the bid—perhaps to $29,000.

Kelly:
That's fine for next year, but I have to answer to my boss for this year's results. Why don't we take some of the pressure off by charging some time from the Bantem job to the internal control project we have with Maxum Company? We're under budget with the Maxum job, and they are paying us based on actual costs plus a 50 percent markup.

Ron:
Can we do that?

Kelly:
We don't do it often, but in cases like this, we have to get creative.

Required:

1. Why is there an incentive to inflate the hours charged to the Maxum job?
2. What should Ron do? (You may want to refer to the IMA's ethical standards discussed in Principles of Managerial Accounting 1.)

Internet Project: Automation and Overhead Allocation. Over the past several decades, manufacturing companies have tended to move away from direct labor and more toward automation (i.e., using machinery rather than people to produce products).

Required:

1. Use the Internet to find several examples of companies that have made the shift toward an automated production environment. Write a one-page summary of your findings, and include specific information indicating what type of automation is being used.
2. How might this shift to automation affect the allocation base used to allocate overhead to products?

Group Project: Labor Costs at General Motors and Toyota. Both **General Motors (GM)** and **Toyota** have production facilities in Texas. **GM's** plant was built in 1956 on a 249-acre site and has since undergone billions of dollars in renovations. **Toyota's** plant was built in 2006 on 2,000 acres. Each plant has a production capacity of 200,000 vehicles per year. **GM** averages close to 22 assembly labor hours per vehicle (no data on labor hours per vehicle are available for **Toyota**). The labor cost per vehicle is $1,800 for **GM**, which uses a unionized labor force, and $800 for **Toyota**, which uses nonunion labor. (Based on Lee Hawkins Jr. and Norihiko Shirouzu, "A Tale of Two Auto Plants," *Wall Street Journal*, May 24, 2006.)

Required:

Form groups of two to four students and respond to the following items:

1. Provide at least two reasons for the significant difference in assembly labor cost per vehicle for **GM** and **Toyota**.
2. What other production costs should be considered in evaluating the efficiency of each plant?

Comprehensive Cases

34. Journal Entries, Closing Manufacturing Overhead, and Preparing an Income Statement. Benning, Inc., is a defense contractor that uses job costing. Because the firm uses a perpetual inventory system, the three supporting schedules to the income

statement (the schedule of raw materials placed in production, the schedule of cost of goods manufactured, and the schedule of cost of goods sold) are *not* necessary. Inventory account beginning balances at January 1, 2020, are listed as follows.

Raw materials inventory	$ 500,000
Work-in-process inventory	$ 700,000
Finished goods inventory	$1,800,000

You will be recording the following transactions, which summarize the activities that occurred during the year ended December 31, 2012:

1. Raw materials were purchased for $300,000 on account.
2. Raw materials totaling $420,000 were placed in production, $60,000 for indirect materials and $360,000 for direct materials.
3. The raw materials purchased in transaction **1** were paid for.
4. A total cost of $800,000 for direct labor, shown on the timesheets, was recorded as wages payable.
5. Production supervisors and other indirect labor working in the factory were owed $540,000, recorded as wages payable.
6. Wages owed, totaling $1,200,000, were paid. (These wages were previously recorded correctly as wages payable.)
7. The costs listed in the following related to the factory were incurred during the period. (Hint: Record these items in one entry with one debit to manufacturing overhead and four separate credits):

Building depreciation	$580,000
Insurance (prepaid during 2012, now expired)	$220,000
Utilities (on account)	$ 80,000
Maintenance (paid cash)	$440,000

8. Manufacturing overhead was applied at a rate of $20 per machine hour, and 90,000 machine hours were utilized during the year. (Hint: No need to calculate the predetermined overhead rate since it is already given to you here.)
9. Miscellaneous selling costs totaling $430,000 were paid. These costs were recorded in an account called selling expenses.
10. Miscellaneous general and administrative costs totaling $265,000 were paid. These costs were recorded in an account called G&A expenses.
11. Goods costing $2,030,000 (per the job cost sheets) were completed and transferred out of work-in-process inventory.
12. Goods were sold on account for $3,800,000.
13. The goods sold in transaction **12** had a cost of $2,570,000 (per the job cost sheets).
14. Payments totaling $3,300,000 from credit customers related to transaction **12** were received.

Required:

1. Prepare T-accounts for raw materials inventory, work-in-process inventory, finished goods inventory, manufacturing overhead, and cost of goods sold. Enter the beginning balances for the inventory accounts. (Manufacturing overhead and cost of goods sold are temporary accounts and thus do not have a beginning balance.)
2. Prepare a journal entry for each transaction from **1** through **14**, and where appropriate, post each entry to the T-accounts set up in requirement **a**. Note that these entries reflect the flow of costs through the inventory and cost of goods sold accounts for the year. Label each entry in the T-accounts by transaction number, include a short description (e.g., direct materials and manufacturing overhead applied), and total each T-account.
3. Based on the balance in the manufacturing overhead account prepared in requirement **b**, prepare a journal entry to close the manufacturing overhead account to cost of goods sold.
4. Prepare an income statement for the year ended December 31, 2020. Remember to adjust cost of goods sold for any underapplied or overapplied overhead.

Why is cost of goods sold adjusted upward on the income statement?

35. Journal Entries, Closing Manufacturing Overhead, and Preparing an Income Statement. Sierra Nursery Company grows a variety of plants and sells them to local nurseries. Raw materials consist of such items as seeds and the fertilizer required to grow plants from the seedling stage to a viable, saleable plant. Sierra Nursery uses a job costing system to track revenues and costs associated with customer orders. Because the firm uses a perpetual inventory system, the three supporting schedules to the income statement (the schedule of raw materials placed in production, the schedule of cost of goods manufactured, and the schedule of cost of goods sold) are *not* necessary. Inventory account beginning balances at January 1, 2020, are as follows:

Raw materials inventory	$50,000
Work-in-process inventory	$60,000
Finished goods inventory	$90,000

You will be recording the following transactions, which summarize the activities that occurred during the year ended December 31, 2020:

1. Raw materials were purchased for $30,000 on account.
2. Raw materials totaling $41,000 were placed in production, $5,000 for indirect materials and $36,000 for direct materials.
3. The raw materials purchased in transaction **1** were paid for.
4. A total cost of $140,000 for 9,000 hours of direct labor, shown on the timesheets, was recorded as wages payable.
5. Production supervisors and other indirect labor working in the nursery were owed $134,000, recorded as wages payable.
6. Wages owed totaling $180,000 were paid. (These wages were previously recorded correctly as wages payable.)
7. The costs listed in the following related to the nursery were incurred during the period. (Hint: Record these items in one entry with one debit to manufacturing overhead and four separate credits):

Equipment depreciation	$22,000
Rent (prepaid during 2012)	$36,000
Utilities (on account)	$33,000
Maintenance (paid cash)	$19,000

8. Manufacturing overhead was applied at a rate of $30 per direct labor hour. (Hint: No need to calculate the predetermined overhead rate since it is already given to you here.)
9. Miscellaneous selling costs totaling $63,000 were paid. These costs were recorded in an account called selling expenses.
10. Miscellaneous general and administrative costs totaling $18,000 were paid. These costs were recorded in an account called G&A expenses.
11. Goods costing $478,000 (per the job cost sheets) were completed and transferred out of work-in-process inventory.
12. Goods were sold on account for $780,000.
13. The goods sold in transaction **12** had a cost of $415,000 (per the job cost sheets).
14. Payments totaling $380,000 from credit customers related to transaction **12** were received.

Required:

1. Prepare T-accounts for raw materials inventory, work-in-process inventory, finished goods inventory, manufacturing overhead, and cost of goods sold. Enter the beginning balances for the inventory accounts. (Manufacturing overhead and cost of goods sold are temporary accounts and thus do not have a beginning balance.)
2. Prepare a journal entry for each transaction from **1** through **14** and where appropriate, post each entry to the T-accounts set up in requirement **a**. Note that these entries reflect the flow of costs through the inventory and cost of goods sold accounts for the year. Label each entry in the T-accounts by transaction number, include a short description (e.g., direct materials and manufacturing overhead applied), and total each T-account.

3. Based on the balance in the manufacturing overhead account prepared in requirement **b**, prepare a journal entry to close the manufacturing overhead account to cost of goods sold.
4. Prepare an income statement for the year ended December 31, 2020. Remember to adjust cost of goods sold for any underapplied or overapplied overhead.
5. Why is cost of goods sold adjusted downward on the income statement?

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Chapter 2 How Does an Organization Use Activity-Based Costing to Allocate Overhead Costs?

Cindy Hall is the owner and chief executive officer of SailRite Company. SailRite builds two models of sailboats that are sold at hundreds of retail boat showrooms throughout the world. At its inception several years ago, the company produced only the Basic model, which is 12 feet long and designed for two sailors. Very few options are available for this model, and the production process is relatively simple. Because many owners of the Basic model wanted to move to a bigger, more sophisticated boat, SailRite developed the Deluxe model two years ago. The Deluxe model is 14 feet long and designed for three sailors. Many additional features are available for this model, and the production process is more complex than for the Basic model. Last year, SailRite sold 5,000 units of the Basic and 1,000 units of the Deluxe.

Although sales of both models increased last year over the year before, company profits have steadily declined. Cindy, the CEO, is concerned about this trend and discusses her concerns with John Lester, the company's accountant; Mary McCann, the vice president of marketing; and Bob Schuler, the vice president of production.

Cindy (CEO):
Ever since we introduced the Deluxe model our profits have taken a beating. I need some input on what we should do to get this turned around.

Mary (Marketing Vice President):
I'm not sure you can blame our salespeople. We've asked them to push the Deluxe model because of the high profit margins, and our sales force has really responded. Sales have steadily increased over the last couple of years, and customers seem to love our sailboats.

Bob (Production Vice President):
I don't think the problem is with our products, and using our current costing system, we make $320 in profit for each Basic model and $850 for each Deluxe model. We need to take a close look at how the cost of each boat is determined. Overhead costs have increased significantly since we started producing the Deluxe boat—to about 45 percent of total production costs—and yet we use only one overhead rate based on direct labor hours to allocate these costs. I don't see how this can lead to an accurate cost, and I assume we set the price based on the cost of each boat.

Cindy:
We certainly considered the cost in our pricing structure. Are you telling me the cost information I have isn't accurate?

John (Accountant):
No, the cost information you have is fine for financial reporting, but not for pricing products. When we were producing only the Basic model, overhead allocation wasn't an issue. All overhead costs were simply assigned to the one product. Now that we have two products, overhead is allocated based on direct labor hours as Bob stated. We are required to allocate overhead for financial reporting purposes, but I wouldn't use this cost information for internal pricing purposes.

Bob:
I can tell you that the production process for the Deluxe model is much more complicated than the one for the Basic model, so I would expect to see significantly higher costs attached to the Deluxe boat.

John:
What I'm hearing is that we need better cost information. I think it's time we move to a more sophisticated costing system called activity-based costing. Give me time to do some research. Let's meet next week.

This dialogue between the accountant and top management emphasizes the importance of having accurate cost information for decision-making purposes. Very few costing systems provide “perfect” product cost information. Overhead (indirect manufacturing costs) can be allocated in a number of different ways and result in a number of different costs for the same product. The goal is to find a system of allocation that best approximates the amount of overhead costs caused by each product. Sophisticated costing systems are expensive, however. Organizations like SailRite must continually ask the question: Will the benefits of having improved cost information outweigh the costs of obtaining the information?

Several options are available to allocate overhead costs. Before we discuss these options, it is important to understand why overhead costs are allocated at all.

2.1 Why Allocate Overhead Costs?

Learning Objectives

1. Understand why organizations allocate overhead costs to products.

Question: Recall that costs for direct labor and direct materials are easily traced to products. When SailRite produces a sailboat, the direct materials include items such as fiberglass to build the hull, mast, sails, and rope. Direct labor includes the employees building the boat. Accounting for these costs is fairly simple. Indirect manufacturing costs (also called manufacturing overhead or overhead) include electricity to run the factory, rent for the factory building, and factory maintenance. These costs are not easily traced to products and pose a much more complicated challenge for SailRite. Accounting for indirect manufacturing costs typically requires allocating overhead using predetermined overhead rates. Why do managers insist on allocating overhead costs to products?

Answer: Three important reasons that managers allocate overhead costs to products are described in the following:

- **Provide information for decision making.** Setting prices for products is one example of a decision that must be made by management. Prices are often established based on the cost of products. It is not enough to simply include direct materials and direct labor. Overhead must be considered as well.
- **Promote efficient use of resources.** Several different activities are performed to produce a product, such as purchasing raw materials, setting up production machinery, inspecting the final product, and repairing defective products. All of these activities consume resources (consuming resources is another way of stating that a cost is associated with each of these activities). If products are charged for the use of these activities, managers will have an incentive to be efficient in utilizing the activities.
- **Comply with U.S. Generally Accepted Accounting Principles (U.S. GAAP).** U.S. GAAP requires that all manufacturing costs—direct materials, direct labor, and overhead—be assigned to products for inventory costing purposes. This requires the allocation of overhead costs to products.

Key Takeaway

- Overhead costs are allocated to products to provide information for internal decision making, to promote the efficient use of resources, and to comply with U.S. Generally Accepted Accounting Principles.

Check Yourself

For each scenario listed as follows, identify which of the three important reasons presented in this section best explains why managers choose to allocate overhead costs to products.

1. Financial statements are prepared for the annual report that is provided to shareholders.
2. Management is considering the addition of a new product line.
3. The production manager decides to decrease the frequency of raw materials purchases to reduce the allocated portion of the purchasing department’s costs.
4. Profits are calculated for each product so management can decide which products to promote.
5. Quality control inspections are reduced to cut down on the allocated portion of the quality control department’s costs.
6. Financial statements are prepared for the company’s bondholders.

7. Management asks for cost information to assist in bidding for a contract.

Solution

1. Comply with U.S. GAAP
2. Provide information for decision making
3. Promote efficient use of resources
4. Provide information for decision making
5. Promote efficient use of resources
6. Comply with U.S. GAAP
7. Provide information for decision making

2.2 Approaches to Allocating Overhead Costs

Learning Objectives

1. Compare and contrast allocating overhead costs using a plantwide rate, department rates, and activity-based costing.

Question: Managers at companies such as Hewlett-Packard often look for better ways to figure out the cost of their products. When Hewlett-Packard produces printers, the company has three possible methods that can be used to allocate overhead costs to products—plantwide allocation, department allocation, and activity-based allocation (called activity-based costing). How do managers decide which allocation method to use?

Answer: The choice of an allocation method depends on how managers decide to group overhead costs and the desired accuracy of product cost information. Groups of overhead costs are called cost pools. For example, **Hewlett Packard's** printer production division may choose to collect all factory overhead costs in one cost pool and allocate those costs from the cost pool to each product using one predetermined overhead rate. Or **Hewlett Packard** may choose to have several cost pools (perhaps for each department, such as assembly, packaging, and quality control) and allocate overhead costs from each department cost pool to products using a separate predetermined overhead rate for each department. In general, the more cost pools used, the more accurate the allocation process.

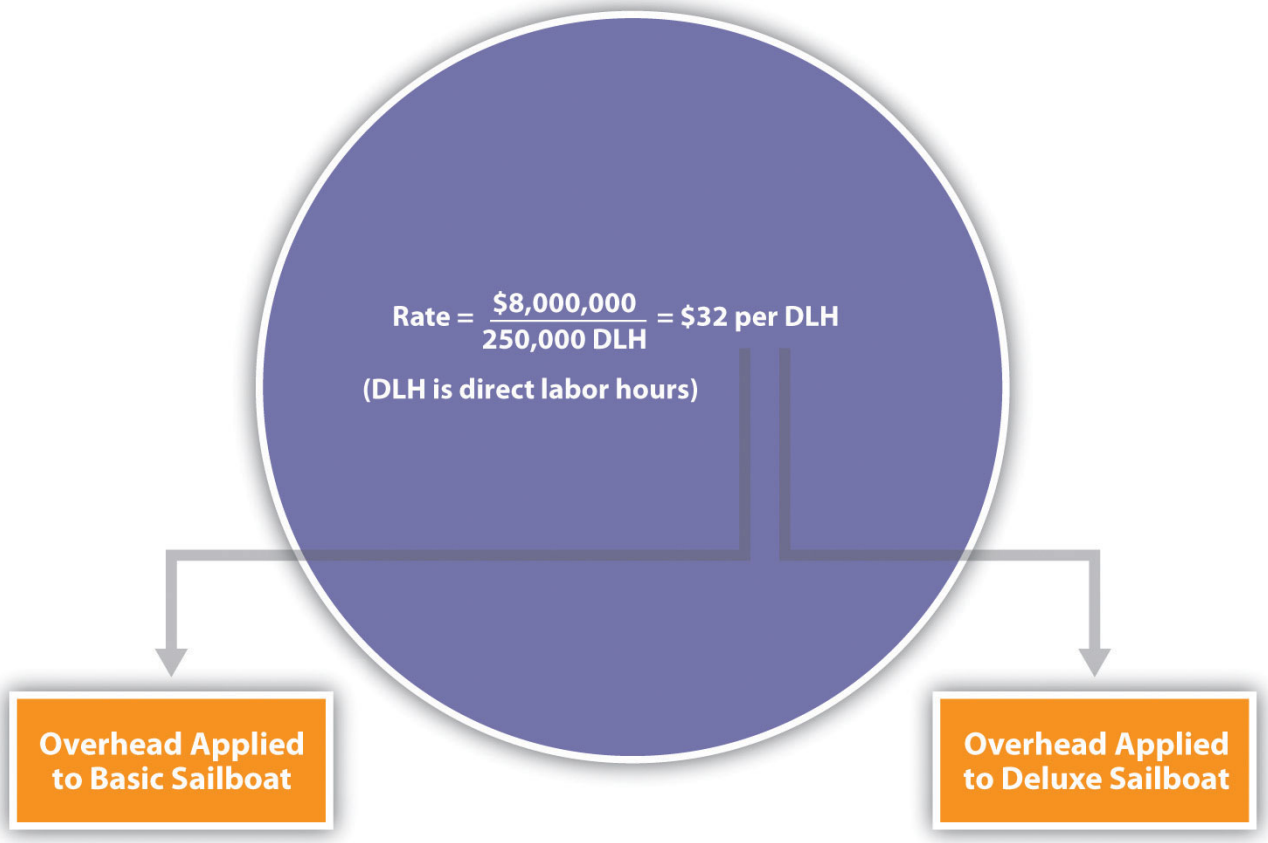
Plantwide Allocation

Question: Let's look at SailRite Company, which was presented at the beginning of the chapter. The managers at SailRite like the idea of using the plantwide allocation method to allocate overhead to the two sailboat models produced by the company. How would SailRite implement the plantwide allocation method?

Answer: The plantwide allocation method uses one predetermined overhead rate to allocate overhead costs. Regardless of the approach used to allocate overhead, a predetermined overhead rate is established for each cost pool. The predetermined overhead rate is calculated as follows (Predetermined overhead rate=Estimated overhead costs / Estimated activity in allocation base. When activity-based costing is used, the denominator can also be called *estimated cost driver activity*. One cost pool accounts for all overhead costs, and therefore one predetermined overhead rate is used to apply overhead costs to products. You learned about this approach in the last chapter where one predetermined rate—typically based on direct labor hours, direct labor costs, or machine hours—was used to allocate overhead costs. (Remember, the focus here is on the allocation of overhead costs. Direct materials and direct labor are easily traced to the product and therefore are not a part of the overhead allocation process.)

Using SailRite Company as an example, assume annual overhead costs are estimated to be $8,000,000 and direct labor hours are used for the plantwide allocation base. Management estimates that a total of 250,000 direct labor hours are worked annually. These estimates are based on the previous year's overhead costs and direct labor hours and are adjusted for expected increases in demand the coming year. The predetermined overhead rate is $32 per direct labor hour (= $8,000,000 ÷ 250,000 direct labor hours). Thus, as shown in Figure 2.1 "Using One Plantwide Rate to Allocate SailRite Company's Overhead", products are charged $32 in overhead costs for each direct labor hour worked.

Figure 2.1 Using One Plantwide Rate to Allocate SailRite Company's Overhead



Product Costs Using the Plantwide Allocation Approach at SailRite

Question: Assume SailRite uses one plantwide rate to allocate overhead based on direct labor hours. What is SailRite's product cost per unit and resulting profit using the plantwide approach to allocate overhead?

Answer: The calculation of a product's cost involves three components—direct materials, direct labor, and manufacturing overhead. Assume direct materials cost $1,000 for one unit of the Basic sailboat and $1,300 for the Deluxe. Direct labor costs are $600 for one unit of the Basic sailboat and $750 for the Deluxe. This information, combined with the overhead cost per unit, gives us what we need to determine the product cost per unit for each model.

Given the predetermined overhead rate of $32 per direct labor hour calculated in the previous section, and assuming it takes 40 hours of direct labor to build one Basic sailboat and 50 hours to build one Deluxe sailboat, we can calculate the estimated manufacturing overhead cost per unit. Manufacturing overhead cost per unit is $1,280 (= $32 × 40 direct labor hours) for the Basic boat and $1,600 (= $32 × 50 direct labor hours) for the Deluxe boat. Combine the manufacturing overhead with direct materials and direct labor, as shown in Figure 2.2 "SailRite Company Product Costs Using One Plantwide Rate Based on Direct Labor Hours", and we are able to calculate the product cost per unit.

Figure 2.2 SailRite Company Product Costs Using One Plantwide Rate Based on Direct Labor Hours

	Basic Sailboat (cost per unit)	Deluxe Sailboat (cost per unit)
Direct materials	$ 1,000	$ 1,300
Direct labor	600	750
Overhead	1,280*	1,600**
Total product cost per unit	$ 2,880	$ 3,650

*$1,280 = 40 direct labor hours per unit × $32 rate.

**$1,600 = 50 direct labor hours per unit × $32 rate.

The average sales price is $3,200 for the Basic model and $4,500 for the Deluxe. Using the product cost information in Figure 2.2 "SailRite Company Product Costs Using One Plantwide Rate Based on Direct Labor Hours", the profit per unit is $320 (= $3,200 price – $2,880 cost) for the Basic model and $850 (= $4,500 price – $3,650 cost) for the Deluxe. Recall from the opening dialogue that SailRite's overall profit has declined ever since it introduced the Deluxe model even though the data shows both products are profitable.

Question: The managers at SailRite like the idea of using the plantwide allocation approach, but they are concerned that this approach will not provide accurate product cost information. Although the plantwide allocation method is the simplest and least expensive approach, it also tends to be the least accurate. In spite of this weakness, why do some organizations prefer to use one plantwide overhead rate to allocate overhead to products?

Answer: Organizations that use a plantwide allocation approach typically have simple operations with a few similar products. Management may not want more accurate product cost information or may not have the resources to implement a more complex accounting system. As we move on to more complex costing systems, remember that these systems are more expensive to implement. Thus the benefits of having improved cost information must outweigh the costs of obtaining the information.

Department Allocation

Question: Assume the managers at SailRite Company prefer a more accurate approach to allocating overhead costs to its two products. As a result, they are considering using the department allocation approach. How would SailRite form cost pools for the department allocation approach?

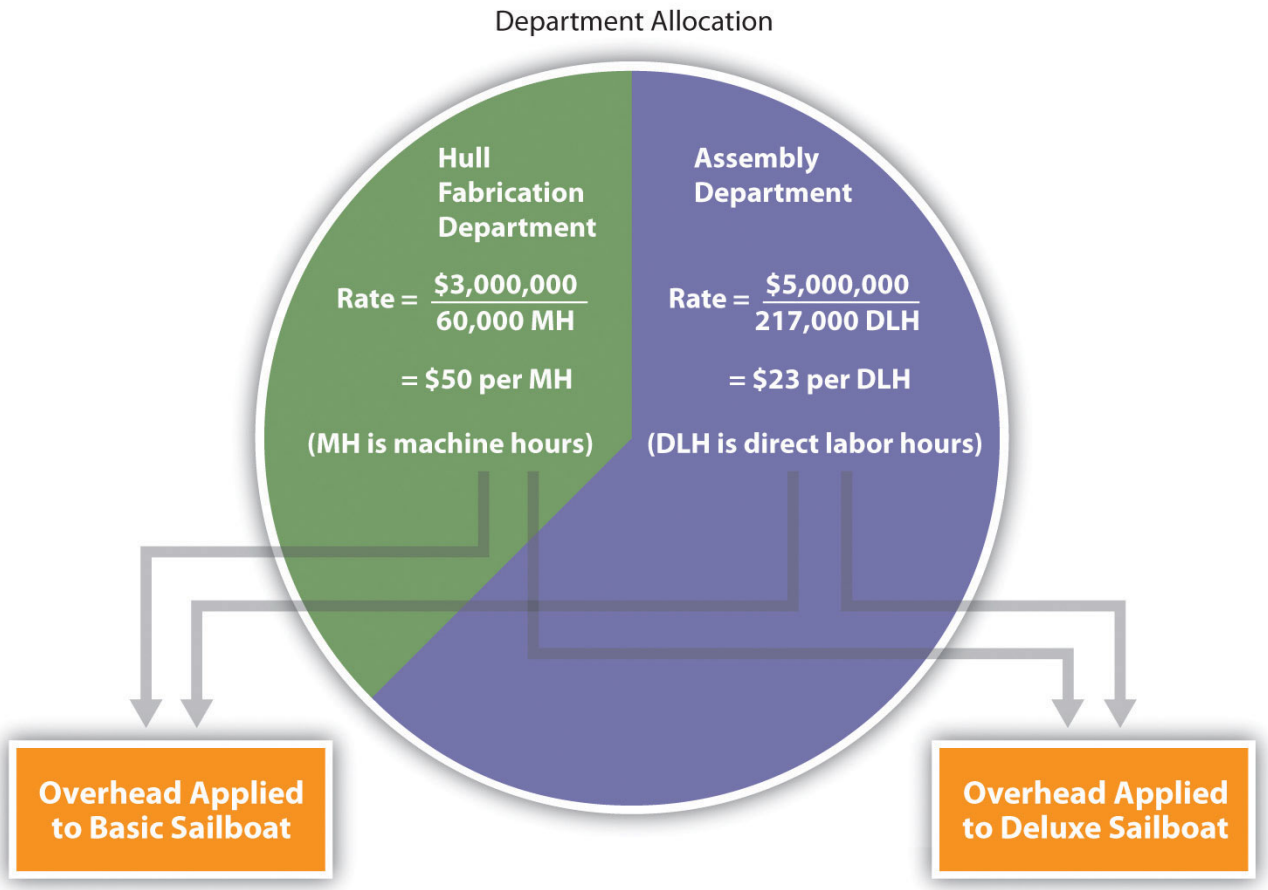
Answer: The department allocation approach is similar to the plantwide approach except that cost pools are formed for each department rather than for the entire plant, and a separate predetermined overhead rate is established for each department. Remember, total estimated overhead costs will not change. Instead, they will be broken out into various department cost pools. This approach allows for the use of different allocation bases for different departments depending on what drives overhead costs for each department. For example, the Hull Fabrication department at SailRite Company may find that overhead costs are driven more by the use of machinery than by labor, and therefore decides to use machine hours as the allocation base. The Assembly department may find that overhead costs are driven more by labor activity than by machine use and therefore decides to use labor hours or labor costs as the allocation base.

Assume that SailRite is considering using the department approach rather than the plantwide approach for allocating overhead. The cost pool in the Hull Fabrication department is estimated to be $3,000,000 for the year, and the cost pool in the Assembly department is estimated at $5,000,000. Note that total estimated overhead cost is still $8,000,000 (= $3,000,000 + $5,000,000). Machine hours (estimated at 60,000 hours used only in the Hull department) will be used as the allocation base for Hull Fabrication, and direct labor hours (estimated at 217,000 hours used only in the Assembly departmetn) will be used as the allocation base for Assembly. Thus two rates are used to allocate overhead (rounded to the nearest dollar) as follows:

1. Hull Fabrication department rate: $50 per machine hour (= $3,000,000 ÷ 60,000 hours)
2. Assembly department rate: $23 per direct labor hour (= $5,000,000 ÷ 217,000 hours)

As shown in Figure 2.3 “Using Department Rates to Allocate SailRite Company’s Overhead”, products going through the Hull Fabrication department are charged $50 in overhead costs for each *machine hour* used. Products going through the Assembly department are charged $23 in overhead costs for each *direct labor hour* used.

Figure 2.3 Using Department Rates to Allocate SailRite Company’s Overhead



The department allocation approach allows cost pools to be formed for each department and provides for flexibility in the selection of an allocation base. Although Figure 2.3 “Using Department Rates to Allocate SailRite Company’s Overhead” shows just two rates, many companies have more than two departments and therefore more than two rates. Organizations that use this approach tend to have simple operations within each department but different activities across departments. One department may use machinery, while another department may use labor, as is the case with SailRite’s two departments. This approach typically provides more accurate cost information than simply using one plantwide rate but still relies on the assumption that overhead costs are driven by direct labor hours, direct labor costs, or machine hours. This assumption of a causal relationship is increasingly less realistic as production processes become more complex.

The plantwide and department allocation methods are “traditional” approaches because both typically use direct labor hours, direct labor costs, or machine hours as the allocation base, and both were used prior to the creation of activity-based costing in the 1980s.

Key Takeaways

- Regardless of the approach used to allocate overhead, a predetermined overhead rate is established for each cost pool. The plantwide allocation approach uses one cost pool to collect and apply overhead costs and therefore uses one predetermined overhead rate for the entire company. The department allocation approach uses several cost pools (one for each department) and therefore uses several predetermined overhead rates.

Check Yourself

Kline Company expects to incur $800,000 in overhead costs this coming year—$200,000 in the Cut and Polish department and $600,000 in the Quality Control department. Total annual direct labor costs are expected to be $160,000. The Cut and Polish department expects to use 25,000 machine hours, and the Quality Control department plans to utilize 50,000 hours of direct labor time for the year.

Required:

1. Assume Kline Company allocates overhead costs with the plantwide approach, and direct labor cost is the allocation base. Calculate the rate used by the company to allocate overhead costs.
2. Assume Kline Company allocates overhead costs with the department approach. Calculate the rate used by each department to allocate overhead costs.

Solutions

1. The plantwide rate is calculated as follows:

   Predetermined overhead rate=Estimated overhead costs / Estimated activity in allocation base=$800,000 / $160,000=$5 per $1 in direct labor cost (or 500 percent of direct labor cost)

2. The department rates are calculated using the same formula as the plantwide rate. However, overhead costs and activity levels are estimated for each department rather than for the entire company, and two separate rates are calculated:

   Cut and Polish department=$200,000/25,000 machine hours=$8 per machine hour
   Quality Control department=$600,000/50,000 direct labor hours=$12 per direct labor hour

2.3 Using Activity-Based Costing to Allocate Overhead Costs

Learning Objectives

1. Understand how to use the five steps of activity-based costing to determine product costs.

Question: Suppose the managers at SailRite Company decide that the benefits of implementing an activity-based costing system would exceed the cost, and thus the company should use activity-based costing to allocate overhead. What are the five steps of activity-based costing, and how would this method work for SailRite?

Answer: Activity-based costing (ABC) uses several cost pools, organized by *activity*, to allocate overhead costs. (Remember that plantwide allocation uses one cost pool for the whole plant, and department allocation uses one cost pool for each department.) The idea is that activities are required to produce products—activities such as purchasing materials, setting up machinery, assembling products, and inspecting finished products. These activities can be costly. Thus the cost of activities should be allocated to products based on the products' use of the activities.

ABC in Action at SailRite Company

Five steps are required to implement activity-based costing. As you work through the example for SailRite Company, once again note that total estimated overhead costs remain at $8,000,000. However, the total is broken out into different *activities* rather than *departments*, and an overhead rate is established for each activity. The five steps are as follows:

Step 1. Identify costly activities required to complete products.

An activity is any process or procedure that consumes overhead resources. The goal is to understand all the activities required to make the company's products. This requires interviewing and meeting with personnel throughout the organization. Companies that use activity-based costing, such as **Hewlett Packard** and **IBM**, may identify hundreds of activities required to make their products. The most challenging part of this step is narrowing down the activities to those that have the biggest impact on overhead costs.

After meeting with personnel throughout the company, SailRite's accountant identified the following activities as having the biggest impact on overhead costs:

- Purchasing materials

- Setting up machines
- Running machines
- Assembling products
- Inspecting finished products

Step 2. Assign overhead costs to the activities identified in step 1.

This step requires that overhead costs associated with each activity be assigned to the activity (i.e., a cost pool is formed for each activity). For SailRite, the cost pool for the purchasing materials activity will include costs for items such as salaries of purchasing personnel, rent for purchasing department office space, and depreciation of purchasing office equipment.

The accountant at SailRite developed the following allocations after careful review of all overhead costs (remember, these are *overhead* costs, not direct materials or direct labor costs):

Activity	Estimated Annual Overhead Cost
Purchasing materials	$1,200,000
Setting up machines	1,600,000
Running machines	2,700,000
Assembling products*	1,500,000
Inspecting finished products	1,000,000
Total	$8,000,000

*We should note that this is not the direct labor cost. Instead, this represents overhead costs associated with assembling products, such as supplies and the factory space being used for assembly.

At this point, we have identified the most important and costly activities required to make products, and we have assigned overhead costs to each of these activities. The next step is to find an allocation base that drives the cost of each activity.

Step 3. Identify the cost driver for each activity.

A cost driver is the action that causes (or "drives") the costs associated with the activity. Identifying cost drivers requires gathering information and interviewing key personnel in various areas of the organization, such as purchasing, production, quality control, and accounting. After careful scrutiny of the process required for each activity, SailRite established the following cost drivers:

Activity	Cost Driver	Estimated Annual Cost Driver Activity
Purchasing materials	Purchase requisitions	10,000 requisitions
Setting up machines	Machine setups	2,000 setups
Running machines	Machine hours	90,000 hours
Assembling products	Direct labor hours	250,000 hours
Inspecting finished products	Inspection hours	20,000 hours

Notice that this information includes an estimate of the level of activity for each cost driver, which is needed to calculate a predetermined rate for each activity in step 4.

Step 4. Calculate a predetermined overhead rate for each activity.

This is done by dividing the estimated overhead costs (from step 2) by the estimated level of cost driver activity (from step 3). Figure 2.4 "Predetermined Overhead Rates for SailRite Company" provides the overhead rate calculations for SailRite Company

based on the information shown in the previous three steps. It shows that products will be charged $120 in overhead costs for each purchase requisition processed, $800 for each machine setup, $30 for each machine hour used, $6 for each direct labor hour worked, and $50 for each hour of inspection time.

Figure 2.4 Predetermined Overhead Rates for SailRite Company

Activity	Cost Driver	(a) Estimated Overhead Costs	(b) Estimated Cost Driver Activity	(a) ÷ (b) Predetermined Overhead Rate
Purchasing materials	Purchase requisitions	$1,200,000	10,000	$120 per requisition
Setting up machines	Machine setups	1,600,000	2,000	800 per setup
Running machines	Machine hours	2,700,000	90,000	30 per machine hour
Assembling products	Direct labor hours	1,500,000	250,000	6 per direct labor hour
Inspecting finished products	Inspection hours	1,000,000	20,000	50 per inspection hour
Total		$8,000,000		

Step 5. Allocate overhead costs to products.

Overhead costs are allocated to products by multiplying the predetermined overhead rate for each activity (calculated in step 4) by the level of cost driver activity used by the product. The term *applied overhead* is often used to describe this process.

Assume the following annual cost driver activity takes place at SailRite for the Basic and Deluxe sailboats: Notice that the total activity levels presented here match the estimated activity levels presented in step 4. This was done to avoid complicating the example with overapplied and underapplied overhead. However, a more realistic scenario would provide *actual* activity levels that are different than *estimated* activity levels, thereby creating overapplied and underapplied overhead for each activity. We described the disposition of overapplied and underapplied overhead in Chapter 1.

Activity	Basic Sailboat	Deluxe Sailboat	Total
Purchasing materials	7,000 requisitions	3,000 requisitions	10,000 requisitions
Setting up machines	1,100 setups	900 setups	2,000 setups
Running machines	50,000 hours	40,000 hours	90,000 machine hours
Assembling products	200,000 hours	50,000 hours	250,000 direct labor hours
Inspecting finished products	12,000 hours	8,000 hours	20,000 inspection hours

Figure 2.5 “Allocation of Overhead Costs to Products at SailRite Company” shows the allocation of overhead using the cost driver activity just presented and the overhead rates calculated in Figure 2.4 “Predetermined Overhead Rates for SailRite Company”. Notice that allocated overhead costs total $8,000,000. This is the same cost figure used for the plantwide and department allocation methods we discussed earlier. Activity-based costing simply provides a more refined way to allocate the same overhead costs to products.

Figure 2.5 Allocation of Overhead Costs to Products at SailRite Company

Activity	Predetermined Overhead Rate	Basic Sailboat: Cost Driver Activity	Basic Sailboat: Overhead Allocated*	Deluxe Sailboat: Cost Driver Activity	Deluxe Sailboat: Overhead Allocated*
Purchasing materials	$120 per requisition	7,000	$ 840,000	3,000	$ 360,000
Setting up machines	800 per setup	1,100	880,000	900	720,000
Running machines	30 per machine hour	50,000	1,500,000	40,000	1,200,000
Assembling products	6 per direct labor hour	200,000	1,200,000	50,000	300,000
Inspecting finished products	50 per inspection hour	12,000	600,000	8,000	400,000
Total overhead costs allocated			$ 5,020,000		$ 2,980,000
Total companywide overhead costs				$ 8,000,000	
Overhead cost per unit for each product**			$ 1,004		$ 2,980

*Overhead allocated equals the predetermined overhead rate times the cost driver activity.

**Overhead cost per unit for the Basic model equals $5,020,000 (overhead allocated) ÷ 5,000 units produced, and for the Deluxe model, it equals $2,980,000 ÷ 1,000 units produced.

The bottom of Figure 2.5 "Allocation of Overhead Costs to Products at SailRite Company" shows the *overhead* cost per unit for each product assuming SailRite produces 5,000 units of the Basic sailboat and 1,000 units of the Deluxe sailboat. This information is needed to calculate the *product* cost for each unit of product, which we discuss next.

Product Costs Using the Activity-Based Costing Approach at SailRite

Question: As shown in Figure 2.5 "Allocation of Overhead Costs to Products at SailRite Company", SailRite knows the overhead cost per unit using activity-based costing is $1,004 for the Basic model and $2,980 for the Deluxe. Now that SailRite has the overhead cost per unit, how will the company find the total product cost per unit and resulting profit?

Answer: Recall from our discussion earlier that the calculation of a product's cost involves three components—direct materials, direct labor, and manufacturing overhead. Assume direct materials cost $1,000 for the Basic sailboat and $1,300 for the Deluxe. Direct labor costs are $600 for the Basic sailboat and $750 for the Deluxe. This information, combined with the overhead cost per unit calculated at the bottom of Figure 2.5 "Allocation of Overhead Costs to Products at SailRite Company", gives us what we need to determine the product cost per unit for each model, which is presented in Figure 2.6 "SailRite Company Product Costs Using Activity-Based Costing". The average sales price is $3,200 for the Basic model and $4,500 for the Deluxe. Using the product cost information in Figure 2.6 "SailRite Company Product Costs Using Activity-Based Costing", the Basic model yields a profit of $596 (= $3,200 price – $2,604 cost) per unit and the Deluxe model yields a *loss* of $530 (= $4,500 price – $5,030 cost) per unit.

Figure 2.6 SailRite Company Product Costs Using Activity-Based Costing

	Basic Sailboat (cost per unit)	Deluxe Sailboat (cost per unit)
Direct materials	$ 1,000	$ 1,300
Direct labor	600	750
Overhead	1,004	2,980
Total product cost per unit	$ 2,604	$ 5,030

As you can see in Figure 2.6 "SailRite Company Product Costs Using Activity-Based Costing", overhead is a significant component of total product costs. This explains the need for a refined overhead allocation system such as activity-based costing.

Comparison of ABC to Plantwide Costing at SailRite

After going through the process of allocating overhead using activity-based costing, John Lester (the company accountant) called a meeting with the same management group introduced at the beginning of the chapter: Cindy Hall (CEO), Mary McCann (vice president of marketing), and Bob Schuler (vice president of production). As you read the following dialogue, refer to Figure 2.7 "Activity-Based Costing Versus Plantwide Costing at SailRite Company", which summarizes John's findings.

Cindy:
What do you have for us, John?

John:
I think you'll find the results of our most recent costing analysis very interesting. We used an approach called activity-based costing to allocate overhead to products.

Bob:
I recall being interviewed last week about the activities involved in the production process.

John:
Yes, here's what we found. The old allocation approach indicates that the Basic boat costs $2,880 to build and the Deluxe boat costs $3,650 to build. Our average sales price for the Basic is $3,200 and $4,500 for the Deluxe. You can see why we pushed sales of the Deluxe boat—it has a profit of $850 per boat.

Cindy:
John, from your analysis, it looks as if we were wrong about the Deluxe boat being the most profitable.

John:
We do have some startling results. Using activity-based costing, an approach I think is much more accurate, the Deluxe boat is not profitable at all. In fact, we lose $530 for each Deluxe boat sold, and the profits from the Basic boat are much higher than we thought at $596 per unit.

Cindy:
I see direct materials and direct labor are the same no matter which costing system we use. Why is there such a large variation in overhead costs?

John:
Good question! When we used our old approach of one plantwide rate based on direct labor hours, the Deluxe process consumed 20 percent of all direct labor hours worked—that is, 50,000 Deluxe hours divided by 250,000 total hours. Therefore the Deluxe model was allocated 20 percent of all overhead costs. Using activity-based costing, we identified five key activities and assigned overhead costs based on the use of these activities. The Deluxe process consumed more than 20 percent of the resources provided for every activity. For example, running machines is one of the most costly activities, and the Deluxe model used about 44 percent of the resources provided by this activity. This is significantly higher than the 20 percent allocated using direct labor hours under the old approach.

Bob:
This certainly makes sense! Each Deluxe boat takes a whole lot more machine hours to produce than the Basic boat.

Cindy:
Thanks for this analysis, John. Now we know why company profits have been declining even though sales have increased. Either the Deluxe sales price must go up or costs must go down—or a combination of both!

Figure 2.7 Activity-Based Costing Versus Plantwide Costing at SailRite Company

Plantwide Costing
(direct labor hours as allocation base)

	Basic Sailboat	Deluxe Sailboat
Direct materials	$ 1,000	$ 1,300
Direct labor	600	750
Overhead*	1,280	1,600
Total product cost per unit (a)	$ 2,880	$ 3,650
Sales price (b)	$ 3,200	$ 4,500
Profit = (b) – (a)	**$ 320**	**$ 850**

Activity-Based Costing
(several different allocation bases)

	Basic Sailboat	Deluxe Sailboat
Direct materials	$ 1,000	$ 1,300
Direct labor	600	750
Overhead**	1,004	2,980
Total product cost per unit (c)	$ 2,604	$ 5,030
Sales price (d)	$ 3,200	$ 4,500
Profit (loss) = (d) – (c)	**$ 596**	**$ (530)**

*From Figure 2.2 “SailRite Company Product Costs Using One Plantwide Rate Based on Direct Labor Hours”.

**From Figure 2.5 “Allocation of Overhead Costs to Products at SailRite Company”.

Question: SailRite has more accurate product cost information using activity-based costing to allocate overhead. Why is the overhead cost per unit so different using activity-based costing?

Answer: Figure 2.8 “Detailed Analysis of Overhead Allocations at SailRite Company” provides a more thorough look at how the Deluxe product consumes a significant share of overhead resources—much higher than the 20 percent that was being allocated based on direct labor hours. Let’s look at Figure 2.8 “Detailed Analysis of Overhead Allocations at SailRite Company” in detail:

- The ABC column represents overhead costs allocated using the activity-based costing shown back in Figure 2.5 “Allocation of Overhead Costs to Products at SailRite Company”.
- The DLH (direct labor hours) column represents overhead costs allocated using direct labor hours as the allocation base where 80 percent was allocated to the Basic boat (= 200,000 hours ÷ 250,000 total hours) and 20 percent allocated to the Deluxe boat (= 50,000 hours ÷ 250,000 total hours).
- The Diff. (difference) column shows the difference between one allocation method and the other. Notice the shift in the allocation of overhead costs using activity-based costing. A total of $1,380,000 in overhead costs shifts to the Deluxe sailboat, which amounts to $1,380 per boat (= $1,380,000 ÷ 1,000 boats).

Figure 2.8 Detailed Analysis of Overhead Allocations at SailRite Company

	Basic Sailboat			Deluxe Sailboat		
Activity	(a) ABC*	(b) DLH**	(a) – (b) Diff.	(c) ABC*	(d) DLH**	(c) – (d) Diff.
Purchasing materials	$ 840,000	$ 960,000	$ (120,000)	$ 360,000	$ 240,000	$ 120,000
Setting up machines	880,000	1,280,000	(400,000)	720,000	320,000	400,000
Running machines	1,500,000	2,160,000	(660,000)	1,200,000	540,000	660,000
Assembling products	1,200,000	1,200,000	–	300,000	300,000	–
Inspecting finished products	600,000	800,000	(200,000)	400,000	200,000	200,000
Total	$5,020,000	$6,400,000	$ (1,380,000)	$2,980,000	$1,600,000	$1,380,000
			$8,000,000			
		$8,000,000				

*Amounts in this column come from Figure 2.5 “Allocation of Overhead Costs to Products at SailRite Company”.

**Amounts in this column are calculated by multiplying 80 percent for the Basic boat (20 percent for the Deluxe) by the total overhead cost for the activity. For example, the total overhead cost for purchasing materials is $1,200,000 (see Figure 2.4 “Predetermined Overhead Rates for SailRite Company”) and $1,200,000 × 80 percent = $960,000. Using the plantwide approach (one plantwide rate based on direct labor hours), $960,000 is the amount allocated to the Basic sailboat for this activity, and $240,000 is the amount allocated to the Deluxe boat.

The primary reason that using activity-based costing shifted overhead costs to the Deluxe sailboat is that producing each Deluxe boat requires more resources than the Basic boat. For example, the Basic boat requires 50,000 machine hours to produce 5,000 boats, and the Deluxe boat requires 40,000 machine hours to produce 1,000 boats. The number of machine hours required per boat produced is as follows:

	Basic	Deluxe
Total machine hours (a)	50,000	40,000
Total boats produced (b)	÷ 5,000	÷ 1,000
Machine hours per boat (a) ÷ (b)	10	40

You can see from this analysis that the Deluxe boat consumes four times the machine hours of the Basic boat. At a rate of $30 per machine hour, the Deluxe boat is assigned $1,200 per boat for this activity ($30 rate × 40 machine hours) while the Basic boat is assigned $300 per boat ($30 rate × 10 machine hours).

Advantages and Disadvantages of ABC

Question: Activity-based costing undoubtedly provides better cost information than most traditional costing methods, such as plantwide and department allocation methods. However, ABC has its limitations. What are the advantages and disadvantages of using activity-based costing?

Answer: The advantages and disadvantages of ABC are as follows:

Advantages

More accurate cost information leads to better decisions. The cost information provided by ABC is generally regarded as more accurate than the information provided by most traditional costing methods. This allows management to make better decisions in areas such as product pricing, product line changes (adding products or eliminating products), and product mix decisions (how much of each product to produce and sell).

Increased knowledge of production activities leads to process improvements and reduced costs. ABC requires identifying the activities involved in the production process (step 1) and assigning costs to these activities (step 2). This provides management with a better view of the detailed activities involved (purchasing materials, machine setups, inspections, and so forth) and the cost of each activity. Managers are more likely to focus on improving efficiency in the most costly activities, thereby reducing costs.

Disadvantages

ABC systems can be costly to implement. ABC systems require teamwork across the organization and therefore require employees to take time out from their day-to-day activities to assist in the ABC process (e.g., to identify costly activities). Assigning costs to activities takes time, as does identifying and tracking cost drivers. And assigning costs to products requires a significant amount of time in the accounting department. Imagine having 15 cost pools (activities), each with a predetermined overhead rate used to assign overhead costs to the company's 80 products—not an unrealistic example for a large company. The accounting costs incurred to maintain such a system can be prohibitively high.

Unitizing fixed costs can be misleading. Product costing involves allocating costs from activity centers to products and calculating a product cost per unit. The problem with this approach is that fixed costs are often a large part of the overhead costs being allocated (e.g., building and machinery depreciation and supervisor salaries). Recall that fixed costs are costs that *do not change in total* with changes in activity.

Looking back to the SailRite example using activity-based costing, the Deluxe sailboat cost $5,030 per unit to produce based on production of 1,000 units (as shown in Figure 2.5 "Allocation of Overhead Costs to Products at SailRite Company"). If SailRite produces 2,000 units of the Deluxe boat, will the unit cost remain at $5,030? Probably not. A significant portion of overhead costs are fixed and will be spread out over more units, thereby reducing the cost per unit. We address this issue at length in later chapters. The point here is that managers must beware of using per unit cost information blindly for decision making, particularly if a significant change in the level of production is anticipated.

The benefits may not outweigh the costs. Companies with one or two products that require very little variation in production may not benefit from an ABC system. Suppose a company produces one product. The overhead costs can be divided into as many cost pools as you like, but all overhead costs will still be assigned to the one product. (We should mention, however, that management would benefit from understanding the activities involved in the process and the costs associated with each activity. It's the allocation to the one product—steps 4 and 5 of ABC—that would provide little useful information in this scenario.)

Companies that produce several different products may believe that the benefits of implementing ABC will outweigh the costs. However, management must be willing to use the ABC information to benefit the company. Companies like **Chrysler Group LLC** have been known to try ABC, only to meet resistance from their managers. Until managers are willing to use the ABC information to make improvements in the organization, there is no point in implementing such a system.

ABC Cost Flows

Question: How are overhead costs recorded when using activity-based costing?

Answer: We presented the flow of costs for a job costing system in Chapter 1, including how to track actual overhead costs and how to track overhead applied using a separate manufacturing overhead account. The cost flows are the same for an activity-based costing system, with one exception. Instead of using one plantwide overhead rate to allocate (or apply) overhead to products, an ABC system uses several overhead rates to allocate overhead. The entry to record this allocation—whether it involves one rate or multiple rates—is the same as the entry in Chapter 1. Simply debit work-in-process inventory and credit manufacturing overhead for the amount of overhead applied. (Some companies use separate work-in-process inventory and manufacturing overhead accounts for each activity. For the sake of simplicity, we do not use separate accounts.)

For example, assume production of SailRite's Basic sailboats has the following cost driver activity for one week of operations:

(a) Activity for the Week	(b) Rate*	(a) × (b) Amount of Overhead Applied
10 purchase requisitions	$120 per requisition	$ 1,200
15 machine setups	800 per setup	12,000
35 machine hours	30 per machine hour	1,050
150 direct labor hours	6 per direct labor hour	900
60 inspection hours	50 per inspection hour	3,000
Total overhead applied to the Basic Sailboat		$ 18,150

*From Figure 2.4 "Predetermined Overhead Rates for SailRite Company".

The entry to record overhead applied to the Basic sailboats for the week is as follows:

Dr. WIP Inventory	18,150	
Cr. Manufacturing overhead		18,150

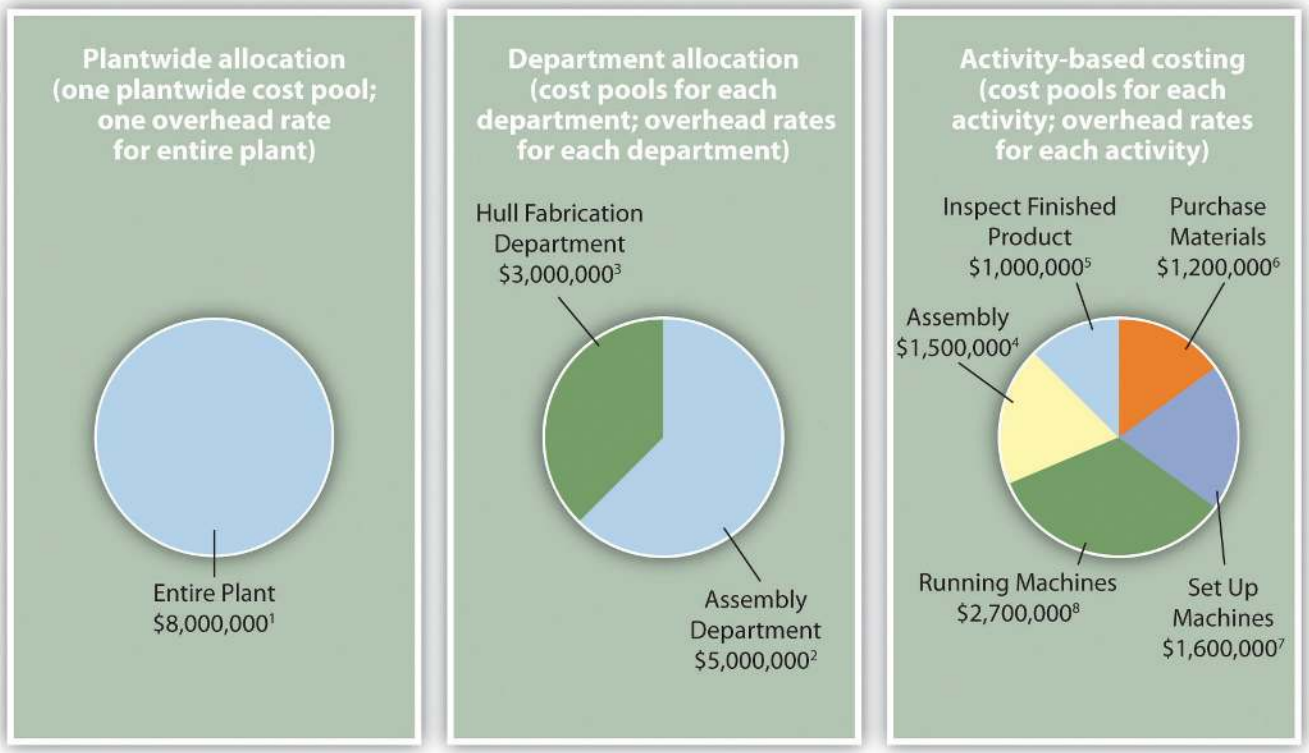
Recall from Chapter 1 that the manufacturing overhead account is closed to cost of goods sold at the end of the period. If actual overhead costs are higher than applied overhead, the resulting *underapplied* overhead is closed with a debit to cost of goods sold and a credit to manufacturing overhead. If actual overhead costs are lower than applied overhead, the resulting *overapplied* overhead is closed with a debit to manufacturing overhead and a credit to cost of goods sold.

Recap of Three Allocation Methods

We have discussed three different methods of allocating overhead to products—plantwide allocation, department allocation, and activity-based costing. Remember, total overhead costs will not change in the short run, but the way total overhead costs are allocated to products will change depending on the method used.

Figure 2.9 "The Three Methods of Overhead Allocation" presents the three allocation methods, using SailRite as an example. Notice that the three pie charts in the illustration are of equal size, representing the $8,000,000 total overhead costs incurred by SailRite.

Figure 2.9 The Three Methods of Overhead Allocation



Overhead Rates:

[1] Allocated based on direct labor hours (DLH):
$8,000,000 ÷ 250,000 DLH = $32 per DLH.

[2] Allocated based on direct labor hours (DLH): $5,000,000 ÷ 217,000 DLH = $23 per DLH.

[3] Allocated based on machine hours (MH): $3,000,000 ÷ 60,000 MH = $50 per MH.

[4] Allocated based on direct labor hours (DLH): $1,500,000 ÷ 250,000 DLH = $6 per DLH.

[5] Allocated based on inspection hours (IH): $1,000,000 ÷ 20,000 IH = $50 per IH.

[6] Allocated based on purchase requisitions (PR): $1,200,000 ÷ 10,000 PR = $120 per PR.

[7] Allocated based on machine setups (MS): $1,600,000 ÷ 2,000 MS = $800 per MS.

[8] Allocated based on machine hours (MH): $2,700,000 ÷ 90,000 MH = $30 per MH.

Key Takeaways

- Activity-based costing focuses on identifying the activities required to make products, on forming cost pools for each activity, and on allocating overhead costs to the products based on their use of each activity. ABC systems and traditional systems often result in vastly different product costs. But even if the resulting product costs are not much different, ABC provides managers with a better understanding of the production activities required for each activity and the associated costs, which often leads to improved efficiency and reduced costs.

Business in Action 2.1

Using Activity-Based Costing to Argue Predatory Pricing

BuyGasCo Corporation, a privately owned chain of gas stations based in Florida, was taken to court for selling regular grade gasoline below cost, and an injunction was issued. Florida law prohibits selling gasoline below refinery cost if doing so injures competition. Using a plantwide approach of allocating costs to products, the plaintiff's costing expert was able to support the

allegation of predatory pricing. The defendant's expert witness, an accounting professor, used activity-based costing to dispute the allegation.

Both costing experts had to allocate costs to each of the three grades of gasoline (regular, plus, and premium) to determine a total cost per grade of fuel and a cost per gallon for each grade. Sales of regular grade fuel were significantly higher (63 percent of total sales) than the other two grades. Using the plantwide approach, the plaintiff's expert allocated all costs based on gallons of gas sold. Using the activity-based costing approach, the defendant's expert formed three activity cost pools—labor, kiosk, and gas dispensing. The first two cost pools allocated costs using gallons of gas sold and therefore were allocated as they would be with the plantwide approach (63 percent for regular grade, 20 percent for plus, and 17 percent for premium). The third cost pool (gas dispensing) allocated costs equally to each grade of fuel (i.e., one-third of costs to each grade of fuel). The gas dispensing pool included costs for storage tanks, all of which were the same size, as well as gas pumps and signs.

Compared with the plantwide approach, activity-based costing showed a lower cost per gallon for regular gas and a higher cost per gallon for the other two grades of fuel. Once the ABC information was presented, the case was settled, and the initial injunction was lifted.

Sources: Thomas L. Barton and John B. MacArthur, "Activity-Based Costing and Predatory Pricing: The Case of the Petroleum Retail Industry," *Management Accounting*, Spring 2003; All Business, "Home Page," http://www.allbusiness.com.

Check Yourself

Parker Company produces an inkjet printer that sells for $150 and a laser printer that sells for $350. Last year, total overhead costs of $1,050,000 were allocated based on direct labor hours. A total of 15,000 direct labor hours were required last year to build 12,000 inkjet printers (1.25 hours per unit), and 10,000 direct labor hours were required to build 4,000 laser printers (2.50 hours per unit). Total direct labor and direct materials costs for the year were as follows:

	Inkjet Printer	Laser Printer
Direct materials	$540,000	$320,000
Direct labor	$600,000	$400,000

The management of Parker Company would like to use activity-based costing to allocate overhead rather than use one plantwide rate based on direct labor hours. The following estimates are for the activities and related cost drivers identified as having the greatest impact on overhead costs.

			Estimated Cost Driver Activity		
Activity	Cost Driver	Estimated Overhead Costs	Inkjet	Laser	Total
Production runs	Number of production runs	$ 400,000	40	10	50
Quality inspections	Inspection hours	250,000	1,200	2,800	4,000
Packaging and shipping	Number of units shipped	400,000	12,000	4,000	16,000
Total		$1,050,000			

Required:

1. Calculate the direct materials cost per unit and direct labor cost per unit for each product.
    1. Using the plantwide allocation method, calculate the predetermined overhead rate and determine the overhead cost per unit for the inkjet and laser products.
    2. What is the cost per unit for the inkjet and laser products?

1. Using the activity-based costing allocation method, calculate the predetermined overhead rate for each activity. (Hint: Step 1 through step 3 in the activity-based costing process have already been done for you; this is step 4.)
2. Using the activity-based costing allocation method, allocate overhead to each product. (Hint: This is step 5 in the activity-based costing process.) Determine the overhead cost per unit. Round amounts to the nearest dollar.
3. What is the product cost per unit for the inkjet and laser products?

2. Calculate the per unit profit for each product using the plantwide approach and the activity-based costing approach. Comment on the differences between the results of the two approaches.

Solutions

1. The cost per unit for direct materials is as follows:

	Inkjet Printer	Laser Printer
Total direct material costs (a)	$ 540,000	$ 320,000
Units produced (b)	12,000 units	4,000 units
Direct material cost per unit (a) ÷ (b)	$ 45 per unit	$ 80 per unit

The cost per unit for direct labor is as follows:

	Inkjet Printer	Laser Printer
Total direct labor costs (c)	$ 600,000	$ 400,000
Units produced (d)	12,000 units	4,000 units
Direct labor cost per unit (c) ÷ (d)	$ 50 per unit	$ 100 per unit

1. The plantwide allocation used by Parker Company is based on direct labor hours. The predetermined overhead rate is calculated as follows:

   Estimated overhead cost / Estimated activity in allocation base=$1,050,000 / 25,000 hours=$42 per direct labor hour

   Because the inkjet printer requires 1.25 direct labor hours to build and the laser printer takes 2.50 direct labor hours to build (both figures are provided in the problem data), $52.50 in overhead is allocated to 1 unit of the inkjet product (= $42 rate × 1.25 hours) and $105 in overhead is allocated to 1 unit of the laser product ($42 rate × 2.50 direct labor hours).

2. Per unit product costs are as follows:

	Inkjet Printer	Laser Printer
Direct materials	$ 45.00	$ 80.00
Direct labor	50.00	100.00
Overhead	52.50*	105.00**
Total product cost per unit	$ 147.50	$ 285.00

Direct materials and direct labor determined from Question 1.

*$52.50 = 1.25 direct labor hours per unit × $42 rate.

**$105 = 2.50 direct labor hours per unit × $42 rate.

1. Predetermined overhead rates are calculated for each activity as follows:

Activity	Cost Driver	(a) Estimated Overhead Costs	(b) Estimated Cost Driver Activity	(a) ÷ (b) Predetermined Overhead Rate
Production runs	Number of production runs	$ 400,000	50 runs	$ 8,000.00 per run
Quality inspections	Inspection hours	250,000	4,000 hours	62.50 per inspection hr.
Packaging and shipping	Number of units shipped	400,000	16,000 units	25.00 per unit shipped
Total		$1,050,000		

2. Overhead costs are allocated as follows:

		Inkjet Printer		Laser Printer	
Activity	Predetermined Overhead Rate	Cost Driver Activity	Overhead Allocated*	Cost Driver Activity	Overhead Allocated*
Production runs	$8,000.00 per run	40	$ 320,000	10	$ 80,000
Quality inspections	62.50 per inspection	1,200	75,000	2,800	175,000
Packaging and shipping	25.00 per unit shipped	12,000	300,000	4,000	100,000
Total overhead costs allocated			$ 695,000		$ 355,000
Total companywide overhead costs				$ 1,050,000	
Overhead cost per unit for each product**			$ 58		$ 89

*Overhead allocated equals the predetermined overhead rate times the cost driver activity.

**Overhead cost per unit for the inkjet printer equals $695,000 (overhead allocated) ÷ 12,000 units produced, and for the laser printer, $355,000 ÷ 4,000 units produced. Amounts are rounded to the nearest dollar.

3. Per unit product costs are as follows:

	Inkjet Printer	Laser Printer
Direct materials	$ 45	$ 80
Direct labor	50	100
Overhead	58	89
Total product cost per unit	$ 153	$ 269

Direct materials and direct labor determined from Question 1. Overhead determined from Question 3b.

Plantwide Allocation
(direct labor hours as the allocation base)

	Inkjet Printer	Laser Printer
Direct materials	$ 45.00	$ 80.00
Direct labor	50.00	100.00
Overhead	52.50	105.00
Total product cost per unit (a)	$147.50	$285.00
Sales price (b)	$150.00	$350.00
Profit = (b) – (a)	**$ 2.50**	**$ 65.00**

Activity-Based Costing
(several different allocation bases)

	Inkjet Printer	Laser Printer
Direct materials	$ 45.00	$ 80.00
Direct labor	50.00	100.00
Overhead	58.00	89.00
Total product cost per unit (c)	$153.00	$269.00
Sales price (d)	$150.00	$350.00
Profit (loss) = (d) – (c)	**$ (3.00)**	**$ 81.00**

2.

Although unit product costs do not change significantly for the inkjet printer when activity-based costing is used (from $147.50 to $153), the cost increases enough to result in a $3 loss for each unit. Conversely, the laser printer costs decrease significantly from $285 to $269 per unit when using activity-based costing, resulting in a profit of $81 per unit.

The shift in overhead costs to the inkjet printer is primarily a result of the inkjet printer using 80 percent of the production run resources and thus being assigned 80 percent of the overhead costs associated with production runs. The plantwide rate approach only assigned 60 percent of all overhead costs to the inkjet printer, including those related to production runs (60 percent = 15,000 inkjet direct labor hours ÷ 25,000 total direct labor hours).

2.4 Using Activity-Based Management to Improve Operations

Learning Objectives

1. Understand the concept of activity-based management.

Question: Activity-based costing is helpful in providing relatively accurate product cost information. However, the value of activity-based costing information goes beyond accurate product costing. When activity-based costing is used in conjunction with activity-based management, organizations are often able to make dramatic improvements to operations. How does activity-based management help an organization reduce costs and become more efficient?

Answer: Activity-based management (ABM)A management tool that uses cost information obtained from an ABC system to improve the efficiency and profitability of operations. provides three steps for managers to use that lead to improved efficiency and profitability of operations.

Step 1. Identify activities required to complete products.

This involves interviewing personnel throughout the company. Recall that activity-based costing also requires the identification of key activities. However, ABM allows for a more detailed analysis because the estimation of costs and related overhead rates are not required when using ABM.

Step 2. Determine whether activities are value-added or non-value-added.

Activities that add to the product's quality and performance are called value-added activities. Activities that do not add to the product's quality and performance are called non-value-added activities. Examples of value-added activities at SailRite include using materials and machines to produce hulls and assembling each sailboat. Examples of non-value-added activities include storing parts in a warehouse and letting machinery sit idle.

Step 3. Continuously improve the value-added activities and minimize or eliminate the non-value-added activities.

Even if an activity is identified as value-added, ABM requires the continuous improvement of the activity. For example, SailRite's assembly process (a value-added activity) may require workers to shift back and forth between Basic and Deluxe sailboats throughout the day, each of which uses different parts and requires different tools. Perhaps the efficiency of this process could be improved by assembling the boats in batches—one day working on Basic boats, another day working on Deluxe boats.

Activities that are non-value-added should be minimized or eliminated. For example, storing parts in a warehouse at SailRite (a non-value-added activity) might be minimized by moving to a just-in-time system that requires suppliers to deliver parts immediately before they are needed for production.

The next time you visit a fast-food restaurant, go to a clothing store, or stand in line at a college bookstore, try to identify value-added and non-value-added activities. Think about ways the organization can eliminate non-value-added activities and improve value-added activities.

Key Takeaway

- Activity-based management provides a three step process that shows management how to use the cost information obtained from an activity-based costing system to improve the efficiency and profitability of operations.

Business in Action 2.2

Why Use Activity-Based Costing (ABC) and Activity-Based Management (ABM)?

A survey of 296 users of activity-based costing and activity-based management showed that the top four objectives of using ABC and ABM were as follows:

1. To provide product costing (58 percent)
2. To analyze processes (51 percent)
3. To evaluate performance (49 percent)
4. To assess profitability (38 percent)

All these objectives are important to most organizations and can be achieved with the help of ABC and ABM systems.

Source: Mohan Nair, "Activity-Based Costing: Who's Using It and Why?" *Management Accounting Quarterly*, Spring 2000.

Check Yourself

Label each of the following activities as value-added or non-value-added:

1. Placing customers who call to order a pizza on hold
2. Assembling desks to be sold to customers
3. Storing raw materials to be used in production the next month

4. Designing a car to maximize comfort
5. Scrapping defective production materials
6. Waiting for a phone call from a customer
7. Moving raw materials from one end of a factory to the other

Solutions to Review Problem 3.4

1. Non-value-added activity
2. Value-added activity
3. Non-value-added activity
4. Value-added activity
5. Non-value-added activity
6. Non-value-added activity
7. Non-value-added activity

2.5 Using Activity-Based Costing (ABC) and Activity-Based Management (ABM) in Service Organizations

Learning Objectives

1. Apply activity-based costing and activity-based management to service organizations.

Question: To this point, we have presented ABC and ABM examples in a manufacturing setting. However, service organizations, such as banks, hospitals, airlines, and government agencies, also use ABC and ABM. Some specialists refer to activity-based costing and activity-based management as *activity-based costing and management*, or *ABCM . How can ABC help service organizations get better product cost information?*

Answer: The same five steps used in manufacturing organizations can also be used in service organizations. To understand how ABC could be used in a service organization, let's look at how ABC can be used to determine the cost of loan products at a financial institution.

Service Organization Example of ABC

Imagine you are the chief financial officer of Five Star Bank. You are interested in implementing an activity-based costing system to evaluate the cost of different loan products, such as auto loans and home equity loans, offered by the bank. The five steps of activity-based costing we presented earlier still apply. Let's look at how these steps might work when evaluating the cost of bank loans.

Step 1. Identify costly activities.

Processing loans includes activities such as meeting with customers, reviewing customer applications, and running credit reports.

Step 2. Assign overhead costs to the activities identified in step 1.

Costs assigned to the activity of *reviewing customer applications* include items such as wages of personnel reviewing applications, depreciation of computer equipment used to review online applications, and supplies needed for the review process.

Step 3. Identify the cost driver for each activity.

Activity cost drivers are shown as follows:

Activity	Cost Driver
Meeting with customers	Hours of meeting time
Reviewing customer applications	Number of applications reviewed
Running credit reports	Number of credit reports run

Step 4. Calculate a predetermined overhead rate for each activity.

This is done by dividing estimated overhead costs for each activity by the estimated cost driver activity. For the activity *meeting with customers*, this calculation results in a rate per hour of meeting time. For the activity *reviewing customer applications*, the calculation results in a rate per application reviewed, and for *running credit reports*, a rate per credit report run.

Step 5. Allocate overhead costs to products.

Overhead is allocated, or *applied*, to products (auto loans and home equity loans in this example) based on the use of each activity's cost driver. If a loan officer reviews 30 auto loan applications, an amount equal to the *rate per application reviewed* times *30 applications* is allocated to the auto loans product.

Service Organization Example of ABM

Question: Managers at Five Star Bank are not only interested in product cost information; they would also like to scrutinize the activities involved in processing loans and make the process more efficient. How can the management of Five Star Bank use activity-based management to become more efficient?

Answer: Managers and accountants can apply the three steps of activity-based management to Five Star Bank as follows:

1. **Identify activities required to complete the product.** This involves interviewing personnel throughout the company to capture all the activities involved in processing loans.
2. **Determine whether activities are value-added or non-value-added.** An example of a value-added activity is the quick approval of a loan. An example of a non-value-added activity is time spent waiting for credit reports.
3. **Continuously improve the value-added activities and minimize, or eliminate, the non-value-added activities.** Five Star Bank should continually strive to improve its ability to approve loans quickly (a value-added activity). While waiting for credit reports (a non-value-added activity), perhaps the bank can find other value-added activities that bank personnel can perform (e.g., responding to customer questions or processing other loan applications).

Business in Action 2.3

Activity-Based Costing at **Blue Cross and Blue Shield of Florida (BCBSF)**

Management at **Blue Cross and Blue Shield of Florida** realized it needed more sophisticated cost information to make better decisions. Given the highly competitive nature of the health care insurance industry and the need to minimize costs, **BCBSF's** management decided to implement an activity-based costing system. Management's primary concern was how to allocate administrative costs totaling $588,000,000 (21 percent of revenue) to the products and services the organization provides.

The benefits of implementing an activity-based costing and management system at **BCBSF** are as follows:

- Product pricing is improved as a result of having better cost information (prices are based on cost).
- Regional management is able to identify the cost of services provided by headquarters and make more efficient use of costly services.
- Product managers use the cost information to design products in a way that is most cost-effective.

As stated by the product director and cost accounting manager at **BCBSF**, "The goal is to provide the right information at the right time to the right people in a cost-efficient way."

Source: Kenneth L. Thurston, Dennis M. Kelemen, and John B. MacArthur, "Cost for Pricing at Blue Cross and Blue Shield of Florida," *Management Accounting Quarterly*, Spring 2000.

Key Takeaways

- Activity-based costing and activity-based management techniques are not limited to manufacturing companies. Virtually all organizations—including service, nonprofit, retail, and governmental—can benefit from implementing some form of ABC and ABM.

Check Yourself

Menzies and Associates provides two products to its clients—tax services and audit services. Last year, total overhead costs of $1,000,000 were allocated based on direct labor hours. A total of 10,000 direct labor hours were required last year for tax clients at a cost of $350,000, and 30,000 direct labor hours were required for audit clients at a cost of $1,200,000. Direct materials used were negligible and are included in overhead costs. Sales revenue totaled $720,000 for tax services and $2,200,000 for audit services.

Management of Menzies and Associates would like to use activity-based costing to allocate overhead rather than use one plantwide rate based on direct labor hours (perhaps the term "officewide" rate would be more appropriate here). The following estimates are for the activities and related cost drivers identified as having the greatest impact on overhead costs.

			Estimated Cost Driver Activity		
Activity	**Cost Driver**	**Estimated Overhead Costs**	**Tax**	**Audit**	**Total**
Scheduling and data entry	Number of clients	$ 400,000	150	100	250
Advertising in journals	Number of ads	100,000	45	5	50
Computer usage	Computer hours	500,000	2,500	2,500	5,000
Total		$1,000,000			

Required:

1. Using the plantwide allocation method, calculate the total cost for each product. (Hint: Product costs for this company include overhead and direct labor.)
2. Calculate the profit for each product using this approach. Also calculate profit as a percent of sales revenue for each product.
1. Using activity-based costing, calculate the predetermined overhead rate for each activity. (Hint: Step 1 through step 3 in the activity-based costing process have already been done for you; this is step 4.)
2. Using activity-based costing, calculate the amount of overhead assigned to each product. (Hint: This is step 5 in the activity-based costing process.)
3. Calculate the profit for each product using this approach. Also calculate profit as a percent of sales revenue for each product.

2. Comment on the results of using activity-based costing compared to plantwide allocation.

Solutions to Review Problem 3.5

1. The plantwide allocation used by Menzies and Associates is based on direct labor hours. The rate is calculated as follows:

   Estimated overhead cost / Estimated activity in allocation base=$1,000,000 / 40,000 hours= $25 per direct labor hour

   Total product costs are as follows:

	Tax	Audit
Direct labor (given)	$ 350,000	$ 1,200,000
Overhead	250,000*	750,000**
Total product cost	$ 600,000	$ 1,950,000

*$250,000 = 10,000 direct labor hours × $25 rate.

**$750,000 = 30,000 direct labor hours per unit × $25 rate.

	Tax	Audit
Direct labor	$ 350,000	$1,200,000
Overhead	250,000	750,000
Total product cost (a)	$ 600,000	$1,950,000
Sales revenue (b)	720,000	2,200,000
Profit (c) = (b) – (a)	120,000	250,000
Profit as percent of revenue (c) ÷ (b)	17% (rounded)	11% (rounded)

2.

1. Predetermined overhead rates are calculated for each activity as follows:

Activity	Cost Driver	(a) Estimated Overhead Costs	(b) Estimated Cost Driver Activity	(a) ÷ (b) Predetermined Overhead Rate
Scheduling and data entry	Number of clients	$ 400,000	250 clients	$ 1,600 per client
Advertising in journals	Inspection ads	100,000	50 ads	2,000 per ad
Computer usage	Computer hours	500,000	5,000 hours	100 per hour
Total		$ 1,000,000		

2. Overhead costs are allocated as follows:

		Tax		Audit	
Activity	Predetermined Overhead Rate	Cost Driver Activity	Overhead Allocated*	Cost Driver Activity	Overhead Allocated*
Scheduling and data entry	$ 1,600 per client	150	$ 240,000	100	$ 160,000
Advertising in journals	2,000 per ad	45	90,000	5	10,000
Computer usage	100 per hour	2,500	250,000	2,500	250,000
Total overhead costs allocated			$ 580,000		$ 420,000
Total companywide overhead costs				$ 1,000,000	

*Overhead allocated equals the predetermined overhead rate times the cost driver activity.

3. The profit and profit as a percent of sales revenue are calculated as follows:

	Tax	Audit
Direct labor	$ 350,000	$ 1,200,000
Overhead	580,000	420,000
Total product cost (d)	$ 930,000	$ 1,620,000
Sales revenue (e)	$ 720,000	$ 2,200,000
Profit (loss) (f) = (e) – (d)	$(210,000)	$ 580,000
Profit (loss) as percent of revenue (f) ÷ (e)	(29)% (rounded)	26% (rounded)

2. Activity-based costing results in a significant increase of overhead costs allocated to the tax product and a decrease of overhead costs allocated to the audit product. The plantwide allocation approach allocates overhead based on direct labor hours, which results in 25 percent of all overhead costs being allocated to tax (= 10,000 direct labor hours in tax ÷ 40,000 total direct labor hours) and 75 percent to audit. However, ABC shows that tax uses 60 percent of scheduling and data entry resources (= 150 tax clients ÷ 250 total clients), 90 percent of advertising resources (= 45 tax ads ÷ 50 total ads), and 50 percent of computer resources (= 2,500 tax computer hours ÷ 5,000 total computer hours). Thus tax is allocated more overhead costs using ABC than using one plantwide rate based on direct labor hours. Note that total profit of $370,000 is the same regardless of the overhead cost allocation approach used. Using the plantwide allocation approach, $370,000 = $120,000 + $250,000. Using the ABC approach, $370,000 = ($210,000) + $580,000.

   Management must use this information to make improvements to the company's operations. It would probably be unwise to eliminate tax services because of the connection they have with audit services (i.e., audit clients may appreciate the convenience of also having tax services available to them). However, management can look for ways to make the process more efficient by focusing on costly activities identified in the ABC analysis.

   Note that when calculating product costs for service organizations, it is difficult, if not impossible, to calculate a product cost *per unit*. Most service organizations do not have an easily defined unit of measure because services vary so much from one customer to another. One alternative is to calculate total profit as a percent of total sales revenue. This allows for a comparison of profitability between different types of services, similar to comparing the profitability for units of product.

2.6 Variations of Activity-Based Costing (ABC)

Learning Objective

1. Expand the use of activity-based costing.

Question: The primary focus of activity-based costing thus far has been on allocating manufacturing overhead costs to products. Although this is important for external reporting purposes, we can expand ABC to include costs beyond manufacturing overhead. Also, we can organize costs in different ways to help managers evaluate performance. What different approaches can be used to organize cost data in a way that helps managers make better decisions?

Answer: Cost data can be organized in a number of ways to help managers make decisions. Four common approaches are addressed in this section:

1. Expanding ABC to include nonmanufacturing costs
2. Allocating service department costs to production departments
3. Using the hierarchy of costs to organize cost information
4. Measuring the costs of controlling and failing to control quality

External Reporting and Internal Decision Making

Question: U.S. Generally Accepted Accounting Principles require the allocation of all manufacturing costs to products for inventory costing purposes. The choice of an allocation method is not critical to this process. Companies that use direct labor hours, machine hours, activity-based costing, or some other method to allocate overhead costs to products are likely to be in compliance with U.S. GAAP. Throughout this chapter, we have illustrated how ABC is used to allocate manufacturing overhead costs. However, organizations often use ABC for purposes that go beyond allocating costs solely for external reporting. How might ABC be used to help companies in areas other than external reporting?

Answer: Commissions paid to sales people for the sale of specific products (often called *selling, general, and administrative*) are included as an operating expense in financial reports prepared for external users as required by U.S. GAAP. However, many organizations may assign commission costs to specific products for internal decision-making purposes. This treatment is not in compliance with U.S. GAAP, but it is perfectly acceptable for internal reporting purposes and may be done using activity-based costing. It is important to understand that managers have ultimate control over which costs should be allocated to products for internal reporting purposes, and this allocation often involves going beyond overhead costs.

Table 2.1 "Examples of Costs Allocated to Products" provides examples of costs that could be allocated to products. It also includes cost categories—product, selling, and general and administrative (G&A)—and indicates whether the cost allocation complies with U.S. GAAP for *external* reporting. As you can see in the far right column, all costs can be allocated to products for *internal* reporting purposes.

Table 2.1 Examples of Costs Allocated to Products

Cost	Cost Category*	OK to Allocate to Products for External Reporting (U.S. GAAP)?	OK to Allocate to Products for Internal Reporting?
Direct materials	Product	Yes	Yes
Direct labor	Product	Yes	Yes
Manufacturing overhead**	Product	Yes	Yes
Sales commissions	Selling	No	Yes
Shipping products to customers	Selling	No	Yes
Product advertising	Selling	No	Yes
Legal costs for product lawsuit	G&A	No	Yes
Processing payroll for production personnel	G&A	No	Yes
Company president's salary	G&A	No	Yes
Costs of implementing ABC	G&A	No	Yes

*See Chapter 1 "How Is Job Costing Used to Track Production Costs?" for information about category definitions.
**Includes all manufacturing costs other than direct labor and direct materials, such as factory related costs for supervisors, building rent, machine maintenance, utilities, and indirect materials. See Chapter 2 "How Is Job Costing Used to Track Production Costs?" for more detail.

Allocating Service Department Costs Using the Direct Method

Question: Most companies have departments that are classified as either service departments or production departments. Service departments within a company. *provide services to other departments within the company and include such functions as accounting, human resources, legal, maintenance, and computer support.* Production departments *are directly involved with producing goods or providing services for customers and include such functions as ordering materials, assembling products, and*

performing quality inspections. Why do companies often allocate a share of service department costs to production departments for internal reporting purposes even though U.S. GAAP generally does not allow it for external reporting?

Answer: Companies allocate service department costs to production departments for several reasons:

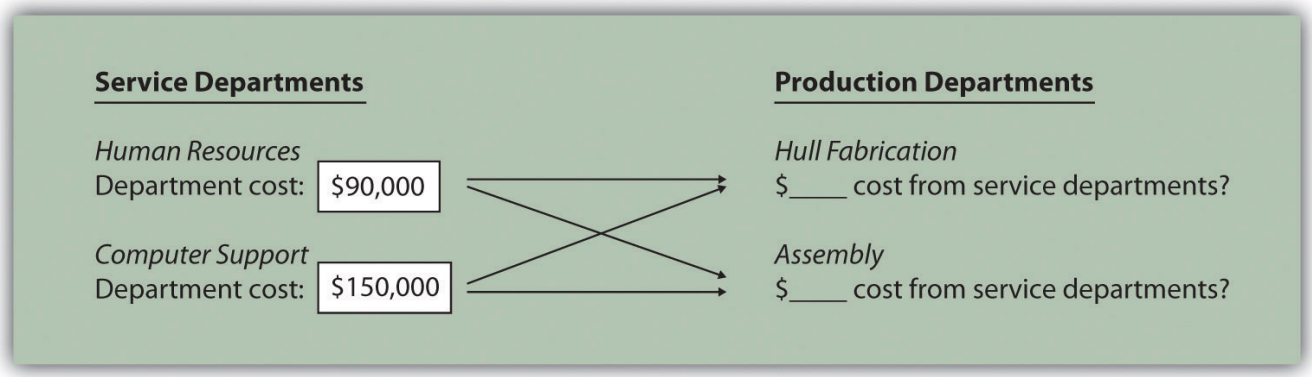
- The services provided by departments within a company are not free, and they should be used as efficiently as possible. Managers of production departments that use these services thus have an incentive to minimize their use.
- To minimize costs, **Hewlett Packard** and other large companies often "outsource" services like building maintenance and legal support (i.e., they have other companies provide the services for them). This creates an incentive for the company's service departments to provide services at a reasonable cost.
- Organizations often include service department costs when determining product costs for internal decision-making purposes, as described earlier (refer to Table 2.1 "Examples of Costs Allocated to Products" for examples).

Question: How do companies allocate service department costs to production departments and how might this be done at SailRite?

Answer: Several methods of allocating service department costs to production departments are available. We introduce the simplest approach—the *direct method*—here (complex approaches are presented in more advanced cost accounting texts). The direct method allocates service department costs directly to production departments but not to other service departments.

For example, assume that SailRite Company has two service departments—Human Resources and Computer Support. Costs associated with Human Resources and Computer Support total $90,000 and $150,000, respectively. Recall that SailRite has two production departments—Hull Fabrication and Assembly. The goal is to allocate service department costs to the two production departments, as shown in Figure 2.10 "Allocating Service Department Costs to Production Departments at SailRite Company: Direct Method (Before Allocations)".

Figure 2.10 Allocating Service Department Costs to Production Departments at SailRite Company: Direct Method (Before Allocations)



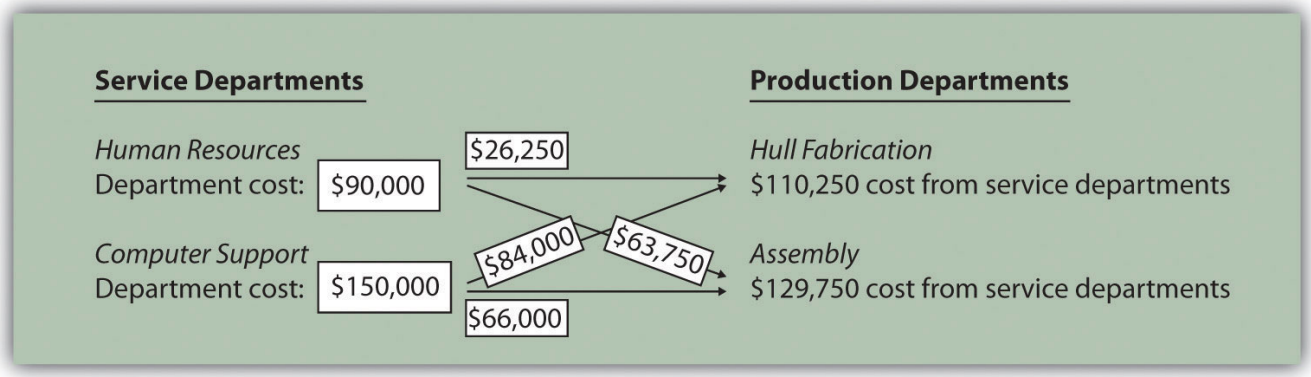
SailRite would like to allocate service department costs using an allocation base that drives these costs. Assume management decides to use the *number of employees* as the allocation base to allocate Human Resources costs, and the *number of computers* as the allocation base to allocate Computer Support costs. Allocation base activity for each production department is as follows:

	Hull Fabrication	Assembly	Total
Number of employees	35	85	120
Number of computers	42	33	75

The allocation rate for human resource services is $750 per employee (= $90,000 department costs ÷ 120 employees). The allocation rate for computer support services is $2,000 per computer (= $150,000 ÷ 75 computers). Thus the Hull Fabrication department receives an allocation of $26,250 in human resource costs (= 35 employees × $750 rate) and $84,000 in computer support costs (= 42 computers × $2,000 rate). The Assembly department receives an allocation of $63,750 in human resource costs (= 85 employees × $750 rate) and $66,000 in computer support costs (= 33 computers × $2,000 rate).

The allocations to production departments are shown in Figure 2.11 “Allocating Service Department Costs to SailRite’s Production Departments: Direct Method (After Allocations)”. If management chooses to allocate service department costs to production departments as described here, there must be some benefit to going through the process. Should these costs be assigned to activity cost pools for the purpose of costing products (activity-based costing)? Should production department managers be evaluated based on the use of these services? Should actual service department usage be compared to budgeted usage for each production department? The answers to these questions vary from one organization to the next. However, one point is certain—the benefits of implementing this allocation system must outweigh the costs!

Figure 2.11 Allocating Service Department Costs to SailRite’s Production Departments: Direct Method (After Allocations)



The Hierarchy of Costs

Question: Some organizations group activities into four cost categories, called the hierarchy of costs, to help managers form cost pools for activity-based costing purposes. The cost hierarchy is a method of costing that groups costs based on whether the activity is at the facility level, product or customer level, batch level, or unit level. Credit for developing the cost hierarchy is generally given to R. Cooper and R. S. Kaplan, “Profit Priorities from Activity-Based Costing,” *Harvard Business Review*, May 1991, 130–35. *groups costs based on whether the activity is at the facility level, product or customer level, batch level, or unit level. What is the difference between each of these categories, and how does this information help managers?*

Answer: Each category within the cost hierarchy is described as follows:

- Facility-level activities of the factory. (or costs) are required to sustain facility operations and include items such as building rent and management of the factory. These costs are generally changed over long time horizons and are incurred regardless of how many product-, batch-, or unit-level activities take place.
- Product-level activities (or customer-level activities) are required to develop, produce, and sell specific types of products. This category includes items such as product development and product advertising. These costs can be changed over a shorter time horizon than facility-level activities and are incurred regardless of the number of batches run or units produced.
- Batch-level activities are required to produce batches (or groups) of products and include items such as machine setups and quality inspections. These costs can be changed over a shorter time horizon than product- and facility-level activities and are driven by the number of batches run rather than the number of units produced. For example, a batch can consist of producing 5 units or 10,000 units. The costs in this category are driven by the number of batches, not the number of units in each batch.
- Unit-level activities are required to produce individual units of product and include items such as energy to run machines, direct labor, and direct materials. These costs can be changed over a short time horizon based on how many units management chooses to produce.

The cost hierarchy serves as a framework for managers to establish cost pools and determine what drives the change in costs for each cost pool. It also provides a sense of how quickly (or slowly) costs change based on decisions made by management. Examples of activities often identified by companies using activity-based costing, and how these activities fit in the cost hierarchy, appear in Table 2.2 “Cost Hierarchy Examples”.

Table 2.2 Cost Hierarchy Examples

Cost Hierarchy Category	Activity/Cost
Facility-level	Plant depreciation
	Building rent
	Management of facility
Product/customer-level	New product development
	Product engineering
	Product marketing and advertising
	Maintaining customer records
Batch-level	Machine setups
	Processing purchase orders
	Batch quality inspections
Unit-level	Energy to run production machines
	Direct labor
	Direct materials

Measuring the Costs of Controlling and Improving Quality

Question: The hierarchy of costs is not the only approach organizations use to group costs. Managers are also concerned about measuring the costs associated with quality. Quality-related costs can be organized into four categories. The first two categories—prevention and appraisal—are costs incurred to control and improve quality. The final two categories—internal failure and external failure—are costs incurred as a result of failing to control and improve quality. What is the difference between these cost categories, and how does this information help managers improve quality?

- Prevention costs are costs incurred to prevent defects in products and services. Examples include designing production processes that minimize defects, providing quality training to employees, and inspecting raw materials before they are placed in production.
- Appraisal costs (often called *detection costs*) are costs incurred to detect defective products before they are delivered to customers. The cost of finished goods inspections falls in this category.
- Internal failure costs are the costs incurred as a result of detecting defective products before they are delivered to customers. Examples include the reworking of defective products, the scrapping of defective products, and the machine downtime resulting from process problems that cause defects.
- External failure costs are the costs incurred as a result of delivering defective products to customers. Examples include warranty repairs, warranty replacements, and product liability resulting from unsafe defective products.

Companies that measure these costs of quality typically calculate the costs in each category as a percent of total revenue. The goal is to steadily shift costs toward the prevention and appraisal categories and away from the internal and external failure categories. As organizations concentrate more on preventing defects, total quality costs as a percent of revenue tends to decline and product quality improves. Table 2.3 “Summary of Quality Costs” provides a summary of the four classifications of quality-related costs.

Table 2.3 Summary of Quality Costs

Quality Cost Category	Description
Prevention cost	Cost of activities that prevent defects in products, such as quality training and raw materials inspections
Appraisal cost	Cost of activities that detect defective products before they are delivered to customers, such as finished goods inspections and field inspections
Internal failure cost	Cost of activities that result from detecting defective products before they are delivered to customers, such as rework and scrap
External failure cost	Cost of activities that result from delivering defective products to customers, such as warranty repairs and warranty replacements

Key Takeaways

- Activity-based costing is not simply used to allocate manufacturing overhead costs to products for external reporting purposes; it is also often used to allocate selling, general, and administrative costs to products for internal decision-making purposes. A number of methods can be used to assist in the cost allocation process. For example, the cost of service departments can be allocated to production departments using the direct method. Also the cost hierarchy can be used to help establish cost pools and identify cost drivers used to allocate costs. Organizations are also concerned with measuring and reducing the cost of quality by categorizing quality costs into four categories—prevention, appraisal, internal failure, and external failure.

Exercises

Fill in the following table to identify if the cost item can be included in the cost of products for external reporting purposes and/or internal reporting purposes. The first item is completed for you.

Cost	OK to Allocate to Products for External Reporting (U.S. GAAP)?	OK to Allocate to Products for Internal Reporting?
Direct materials	Yes	Yes
Salaries of sales people		
Indirect materials used in production		
Rent for headquarters building		
Product promotions		
Direct labor		
Legal costs for patent applications		
Processing payroll for human resource personnel		
Depreciation of factory equipment		
Marketing vice president’s salary		
Depreciation of administrative department equipment		

Solution

Cost	OK to Allocate to Products for External Reporting (U.S. GAAP)?	OK to Allocate to Products for Internal Reporting?
Direct materials	Yes	Yes
Salaries of sales people	No	Yes
Indirect materials used in production	Yes	Yes
Rent for headquarters building	No	Yes
Product promotions	No	Yes
Direct labor	Yes	Yes
Legal costs for patent applications	No	Yes
Processing payroll for human resource personnel	No	Yes
Depreciation of factory equipment	Yes	Yes
Marketing vice president's salary	No	Yes

End-of-Chapter Exercises

Questions

1. Why do managers allocate overhead costs to products?
2. Describe the three methods of allocating overhead costs.
3. What is a cost pool, and how does it relate to allocating overhead to products?
4. What is the difference between an activity and a cost driver?
5. How do cost flows using activity-based costing differ from cost flows using one plantwide rate?
6. Describe the five steps required to implement activity-based costing.
7. What are some advantages of using an activity-based costing system?
8. What are some disadvantages of using an activity-based costing system?
9. Explain how to record the application of overhead to products using activity-based costing.
10. Describe the three steps required to implement activity-based management.
11. How does activity-based management differ from activity-based costing?
12. What is the difference between a value-added activity and a non-value-added activity? Provide two examples of non-value-added activities for each of the following:
    1. Fast-food restaurant
    2. Clothing store
    3. College bookstore
13. What selling costs and general and administrative costs might be allocated to products using activity-based costing? Why do some managers prefer allocating these costs to products?
14. What are service departments? Why do some managers allocate service department costs to production departments?
15. Describe the four categories included in the hierarchy of costs.
16. What is the difference between a facility-level cost and a unit-level cost?

17. How does the hierarchy of costs help managers allocate overhead costs?
18. Describe the four categories related to the costs of quality. How might the allocation of quality costs to these four categories help managers?

Brief Exercises

23. **Product Costing at SailRite.** Refer to the dialogue presented at the beginning of the chapter and the follow-up dialogue before Figure 2.7 “Activity-Based Costing Versus Plantwide Costing at SailRite Company”.

    Required:

    1. In the opening dialogue, why was the owner concerned about the product costs for each of the company’s boats?
    2. In the follow-up dialogue before Figure 2.7 “Activity-Based Costing Versus Plantwide Costing at SailRite Company”, what did the company’s accountant discover about the profitability of each boat using activity-based costing? (Refer to Figure 2.7 “Activity-Based Costing Versus Plantwide Costing at SailRite Company” as you prepare your answer.)

24. **Calculating Plantwide Predetermined Overhead Rate.** Manufacturing overhead costs totaling $5,000,000 are expected for this coming year. The company also expects to use 50,000 direct labor hours and 20,000 machine hours.

    Required:

    1. Calculate the plantwide predetermined overhead rate using direct labor hours as the base. Provide a one-sentence description of how the rate will be used to allocate overhead costs to products.
    2. Calculate the plantwide predetermined overhead rate using machine hours as the base. Provide a one-sentence description of how the rate will be used to allocate overhead costs to products.

25. **Calculating Department Predetermined Overhead Rates.** Manufacturing overhead costs totaling $1,000,000 are expected for this coming year—$400,000 in the Assembly department and $600,000 in the Finishing department. The Assembly department expects to use 4,000 machine hours, and the Finishing department expects to use 30,000 direct labor hours.

    Required:

    1. Assume this company uses the department approach for allocating overhead costs. Calculate the predetermined overhead rate for each department, and explain how these rates will be used to allocate overhead costs to products.
    2. Why do different departments use different allocation bases (e.g., direct labor hours or machine hours)?

26. **Identifying Cost Drivers.** Ehrman Company identified the activities listed in the following as being most important (step 1 and step 2 of activity-based costing), and it formed cost pools for each activity.

    1. Purchasing raw materials
    2. Inspecting raw materials
    3. Storing raw materials
    4. Maintaining production equipment
    5. Setting up machines to produce batches of product
    6. Testing finished products

    Required:

    Perform step 3 of the activity-based costing process by identifying a possible cost driver for each activity.

27. **Identifying Cost Drivers: Service Company.** McHale Architects, Inc., designs, engineers, and supervises the construction of custom homes. The following activities were identified as being most important (step 1 and step 2 of activity-based costing), and cost pools were formed for each activity.

    1. Meeting with customers
    2. Coordinating inspections with the building department
    3. Consulting with contractors
    4. Maintaining office equipment
    5. Processing customer billings (invoices)

    Required:

Perform step 3 of the activity-based costing process by identifying a possible cost driver for each activity.

28. **Value-Added and Non-Value-Added Activities.** Novak Corporation manufactures custom-made kayaks and accessories. The company performs the following activities.

    1. Storing parts and materials
    2. Queuing orders before beginning production
    3. Assembling kayaks
    4. Waiting for materials to arrive to continue production
    5. Painting kayaks
    6. Designing kayaks to maximize comfort
    7. Scrapping defective materials

    Required:

    Label each activity as value-added or non-value-added.

29. **Allocation Base for Service Departments.** Valencia Company has 15 production departments and produces hundreds of products. Service department costs are allocated to production departments using the direct method. Five service departments provide the following services to the production departments.

    1. The Computer Technology department provides computer support.
    2. The Personnel department posts job openings, hires employees, and coordinates employee benefits.
    3. The Accounting department processes accounting data, provides financial reports, and performs general accounting duties.
    4. The Maintenance department maintains buildings and equipment.
    5. The Legal department provides legal services.

    Required:

    1. For each service department, provide a possible allocation base. Explain why the base you chose for each service department is reasonable.
    2. Does the direct method provide for allocations from one service department to another? Explain.

Exercises:

30. **Plantwide Versus Department Allocations of Overhead.** San Juan Company expects to incur $600,000 in overhead costs this coming year—$100,000 in the Cutting department, $300,000 in the Assembly department, and $200,000 in the Finishing department. Direct labor hours worked in all departments are expected to total 40,000 (used for the plantwide rate). The Cutting department expects to use 20,000 machine hours, the Assembly department expects to use 25,000 direct labor hours, and the Finishing department expects to incur $100,000 in direct labor costs (this information will be used for department rates).

    Required:

    1. Assume San Juan Company uses the plantwide approach for allocating overhead costs and direct labor hours as the allocation base. Calculate the predetermined overhead rate, and explain how this rate will be used to allocate overhead costs.
    2. Assume San Juan Company uses the department approach for allocating overhead costs. Calculate the predetermined overhead rate for each department, and explain how these rates will be used to allocate overhead costs.

31. **Computing Product Costs Using Activity-Based Costing.** Stillwater Company identified the following activities, estimated costs for each activity, and identified cost drivers for each activity for this coming year. (These are the first three steps of activity-based costing.)

Activity	Cost Driver	Estimated Annual Overhead Costs	Estimated Annual Cost Driver Activity
Ordering parts	Number of purchase requisitions	$ 400,000	5,000 purchase requisitions
Tracking inventory of parts	Number of parts purchased	560,000	80,000 parts purchased
Running machines	Machine hours	350,000	7,000 machine hours
Inspecting finished products	Inspections hours	200,000	1,000 inspection hours
Total		$1,510,000	

The company produces three products, Z1, Z2, and Z3. Information about these products for the month of January follows:

	Z1	Z2	Z3
Direct materials cost per unit	$100	$ 75	$200
Direct labor cost per unit	35	25	70
Overhead cost per unit	?	?	?
Product cost per unit	$?	$?	$?
Units produced	250 units	500 units	700 units

Actual cost driver activity levels for the month of January are as follows:

	Z1	Z2	Z3
Number of purchase requisitions	50	70	100
Number of parts purchased	4,000	3,300	3,600
Machine hours	330	240	310
Inspections hours	10	50	30

Required:

1. Using the estimates for the year, compute the predetermined overhead rate for each activity (this is step 4 of the activity-based costing process).
2. Using the activity rates calculated in requirement **a** and the actual cost driver activity levels shown for January, allocate overhead to the three products for the month of January (this is step 5 of the activity-based costing process).
3. For each product, calculate the overhead cost per unit for the month of January. Round results to the nearest cent.
4. For each product, calculate the product cost per unit for the month of January. Round results to the nearest cent.

32. **Journal Entry to Apply Overhead.** Caspian Company is deciding which of three approaches it should use to apply overhead to products. Information for each approach is provided in the following.

- **One plantwide rate.** The predetermined overhead rate is 150 percent of direct labor cost.
- **Department rates.** The Machining department uses a rate of $55 per machine hour, and the Assembly department uses a rate of $35 per direct labor hour.

- **Activity-based costing rates.** Three activities were identified and rates were calculated for each activity.

Purchase requisitions	$15 per requisition processed
Production setup	$50 per setup
Quality control	$70 per inspection

Required:

1. Direct labor costs for the year totaled $80,000. Using the plantwide method, calculate the amount of overhead applied to products and make the appropriate journal entry.
2. During the year, the Machining department used 1,000 machine hours, and the Assembly department used 1,200 direct labor hours. Using the department method, calculate the amount of overhead applied to products and make the appropriate journal entry.
3. During the year, 900 purchase requisitions were processed, 1,300 production setups were performed, and 400 products were inspected. Using the activity-based costing approach, calculate the amount of overhead applied to products, and make the appropriate journal entry.

33. **Allocating Service Department Costs.** Crandall Company has two production departments (P1 and P2) and three service departments (S1, S2, and S3). Service department costs are allocated to production departments using the direct method. The $400,000 costs of department S1 are allocated based on the number of employees in each production department. The $600,000 costs of department S2 are allocated based on the square footage of space occupied by each production department. The $300,000 costs of department S3 are allocated based on hours of computer support used by each production department. Information for each production department follows.

Production Department	Number of Employees	Square Feet Occupied	Computer Support Hours
P1	20	3,000	10,000
P2	80	6,000	15,000
Total	100	9,000	25,000

Required:

1. Calculate the service department costs allocated to each production department.
2. In general, do U.S. Generally Accepted Accounting Principles allow for the allocation of service department costs to production departments for the purpose of valuing inventory?

34. **Cost Hierarchy.** The following activities and costs are for Tanaka Company.

1. Direct materials used by workers to assemble products
2. Purchase requisitions issued for raw materials
3. Machines set up to produce groups of products
4. New product research and development
5. Maintenance performed on the factory building
6. Direct labor assembling products
7. Product designed for a specific customer
8. Factory building rent

Required:

1. Determine whether each item is a facility-level, product- or customer-level, batch-level, or unit-level cost.
2. Provide one example of an appropriate allocation base for each item. (For instance, an appropriate allocation base for item **1** is the quantity of direct materials used.)

Problems

35. Activity-Based Costing Versus Traditional Approach. Techno Company produces a regular computer monitor that sells for $175 and a flat panel computer monitor that sells for $300. Last year, total overhead costs of $3,675,000 were allocated based on direct labor hours. A total of 63,000 direct labor hours were required last year to build 36,000 regular monitors (1.75 hours per unit), and 42,000 direct labor hours were required to build 12,000 flat panel monitors (3.50 hours per unit). Total direct labor and direct materials costs for last year were as follows:

	Regular Monitor	Flat Panel Monitor
Direct materials	$1,908,000	$ 900,000
Direct labor	$1,728,000	$1,200,000

The management of Techno Company would like to use activity-based costing to allocate overhead rather than one plantwide rate based on direct labor hours. The following estimates are for the activities and related cost drivers identified as having the greatest impact on overhead costs.

			Estimated Cost Driver Activity		
Activity	Cost Driver	Estimated Overhead Costs	Regular	Flat Panel	Total
Purchase orders	Number of purchase orders	$1,200,000	400	600	1,000
Production setups	Number of setups	1,125,000	120	30	150
Quality inspections	Inspection hours	750,000	3,600	8,400	12,000
Packaging and shipping	Number of units shipped	$ 600,000	36,000	12,000	48,000
Total		$3,675,000			

Required:

- Calculate the direct materials cost per unit and direct labor cost per unit for each product.
- Using the plantwide allocation method, calculate the product cost per unit for the regular and flat panel products. Round results to the nearest cent
- Using the activity-based costing allocation method, calculate the predetermined overhead rate for each activity. (Hint: Step 1 through step 3 in the activity-based costing process have already been done for you; this is step 4.
- Using the activity-based costing allocation method, allocate overhead to each product. (Hint: This is step 5 in the activity-based costing process.) Determine the overhead cost per unit. Round results to the nearest cent
- Using the plantwide allocation method, calculate the predetermined overhead rate and determine the overhead cost per unit allocated to the regular and flat panel products.
  1. What is the product cost per unit for the regular and flat panel products?
  2. Calculate the per unit profit for each product using the plantwide approach and the activity-based costing approach.

3. How much did the profit per unit change for each product when moving from the plantwide approach to the activity-based costing approach? What caused this change?

36. Activity-Based Costing Versus Traditional Approach, Activity-Based Management. Quality Furniture, Inc., produces a wood desk that sells for $500 and a wood table that sells for $900. Last year, total overhead costs of $6,000,000 were allocated based on direct labor costs. Direct labor costs totaled $2,000,000 last year, and Quality Furniture produced 15,000 desks and 5,000 tables. Total direct labor and direct materials costs by product for last year were as follows:

	Desk	**Table**
Direct materials	$1,575,000	$950,000
Direct labor	$1,200,000	$800,000

The management of Quality Furniture would like to use activity-based costing to allocate overhead rather than one plantwide rate based on direct labor costs. The following estimates are for the activities and related cost drivers identified as having the greatest impact on overhead costs.

			Estimated Cost Driver Activity		
Activity	**Cost Driver**	**Estimated Overhead Costs**	**Desk**	**Table**	**Total**
Purchase orders	Number of purchase orders	$ 800,000	900	100	1,000
Machine setups	Number of setups	1,600,000	240	260	500
Machine maintenance	Machine hours	2,400,000	42,000	18,000	60,000
Quality inspections	Number of inspections	1,200,000	15,000	5,000	20,000
Total		$6,000,000			

Required:

Calculate the direct materials cost per unit and direct labor cost per unit for each product.

- Using the plantwide allocation method, calculate the predetermined overhead rate and determine the overhead cost per unit allocated to the desk and table products.
- Using the plantwide allocation method, calculate the product cost per unit for the desk and table products. Round results to the nearest cent.
- Using the activity-based costing allocation method, calculate the predetermined overhead rate for each activity. (Hint: Step 1 through step 3 in the activity-based costing process have already been done for you; this is step 4.)
- Using the activity-based costing allocation method, allocate overhead to each product. (Hint: This is step 5 in the activity-based costing process.) Determine the overhead cost per unit. Round results to the nearest cent.
- What is the product cost per unit for the desk and table products?

1. Calculate the per unit profit for each product using the plantwide approach and the activity-based costing approach. How much did the per unit profit change when moving from one approach to the other?
2. Refer to the estimated cost driver activity provided. Calculate the percent of each activity consumed by each product (e.g., the desk product issued 900 of the 1,000 purchase orders issued in total and therefore consumes 90 percent of this activity). These percentages represent the amount of overhead costs allocated to each product using activity-based costing. Using the plantwide approach, 60 percent of all overhead costs are allocated to the desk and 40 percent to the table. Compare the activity-based costing percentages to the percentage of overhead allocated to each product using the plantwide approach. Use this information to explain what caused the shift in overhead costs to the desk product using activity-based costing.

37. Calculating and Recording Overhead Applied. Assume Quality Furniture, Inc., discussed in Problem 36, uses activity-based costing.

Required:

1. Using the data presented at the beginning of Problem 36, calculate the predetermined overhead rate for each activity.
2. The following activity associated with the desk product was reported for the month of March.

Number of purchase orders processed	40
Number of machine setups	22
Number of machine hours	2,425
Number of quality inspections	890

   Using the predetermined overhead rates calculated in requirement **a**, determine the amount of overhead applied to the desk product for the month of March.

3. Make the journal entry to record overhead applied to the desk product for the month of March.
4. Assume you are the manager of the desk product line and would like to reduce the amount of overhead costs being applied to your products. Which activity would you focus on first? Why?

38. Computing Product Costs Using Activity-Based Costing, Service Company. Roseville Community Bank uses activity-based costing to assign overhead costs to two different loan products—student loans and auto loans. The bank identified the following activities, estimated costs for each activity, and identified cost drivers for each activity for this coming year. (These are the first three steps of activity-based costing.)

Activity	Cost Driver	Estimated Annual Overhead Costs	Estimated Annual Cost Driver Activity
Meeting with customers	Hours of meeting time	$ 400,000	20,000 hours
Reviewing applications	Number of applications reviewed	120,000	8,000 applications
Running credit reports	Number of credit reports run	420,000	6,000 credit reports
Total		$ 940,000	

The following information for the two loan products offered by Roseville Community Bank is for the month of July:

	Student Loans	Auto Loans
Direct labor cost per loan	$250	$150
Overhead cost per loan	?	?
Total cost per loan	$?	$?
Loans approved	100 loans	300 loans

Actual cost driver activity levels for the month of July are as follows:

	Student Loans	Auto Loans
Hours of meeting time	400	350
Number of applications reviewed	175	700
Number of credit reports run	150	550

Required:

1. Using the estimates for the year, compute the predetermined overhead rate for each activity (this is step 4 of the activity-based costing process).
2. Using the activity rates calculated in requirement **a** and the actual cost driver activity levels shown for July, allocate overhead to the two products for the month of July.
3. For each loan product, calculate the overhead cost per loan approved for the month of July. Round results to the nearest cent.
4. For each loan product, calculate the total cost per loan approved for the month of July. Round results to the nearest cent.
5. Assume you are the manager of the auto loans product line and would like to reduce the amount of overhead costs being applied to your products. Which activity would you focus on first? Why?

39. Activity-Based Costing Versus Traditional Approach: Service Company, Activity-Based Management. Hodges and Associates is a small firm that provides structural engineering services for its clients. The company performs structural engineering services for both residential and commercial buildings. Last year, total overhead costs of $330,000 were allocated based on direct labor costs. A total of $300,000 in direct labor costs were incurred in the following areas: $120,000 in the residential segment and $180,000 in the commercial segment. Direct materials used were negligible and are included in overhead costs. Sales revenue totaled $450,000 for residential services and $330,000 for commercial services.

The management of Hodges and Associates would like to use activity-based costing to allocate overhead rather than a plantwide rate based on direct labor costs. The following estimates are for the activities and related cost drivers identified as having the greatest impact on overhead costs.

			Estimated Cost Driver Activity		
Activity	Cost Driver	Estimated Overhead Costs	Residential	Commercial	Total
Scheduling and data entry	Direct labor hours	$100,000	4,500	3,500	8,000
Computer maintenance	Number of computer hours	70,000	8,000	12,000	20,000
Processing permit applications	Number of applications	160,000	400	400	800
Total		$330,000			

Required:

1. Using the plantwide allocation method, calculate the total cost for each product. (Hint: Product costs for this company include overhead and direct labor.)
2. Using the plantwide approach, calculate the profit for each product. Also calculate profit as a percent of sales revenue for each product (round to the nearest tenth of a percent).

2. What caused the shift of overhead costs to the residential product using activity-based costing? How might management use this information to make improvements within the company?

40. Calculating and Recording Overhead Applied: Service Company. Assume Hodges and Associates, discussed in Problem 44, uses activity-based costing.

Required:

1. Using the data presented at the beginning of Problem 39, calculate the predetermined overhead rate for each activity. Round results to the nearest cent.
2. The following activity associated with the commercial product was reported for the month of September.

Number of direct labor hours	350
Number of computer hours	960
Number of applications	50

   Using the predetermined overhead rates calculated in requirement **a**, determine the amount of overhead applied to the commercial product for the month of September.

3. Make the journal entry to record overhead applied to the commercial product for the month of September.
4. Assume you are manager of the commercial product line and would like to reduce the amount of overhead costs being applied to your products. Which activity would you focus on first? Why?

41. **Allocating Service Department Costs.** Szabo Industries has two production departments (Finishing and Painting) and three service departments (Maintenance, Computer Support, and Personnel). Service department costs are allocated to production departments using the direct method. Maintenance allocates costs totaling $3,000,000 based on the square footage of space occupied by each production department. Computer Support allocates costs totaling $4,000,000 based on hours of computer support used by each production department. Personnel allocates costs totaling $2,500,000 based on number of employees in each production department. Information for each production department follows.

Production Department	Square Feet Occupied	Computer Support Hours	Number of Employees
Finishing	10,000	21,000	70
Painting	30,000	39,000	180
Total	40,000	60,000	250

Required:

1. Calculate the service department costs allocated to each production department.
2. Why do companies allocate service department costs to production departments?

42. **Selecting an Allocation Base for Service Costs.** Winstead, Inc., is looking for an appropriate allocation base to allocate personnel costs totaling $5,000,000. Service department costs are allocated to three production departments: Assembly, Sanding, and Finishing. Management is considering two allocation bases.

Possible Allocation Base	Assembly	Sanding	Finishing
Number of employees	30	20	50
Square feet of space occupied	25,000	15,000	10,000

Required:

1. Calculate the amount of personnel department costs allocated to production departments using each allocation base.
2. Which allocation base do you think is most reasonable? Why?

One Step Further: Skill-Building Cases

43. Overhead Allocation. Do you agree with the following statement? Explain your answer.

Total estimated overhead costs will vary depending on whether we use the plantwide method, department method, or activity-based costing to allocate overhead.

44. Cost Allocation Issues. Assume you rent a house with two friends. The total monthly rent is $1,500. Your bedroom is the smallest of the three bedrooms, and each of the others has a bathroom attached. You and your friends are trying to decide how to divide up the rent. Two possibilities are being discussed.

1. Share the cost equally among the three of you.
2. Determine rent based on square feet occupied (the attached bathrooms would be part of the square footage measurement).

Required:

1. Which approach do you think is most fair for all involved? Why?
2. Which approach is easiest? Why?
3. Suggest another approach to dividing up the cost of rent.

45. Changing Plantwide Allocation Rate at SailRite. Recall from the chapter discussion that SailRite uses one plantwide rate based on direct labor hours to allocate manufacturing overhead costs to the company's two sailboat products—Basic and Deluxe. Management was concerned about the inaccuracy of overhead costs being assigned to each product and decided to calculate product costs using activity-based costing. Product cost and profit results are summarized in the following for the plantwide allocation approach (based on direct labor hours) and activity-based costing approach. This information was presented in the chapter in Figure 3.7 "Activity-Based Costing Versus Plantwide Costing at SailRite Company".

Plantwide Allocation
(direct labor hours as allocation base)

	Basic Sailboat	Deluxe Sailboat
Direct materials	$ 1,000	$ 1,300
Direct labor	600	750
Overhead*	1,280	1,600
Total product cost per unit (a)	$ 2,880	$ 3,650
Sales price (b)	$ 3,200	$ 4,500
Profit = (b) – (a)	**$ 320**	**$ 850**

Activity-Based Costing
(several different allocation bases)

	Basic Sailboat	Deluxe Sailboat
Direct materials	$ 1,000	$ 1,300
Direct labor	600	750
Overhead**	1,004	2,980
Total product cost per unit (c)	$ 2,604	$ 5,030
Sales price (d)	$ 3,200	$ 4,500
Profit (loss) = (d) – (c)	**$ 596**	**$ (530)**

*Overhead taken from Figure 3.2 "SailRite Company Product Costs Using One Plantwide Rate Based on Direct Labor Hours".

**Overhead taken from Figure 3.5 "Allocation of Overhead Costs to Products at SailRite Company".

Although management of SailRite prefers the accuracy of activity-based costing, the cost of maintaining such an accounting system for the long term is prohibitive. John, the accountant, has proposed going back to using one plantwide rate, but he would like to allocate overhead costs using machine hours rather than direct labor hours.

Recall that overhead costs totaled $8,000,000. A total of 90,000 machine hours were used for the period: 50,000 for Basic sailboats and 40,000 for Deluxe sailboats. The company produced 5,000 units of the Basic model and 1,000 units of the Deluxe model. Thus the Basic model uses 10 machine hours per unit (= 50,000 machine hours ÷ 5,000 units) and the Deluxe model uses 40 machine hours per unit (= 40,000 machine hours ÷ 1,000 units).

Required:

1. Calculate the predetermined overhead rate using machine hours as the allocation base, and determine the overhead cost per unit allocated to the Basic and Deluxe sailboats. Round results to the nearest cent.
2. For each product, calculate the unit product cost and profit using the same format presented previously. Round results to the nearest cent.
3. Compare your results in requirement **b** to the results using direct labor hours as the allocation base and activity-based costing.

4. Provide at least two reasons why management might prefer machine hours as the overhead allocation base rather than direct labor hours or activity-based costing.

46. Service Department Cost Allocation. Biotech, Inc., recently began providing cafeteria services to its employees. Because revenue from the sale of food at the cafeteria does not fully cover cafeteria expenses, Biotech must pay for the shortfall. These costs are allocated to production departments based on employee usage. That is, the company tracks which employees use the cafeteria and allocates costs to production departments accordingly.

Sarah Kolster, manager of the quality testing department, is not happy with receiving cafeteria cost allocations. She is evaluated based on meeting a cost budget established at the beginning of the fiscal year, which does not include the cafeteria allocation, and she clearly has an incentive to minimize costs.

When Sarah met with the company's accountant, Dan, regarding this issue, she said, "Dan, I like the idea of providing cafeteria service to our employees, but the costs allocated to my department are killing my budget. Last month alone, I was allocated $3,000 in costs related to the new cafeteria. I have no choice but to require my employees to go elsewhere for food."

Dan responded, "I understand your concern, Sarah. Management's intent was to provide a service to our employees that would improve productivity and reward employees for their hard work. If you tell your employees to stop using the cafeteria, more costs will be allocated to other departments, and the other departments might also stop using the cafeteria. My belief is that the cafeteria will be self-sufficient within a year if more employees are encouraged to use it. This translates into no more cost allocations to departments within a year. I'll discuss your concerns with top management later this week."

Required:

1. Why does Biotech, Inc., allocate cafeteria costs to departments?
2. What recommendations would you make to top management regarding the way cafeteria costs are allocated to departments?

Comprehensive Case

47. Activity-Based Costing, Journal Entries, T-Accounts, and Preparing an Income Statement. This problem is an adaptation of the example presented at the end of Chapter 1 "How Is Job Costing Used to Track Production Costs?" for Custom Furniture Company. The only difference is that this problem uses activity-based costing to allocate overhead costs rather than one plantwide rate. Recall that inventory beginning balances were $25,000 for raw materials inventory, $35,000 for work-in-process inventory, and $90,000 for finished goods inventory.

Management of Custom Furniture Company would like to use activity-based costing to allocate overhead costs totaling $1,140,000 rather than one plantwide rate based on direct labor hours. The following estimates are for the activities and related cost drivers identified as having the greatest impact on overhead costs.

Activity	Cost Driver	Estimated Annual Overhead Costs	Estimated Annual Cost Driver Activity
Purchase orders	Number of purchase orders	$ 260,000	800 orders
Machine setups	Number of setups	360,000	1,000 setups
Machine maintenance	Machine hours	140,000	20,000 machine hours
Misc. production activities	Direct labor hours	380,000	38,000 direct labor hours
Total		$1,140,000	

Transactions for the month of May are shown as follows:

1. Raw materials were purchased during the month for $15,000 on account.

2. Raw materials totaling $21,000 were placed in production: $3,000 for indirect materials (glue, screws, nails, and the like) and $18,000 for direct materials (wood planks, hardware, etc.).
3. Timesheets from the direct labor workforce show total costs of $40,000, to be paid the next month.
4. Production supervisors and other indirect labor working in the factory are owed wages totaling $27,000.
5. The following costs were incurred related to the factory: building depreciation of $29,000, insurance of $11,000 (originally recorded as prepaid insurance), utilities of $4,000 (to be paid the next month), and maintenance costs of $22,000 (paid immediately).
6. Manufacturing overhead is applied to products based on the following cost driver activity for the month:

Number of purchase orders	75
Number of machine setups	120
Machine hours	1,850
Direct labor hours	3,240

7. The following selling costs were incurred: wages of $5,000 (to be paid the next month), building rent of $3,000 (originally recorded as prepaid rent), and advertising totaling $10,000 (to be paid the next month).
8. The following general and administrative (G&A) costs were incurred: wages of $13,000 (to be paid the next month), equipment depreciation of $6,000, and building rent of $7,000 (originally recorded as prepaid rent).
9. Completed goods costing $155,000 were transferred out of work-in-process inventory.
10. Sold goods for $100,000 on account and $90,000 cash.
11. The goods sold in the previous transaction had a cost of $129,000.
12. Closed the manufacturing overhead account to cost of goods sold.

Required:

1. Calculate the predetermined overhead rate for each activity.
2. Prepare T-accounts for the following accounts: cash, accounts receivable, prepaid insurance, prepaid rent, raw materials inventory, work-in-process inventory, finished goods inventory, accumulated depreciation (building and equipment), accounts payable, wages payable, manufacturing overhead, sales, cost of goods sold, advertising expense (selling), rent expense (selling), wages expense (selling), depreciation expense (G&A), rent expense (G&A), and wages expense (G&A). Enter beginning balances in T-accounts for the inventory accounts (raw materials, work in process, and finished goods).
3. Prepare a journal entry for each of the transactions **1** through **11**, and post each entry to the T-accounts set up in requirement **b**. Label each entry in the T-accounts by transaction number, and total each T-account.
4. Is overhead underapplied or overapplied for the month of May? Based on the balance in the manufacturing overhead T-account prepared in requirement **c**, prepare a journal entry for transaction **12**.
5. Prepare an income statement for the month of May. (Hint: Be sure to include the adjustment made to cost of goods sold in requirement **d**.)

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Chapter 3 How Is Process Costing Used to Track Production Costs?

Ann Watkins owns and operates a company that mass produces wood desks used in classrooms throughout the world. Ann's company, Desk Products, Inc., maintains an advantage over its competitors by producing one desk in large quantities—4,000 to 8,000 desks per month—using a universally accepted design. This enables the company to buy materials in bulk, often leading to volume price discounts from suppliers. Because the exact same desk is produced for all customers, Desk Products purchases precut wood materials from suppliers. As a result, Desk Products can limit the production process to two processing departments—Assembly and Finishing. The Assembly department requisitions precut materials and hardware from the raw materials storeroom, assembles each desk, and moves the assembled desks to the Finishing department. The Finishing department sands and paints each desk and moves completed desks to the finished goods warehouse.

A new competitor recently began producing a similar desk, and Ann is concerned about whether Desk Products' production costs are reasonable. In particular, Ann is concerned about the costs in the Assembly department since this department is responsible for the majority of the company's production costs. Ann talks with the accountant at Desk Products, John Fuller, to investigate.

Ann:
John, as you know, we have a new competitor that is aggressively going after our customers. It looks as if we will have to focus on keeping costs low to compete. The Assembly department is my biggest concern, and it would help if I knew the cost of each desk that goes through this department.

John:
Although we don't track production costs for each desk individually, we do use a process costing system that assigns costs to each batch of desks produced. This system enables us to calculate a cost per unit as the products move through the Assembly department.

Ann:
Excellent! Can you get me the cost information for the Assembly department for last month?

John:
Sure, I'll put together a production cost report for you by the end of the week.

We return to Desk Products, Inc., throughout the chapter to explain how process costing systems work.

3.1 Comparison of Job Costing with Process Costing

Learning Objectives

1. Compare and contrast job costing and process costing.

Question: A process costing system *is used by companies that produce similar or identical units of product in batches employing a consistent process. Examples of companies that use process costing include Chevron Corporation (petroleum products), the Wrigley Company (chewing gum), and Pittsburgh Paints (paint). A* job costing system *is used by companies that produce unique products or jobs. Examples of companies that use job costing systems include Boeing (airplanes), Lockheed Martin (advanced technology systems), and Deloitte & Touche (accounting). What are the similarities and differences between job costing and process costing systems?*

Answer: Although these systems have marked differences, they are also similar in many ways. (As you read through this section, refer to Principles of Managerial Accounting 1 for a review of important terms if necessary.) Recall the three inventory accounts that accountants use to track product cost information—raw materials inventory, work-in-process inventory, and finished goods

inventory. These three inventory accounts are used to record product cost information for both process costing and job costing systems. However, several work-in-process inventory accounts are typically used in a process costing system to track the flow of product costs through each production *department*. Thus each department has its own work-in-process inventory account. (For the purposes of this chapter, assume each department represents a production *process*. This explains the term *process costing* because we are tracking costs by process.) The sum of all work-in-process inventory accounts represents total work in process for the company.

Recall the three components of product costs—direct materials, direct labor, and manufacturing overhead. Assigning these product costs to individual products remains an important goal for process costing, just as with job costing. However, instead of assigning product costs to individual *jobs* (shown on a job cost sheet), process costing assigns these costs to departments (shown on a departmental production cost report).

Figure 3.1 “A Comparison of Cost Flows for Job Costing and Process Costing” shows how product costs flow through accounts for job costing and process costing systems. Table 3.1 “A Comparison of Process Costing and Job Costing” outlines the similarities and differences between these two costing systems. Review these illustrations carefully before moving on to the next section.

Figure 3.1 A Comparison of Cost Flows for Job Costing and Process Costing

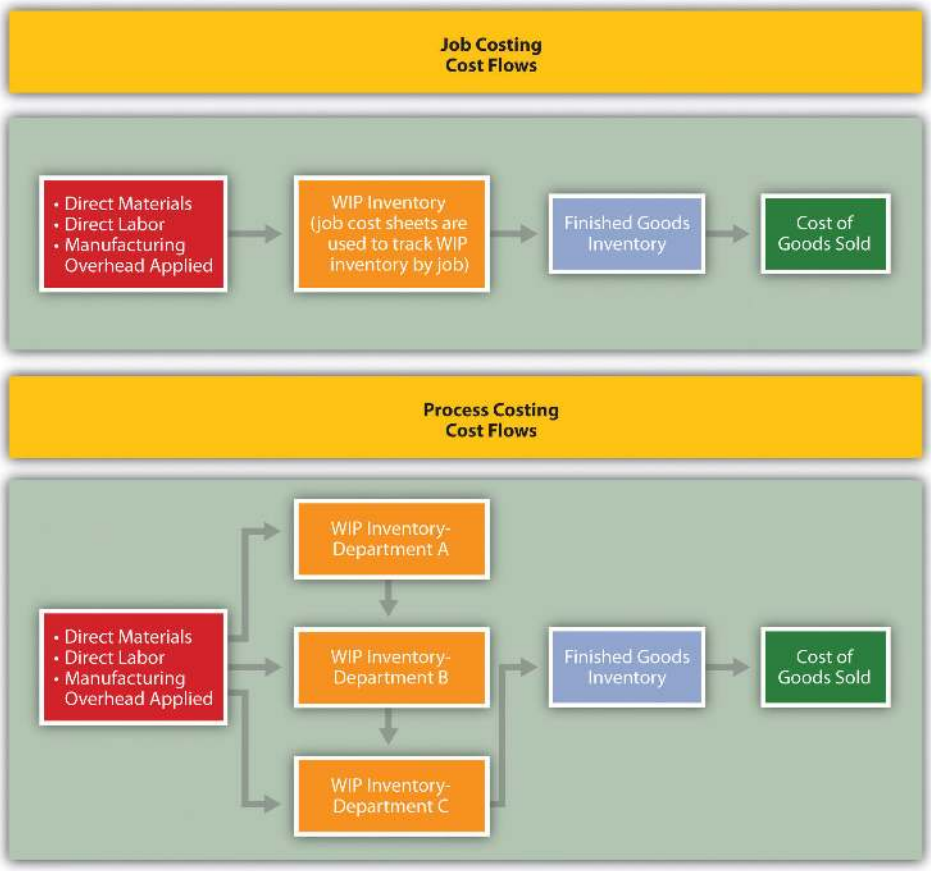


Table 3.1 A Comparison of Process Costing and Job Costing

Product Costs		
Similarities	Product costs consist of direct materials, direct labor, and manufacturing overhead.	
Differences	*Process Costing*	*Job Costing*
	Product costs are assigned to departments (or processes).	Product costs are assigned to jobs.
Unit Cost Information		
Similarities	Unit cost information is needed by management for decision-making purposes.	
Differences	*Process Costing*	*Job Costing*
	Unit cost information comes from the departmental production cost report.	Unit cost information comes from the job cost sheet.
Inventory Accounts		
Similarities	Inventory accounts include raw materials inventory, work-in-process inventory, and finished goods inventory.	
Differences	*Process Costing*	*Job Costing*
	Several different work-in-process inventory accounts are used—one for each department (or process).	One work-in-process inventory account is used—job cost sheets track costs assigned to each job.

Business in Action 3.1

Source: Photo courtesy of Simon Berry, http://www.flickr.com/photos/bezznet/3105213435/.

The Production Process at **Coca-Cola**

The Coca-Cola Company is one of the world's largest producers of nonalcoholic beverages. According to the company, more than 11,000 of its soft drinks are consumed every second of every day.

In the first stage of production, **Coca-Cola** mixes direct materials—water, refined sugar, and secret ingredients—to make the liquid for its beverages. The second stage includes filling cleaned and sanitized bottles before placing a cap on each bottle. In the third stage, filled bottles are inspected, labeled, and packaged.

Work in process begins with the first stage of production (mixing and blending), continues with the second stage (bottling), and ends with the third stage (inspecting, labeling, and packaging). When products have gone through all three stages of production, they are shipped to a warehouse, and the costs are entered into finished goods inventory. Once products are delivered to retail stores, product costs are transferred from finished goods inventory to cost of goods sold.

Source: **Coca-Cola Company**, http://www2.coca-cola.com/ourcompany/bottlingtoday.

Key Takeaways

- A process costing system is used by companies that produce similar or identical units of product in batches employing a consistent process. A job costing system is used by companies that produce unique products or jobs. Process costing systems track costs by processing department, whereas job costing systems track costs by job.

Check Yourself

Identify whether each business listed in the following would use job costing or process costing.

1. Trash bag manufacturer
2. Custom furniture manufacturer
3. Shampoo manufacturer
4. Automobile repair shop
5. Sports drink manufacturer
6. Antique boat restorer

Solution

1. Process costing
2. Job costing
3. Process costing
4. Job costing
5. Process costing
6. Job costing

3.2 Product Cost Flows in a Process Costing System

Learning Objective

1. Identify how product costs flow through accounts using process costing.

As products physically move through the production process, the product costs associated with these products move through several important accounts as shown back in Figure 3.1 “A Comparison of Cost Flows for Job Costing and Process Costing”. In this section, we present a detailed look at how product costs flow through accounts using a process costing system. Later in the chapter, we explain how dollar amounts are established for product costs that flow through the accounts. As you review each of the following cost flows for a process costing system, remember that product costs are now tracked by *department* rather than by *job*.

Direct Materials

Question: In a process costing setting, direct materials are often used by several production departments. How do we record direct materials costs for each production department?

Answer: When direct materials are requisitioned from the raw materials storeroom, a journal entry is made to reduce the raw materials inventory account and increase the appropriate work-in-process inventory account. For example, assume the Assembly department of Desk Products, Inc., requisitions direct materials to be used in production. The journal entry to reflect this is as follows:

1.a. WIP inventory—*assembly*	XXX	
Raw materials inventory		XXX

The use of direct materials is not limited to one production department. Suppose the Finishing department requisitions direct materials for production. The journal entry to reflect this is as follows:

1.b. WIP inventory—*finishing*	XXX	
Raw materials inventory		XXX

Notice that two different work-in-process inventory accounts are used to track production costs—one for each department.

Direct Labor

Question: Each production department typically has a direct labor work force. How do we record direct labor costs for each production department?

Answer: Direct labor costs are recorded directly in the production department's work-in-process inventory account. Assume direct labor costs are incurred by the Assembly department. The journal entry to reflect this is as follows:

2.a. WIP inventory—*assembly*	XXX	
Wages payable		XXX

As with direct materials, the use of direct labor is not limited to one production department. Suppose direct labor costs are incurred by the Finishing department. The journal entry to reflect this is as follows:

2.b. WIP inventory—*finishing*	XXX	
Wages payable		XXX

Manufacturing Overhead

Question: Manufacturing overhead costs are typically assigned to products using a predetermined overhead rate using a normal costing system as discussed in Chapter 1 and Chapter 2 (activity-based costing). How do we record manufacturing overhead costs for each department?

Answer: Assume manufacturing overhead costs (often simply called *overhead* costs) are being applied to products going through the Assembly department. The journal entry to reflect this is as follows:

3.a. WIP inventory—*assembly*	XXX	
Manufacturing overhead		XXX

The journal entry to reflect manufacturing overhead costs being applied to products going through the Finishing department is as follows:

3.b. WIP inventory—*finishing*	XXX	
Manufacturing overhead		XXX

Transferred-In Costs

Question: At this point, we have discussed how to record product costs (direct materials, direct labor, and manufacturing overhead) related to each production department. As you review Figure 3.1 "A Comparison of Cost Flows for Job Costing and Process Costing", notice that products often flow from one production department to the next. Transferred-in costs *are the costs associated with products moving from one department to another. How do we record transferred-in costs for each department?*

Answer: Assume the Assembly department at Desk Products, Inc., completes a batch of desks and moves the desks to the Finishing department. The costs associated with these desks must be transferred from the work-in-process inventory account for the Assembly department to the work-in-process inventory account for the Finishing department. Thus these costs are being *transferred in* to the Finishing department. The journal entry to reflect this is as follows:

4. WIP inventory—*finishing*	XXX	
WIP inventory—*assembly*		XXX

Finished Goods

Question: Goods are completed and ready to sell once they have gone through the final production department. The final production department at Desk Products, Inc., is the Finishing department. How do we record production costs for products moved from the final production department to the finished goods warehouse?

Answer: When goods go through the final production department and are completed, the related costs are moved to the finished goods inventory account. The journal entry to reflect this is as follows:

5. Finished goods inventory	XXX	
WIP inventory—*finishing*		XXX

Cost of Goods Sold

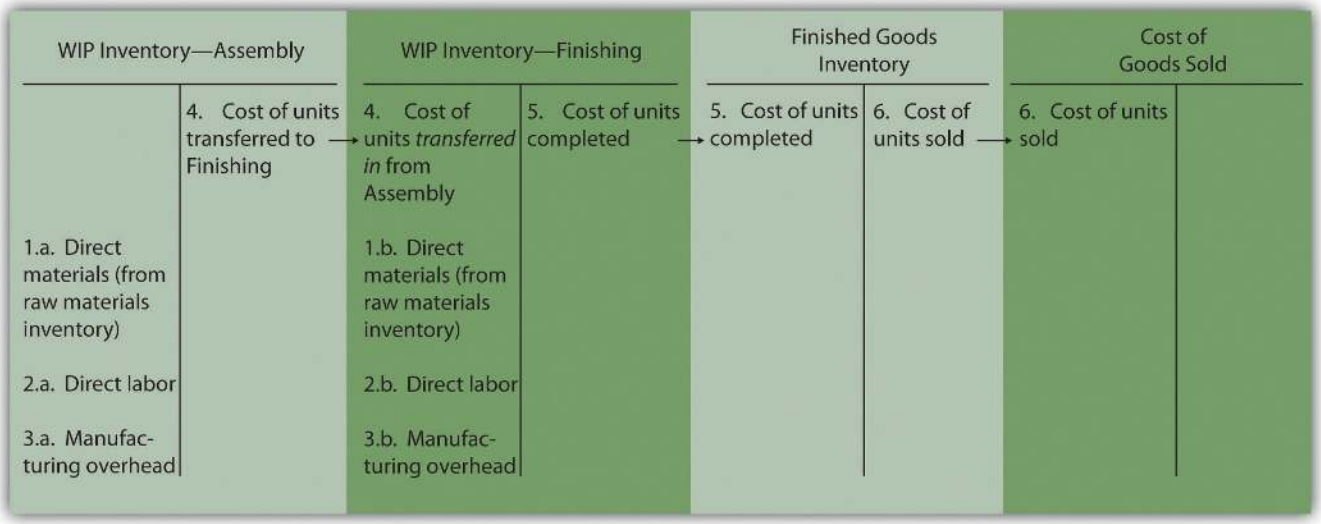
Question: How do we record production costs for goods that have been sold?

Answer: Once the completed goods are sold, the related costs are moved out of the finished goods inventory account and into the cost of goods sold account. The journal entry to reflect this is as follows:

6. Cost of goods sold	XXX	
Finished goods inventory		XXX

Figure 3.2 "Flow of Product Costs in a Process Costing System" summarizes the flow of product costs through T-accounts for each of the journal entries presented in this section. Note that when goods are sold and production costs are moved from finished goods inventory to cost of goods sold, an additional entry is made to record the revenue associated with this transaction. We do not show this entry because the focus of this section is on the flow of production costs rather than revenues.

Figure 3.2 Flow of Product Costs in a Process Costing System



Key Takeaways

- The cost flows in a process costing system are similar to the cost flows in a job costing system. The primary difference between the two costing methods is that a process costing system assigns product costs—direct materials, direct labor, and manufacturing overhead—to each production department (or process) rather than to each job. Each production department has its own work-in-process inventory account when using process costing.

Exercises

Chewy Gum Corporation produces bubble gum in large batches and uses a process costing system. Three departments—Mixing, Rolling, and Packaging—are involved in the production process. Chewy Gum has the following transactions:

1. Direct materials totaling $20,000—$6,000 for the Mixing department, $5,000 for the Rolling department, and $9,000 for the Packaging department—are requisitioned and placed in production.
2. Each production department incurs the following direct labor costs (wages payable):

Mixing	$2,500
Rolling	$4,600
Packaging	$2,200

3. Manufacturing overhead costs are applied to each department as follows:

Mixing	$10,000
Rolling	$ 7,000
Packaging	$ 7,500

4. Products with a cost of $5,500 are transferred from the Mixing department to the Rolling department.
5. Products with a cost of $6,400 are transferred from the Rolling department to the Packaging department.
6. Products with a cost of $9,100 are completed and transferred from the Packaging department to the finished goods warehouse.
7. Products with a cost of $8,300 are sold to customers.

Perform the following steps for each transaction:

1. Prepare a journal entry to record the transaction.
2. Summarize the flow of costs through T-accounts. Use the format presented in Figure 3.2 “Flow of Product Costs in a Process Costing System” (no need to include T-accounts for raw materials inventory, wages payable, or manufacturing overhead). Assume there are no beginning balances in the work-in-process inventory, finished goods inventory, and cost of goods sold accounts.

Solution

1.

WIP inventory—mixing	6,000	
WIP inventory—rolling	5,000	
WIP inventoryy—packaging	9,000	
Raw materials inventory		20,000

2.

WIP inventory—mixing	2,500	
WIP inventory—rolling	4,600	
WIP inventoryy—packaging	2,200	
Wages payable		9,300

3.

WIP inventory—mixing	10,000	
WIP inventory—rolling	7,000	
WIP inventory—packaging	7,500	
Manufacturing overhead		24,500

4.

WIP inventory—rolling	5,500	
WIP inventory—mixing		5,500

5.

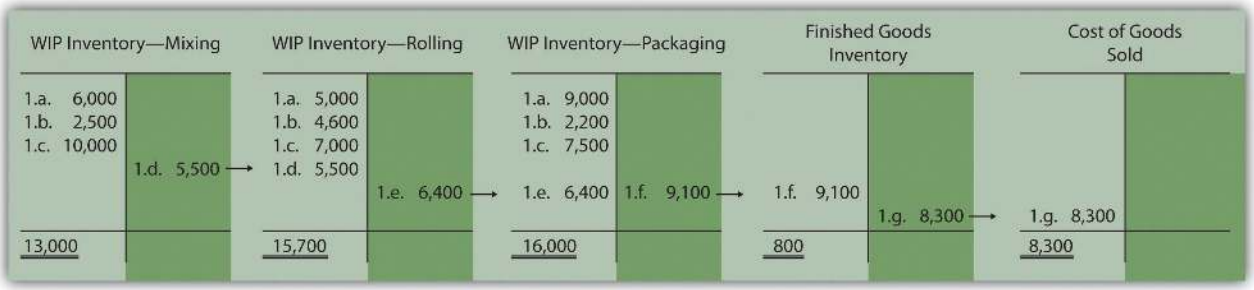
WIP inventory—packaging	6,400	
WIP inventory—rolling		6,400

6.

Finished goods inventory	9,100	
WIP inventory—packaging		9,100

7.

Cost of goods sold	8,300	
Finished goods inventory		8,300

8. 

3.3 Determining Equivalent Units

Key Takeaways

1. Understand the concept of an equivalent unit.

Question: The beginning of this chapter describes process costing and the flow of costs through accounts used in a process costing system. The challenge is determining the unit cost of products being transferred out of each departmental work-in-process inventory account. We start the process of determining unit cost information with an important concept, the concept of equivalent units. What are equivalent units, and how are equivalent units calculated?

Answer: Units of product in work-in-process inventory are assumed to be *partially* completed; otherwise, the units would not be in work-in-process inventory. Process costing requires *partially* completed units in ending work-in-process inventory to be converted to the equivalent *completed* units (called *equivalent units*). Equivalent units are calculated by multiplying the number of physical (or actual) units on hand by the percentage of completion of the units. If the physical units are 100 percent complete, equivalent units will be the same as the physical units. However, if the physical units are not 100 percent complete, the equivalent units will be less than the physical units.

For example, if four physical units of product are 50 percent complete at the end of the period, an equivalent of two units has been completed (2 equivalent units = 4 physical units × 50 percent). The formula used to calculate equivalent units is as follows:

Equivalent units = Number of physical units × Percentage of completion

Question: With the concept of equivalent units now in hand, we can calculate equivalent units for the three product costs—direct materials, direct labor, and manufacturing overhead. Why do we calculate equivalent units separately for direct materials, direct labor, and manufacturing overhead?

Answer: Equivalent units in work in process are often different for direct materials, direct labor, and manufacturing overhead because these three components of production may enter the process at varying stages. For example, in the Assembly department at Desk Products, Inc., direct materials enter production early in the process while direct labor and overhead are used throughout the process. (Imagine asking workers to assemble desks without materials!) Thus equivalent units must be calculated for each of the three production costs. (Note that direct labor and manufacturing overhead are sometimes combined in a category called *conversion costs*, which assumes both are added to the process at the same time. In this text, we keep direct labor and manufacturing overhead separate.) The next section presents how we use the equivalent unit concept for product costing purposes. Be sure you understand the concept of equivalent units before moving on.

Business in Action 3.2

Calculating Full-Time Equivalent Students

The concept of an equivalent unit can be applied to determine the number of *full-time equivalent students (FTES)* at a school. Colleges use FTES data to plan and make decisions about course offerings, staffing, and facility needs. Although having information about the number of students enrolled (the *headcount*) is helpful, headcount data do not provide an indication of whether the students are full time or part time. Clearly, full-time students take more classes each term and generally use more resources than part-time students. Thus administrators often prefer to convert enrollment data to FTES.

Using a simple example to explain this concept, assume 30 students attend school and each takes half a full load of classes. The headcount is 30. However, this is the equivalent of 15 full-time students, or 15 FTES.

To apply this to the real world, let's look at the enrollment data for **Sierra College**, a community college located near Sacramento, California. During a recent semester, the student headcount in a specific department at **Sierra College** was 8,190. Because a large number of students in the department were part time, the full-time equivalent number of students totaled 3,240.

Source: Based on enrollment data from Sierra College.

Key Takeaways

- When units of work-in-process (WIP) inventory exist at the end of the reporting period, process costing requires that these partially completed units be converted to the equivalent completed units (called equivalent units). The equation used to calculate equivalent completed units is as follows:

  Equivalent units = Number of physical units × Percentage of completion

- Because direct materials, direct labor, and manufacturing overhead typically enter the production process at different stages, equivalent units must be calculated separately for each of these production costs.

Check Yourself

Soap Production Company's Mixing department shows the following information for the 1,000 units of product remaining in work in process at the end of the period. Assume there was no beginning inventory.

Direct materials	90 percent complete
Direct labor	30 percent complete
Overhead	60 percent complete

Calculate the equivalent units for each of the three product costs—direct materials, direct labor, and overhead.

Solution

The formula used to calculate equivalent units is as follows:

Equivalent units = Number of partially completed units × Percentage of completion

Materials	900 equivalent units = 1,000 partially completed units × 90 percent
Labor	300 equivalent units = 1,000 partially completed units × 30 percent
Overhead	600 equivalent units = 1,000 partially completed units × 60 percent

3.4 The Weighted Average Method

Learning Objective

1. Use four steps to assign costs to products using the weighted average method.

Most companies use either the *weighted average* or *first-in-first-out (FIFO)* method to assign costs to inventory in a process costing environment. The weighted average method includes costs in beginning inventory and current period costs to establish an average cost per unit. The first-in-first-out (FIFO) method keeps beginning inventory costs separate from current period costs and assumes that beginning inventory units are completed and transferred out *before* the units started during the current period are completed and transferred out. We focus on the weighted average approach here and leave the discussion of the FIFO method to more advanced cost accounting textbooks.

Question: The primary goal stated in Chapter 1 "How Is Job Costing Used to Track Production Costs?" and Chapter 2 "How Does an Organization Use Activity-Based Costing to Allocate Overhead Costs?", and continued in this chapter, is to assign product costs to products. In a process costing system, cost per equivalent unit *is the term used to describe the average unit cost for each product. How is the concept of cost per equivalent unit used to assign costs to (1) completed units transferred out and (2) units still in work-in-process (WIP) inventory at the end of the period?*

Answer: Costs are assigned to completed units transferred out and units in ending WIP inventory using a four-step process. We list the four steps in the following and then explain them in detail. Review these steps carefully.

Step 1. Summarize the physical flow of units and compute the equivalent units for direct materials, direct labor, and overhead.

Step 2. Summarize the costs to be accounted for (separated into direct materials, direct labor, and overhead).

Step 3. Calculate the cost per equivalent unit.

Step 4. Use the cost per equivalent unit to assign costs to (1) completed units transferred out and (2) units in ending WIP inventory.

The Four Key Steps of Assigning Costs

Recall that Desk Products, Inc., has two departments—Assembly and Finishing. Although this chapter focuses on the Assembly department, the Finishing department would also use the four steps to determine product costs for completed units transferred out and ending WIP inventory. Table 3.2 "Production Information for Desk Products' Assembly Department" presents information for the Assembly department at Desk Products for the month of May. Review this information carefully as it will be used to illustrate the four key steps.

Table 3.2 Production Information for Desk Products' Assembly Department

Assembly Department—Month of May
• The company had 3,000 units in beginning WIP inventory; all were completed and transferred out during May.

• During May, 6,000 units were started. Of the 6,000 units started:
  ◦ 1,000 units were completed and transferred out to the Finishing department (100 percent complete with respect to direct materials, direct labor, and overhead); thus 1,000 units were *started and completed* during May.
  ◦ 5,000 units were partially completed and remained in ending WIP inventory on May 31 (60 percent complete for direct materials, 30 percent complete for direct labor, and 30 percent complete for overhead, which is applied based on direct labor hours).

• Costs in beginning WIP inventory totaled $161,000 (= $95,000 in direct materials + $40,000 in direct labor + $26,000 in overhead).
• Costs incurred during May totaled $225,000 (= $115,000 in direct materials + $70,000 in direct labor + $40,000 in overhead).

Question: Costs for the Assembly department totaled $386,000 for the month of May ($386,000 = $161,000 in beginning WIP inventory + $225,000 incurred during May). How much of the $386,000 should be assigned to (1) completed units transferred out to the Finishing department and (2) units remaining in the Assembly department ending WIP inventory?

Answer: Let's use the four key steps as follows to answer this question.

Step 1. Summarize the physical flow of units and compute the equivalent units for direct materials, direct labor, and overhead.

This step uses the basic cost flow equation presented in Chapter 1 "How Is Job Costing Used to Track Production Costs?" to identify the physical flow of units (the basic cost flow equation applies to *costs* and to *units*):

Beginning balance + Transfers in=Transfers out + Ending balance (BB) + (TI) Units to be accounted for= (TO) + (EB) Units accounted for

Question: What are the two categories used to summarize the physical flow of units?

Answer: The first category, *units to be accounted for*, includes the beginning balance *(BB)* and transfers in *(TI)*. The second category, *units accounted for*, includes the ending balance *(EB)* and transfers out *(TO)*. As you can see from the previous equation, *units to be accounted for* must equal *units accounted for*. Here is how it looks for the Assembly department for the month of May:

Units to Be Accounted For	
Units in beginning WIP inventory, May 1	3,000 *(BB)*
Units started during May	6,000 *(TI)*
Total units to be accounted for	9,000
Units Accounted For*	BB + TI = TO + EB
Units completed and transferred out	4,000 *(TO)*
Units in ending WIP inventory	5,000 *(EB)*
Total units accounted for	9,000

*This information is used in the physical units column of Figure 3.4 "Flow of Units and Equivalent Unit Calculations for Desk Products' Assembly Department".

This step shows that 3,000 units were in WIP inventory on May 1 and 6,000 units were started during May. Thus 9,000 units must be accounted for. These 9,000 units will end up in one of two places, either completed and transferred out (to the Finishing department) or not completed and therefore in ending WIP inventory. The previous schedule shows that 4,000 units were completed and transferred out (3,000 from beginning WIP inventory and 1,000 from the units started and completed during the month), and 5,000 units remain in ending WIP inventory.

Question: Based on the previous information for Desk Products, Inc., we now know that 4,000 units were completed and transferred out, and 5,000 units were in ending WIP inventory at the end of May. How do we convert this information into equivalent units?

Answer: The *units accounted for* (4,000 transferred out and 5,000 in ending WIP inventory) must be converted into equivalent units for direct materials, direct labor, and overhead, as shown in Figure 3.4 "Flow of Units and Equivalent Unit Calculations for Desk Products' Assembly Department". The 4,000 units transferred out are 100 percent complete for direct materials, direct labor, and overhead (otherwise, they would not be transferred out), which results in equivalent units matching the physical units. However, the 5,000 units in ending WIP inventory are at varying levels of completion for direct materials, direct labor, and overhead, and must be converted into equivalent units using the following formula (as described earlier in the chapter):

Equivalent units = Number of physical units × Percentage of completion

Later in step 3, we will use equivalent unit information for the Assembly department to calculate the cost per equivalent unit.

Figure 3.4 Flow of Units and Equivalent Unit Calculations for Desk Products' Assembly Department

		Equivalent Units		
Units Accounted For	**Physical Units[a]**	**Direct Materials**	**Direct Labor**	**Overhead**
Units completed and transferred out	4,000	4,000[b]	4,000[b]	4,000[b]
Units in ending WIP inventory	5,000	3,000[c]	1,500[c]	1,500[c]
Total units accounted for	9,000	7,000	5,500	5,500

[a] This column represents actual physical units accounted for *before* converting to equivalent units.

[b] Equivalent units = Number of physical units × Percentage of completion. Units completed and transferred out are 100 percent complete. Thus equivalent units are the same as the physical units. (Information is from Table 3.2 "Production Information for Desk Products' Assembly Department".)

[c] Equivalent units = Number of physical units × Percentage of completion. For direct materials, 3,000 equivalent units = 5,000 physical units × 60 percent complete; for direct labor and overhead, 1,500 equivalent units = 5,000 physical units × 30 percent complete. (Information is from Table 3.2 "Production Information for Desk Products' Assembly Department".)

Step 2. Summarize the costs to be accounted for (separated into direct materials, direct labor, and overhead).

Question: How do we summarize the costs that are used to calculate the cost per equivalent unit?

Answer: The total costs to be accounted for include the costs in beginning WIP inventory and the costs incurred during the period. Figure 3.5 "Summary of Costs to Be Accounted for in Desk Products' Assembly Department" shows these costs for the Assembly department. Notice that the costs are separated into direct materials, direct labor, and overhead.

Figure 3.5 Summary of Costs to Be Accounted for in Desk Products' Assembly Department

Costs to Be Accounted For	**Direct Materials**	**Direct Labor**	**Overhead**	**Total**
Costs in beginning WIP inventory[a]	$ 95,000	$ 40,000	$ 26,000	$161,000
Costs incurred during May[a]	115,000	70,000	40,000	225,000
Total costs to be accounted for	$ 210,000	$110,000	$ 66,000	$386,000

[a] Information is from Table 3.2 "Production Information for Desk Products' Assembly Department".

Figure 3.5 "Summary of Costs to Be Accounted for in Desk Products' Assembly Department" shows that costs totaling $386,000 must be assigned to (1) completed units transferred out and (2) units in ending WIP inventory.

Step 3. Calculate the cost per equivalent unit.

Question: We now have the costs (Figure 3.5 "Summary of Costs to Be Accounted for in Desk Products' Assembly Department") and equivalent units (Figure 3.4 "Flow of Units and Equivalent Unit Calculations for Desk Products' Assembly Department")

needed to determine the cost per equivalent unit for direct materials, direct labor, and overhead. How do we use this information to calculate the cost per equivalent unit?

Answer: The formula to calculate the cost per equivalent unit using the weighted average method is as follows:

Key Equation

Cost per equivalent unit=Costs in beginning WIP + Current period costs / Equivalent units completed and transferred out + Equivalent units in ending WIP

In summary, the same formula is as follows:

Cost per equivalent unit=Total costs to be accounted for*/ Total equivalent units accounted for**

*From the bottom of Figure 3.5 "Summary of Costs to Be Accounted for in Desk Products' Assembly Department".

**From the bottom of Figure 3.4 "Flow of Units and Equivalent Unit Calculations for Desk Products' Assembly Department".

Figure 3.6 "Calculation of the Cost per Equivalent Unit for Desk Products' Assembly Department" presents the cost per equivalent unit calculation for Desk Products' Assembly department.

Figure 3.6 Calculation of the Cost per Equivalent Unit for Desk Products' Assembly Department

	Direct Materials	Direct Labor	Overhead	Total
Total costs to be accounted for[a]	$ 210,000	$110,000	$ 66,000	
Total equivalent units accounted for[b]	÷ 7,000	÷ 5,500	÷ 5,500	
Cost per equivalent unit	$ 30	$ 20	$ 12	$ 62

[a] Information is from Figure 3.5 "Summary of Costs to Be Accounted for in Desk Products' Assembly Department".

[b] Information is from Figure 3.4 "Flow of Units and Equivalent Unit Calculations for Desk Products' Assembly Department".

The cost per equivalent unit is calculated for direct materials, direct labor, and overhead. Simply divide *total costs to be accounted for* by *total equivalent units accounted for*. It is important to note that the information shown in Figure 3.6 "Calculation of the Cost per Equivalent Unit for Desk Products' Assembly Department" allows managers to carefully assess the unit cost information in the Assembly department for direct materials, direct labor, and overhead. We discuss this further later in the chapter.

Step 4. Use the cost per equivalent unit to assign costs to (1) completed units transferred out and (2) units in ending WIP inventory.

Question: Recall our primary goal of assigning costs to completed units transferred out and to units in ending WIP inventory. How do we accomplish this goal?

Answer: Costs are assigned by multiplying the cost per equivalent unit (shown in Figure 3.6 "Calculation of the Cost per Equivalent Unit for Desk Products' Assembly Department") by the number of equivalent units (shown in Figure 3.4 "Flow of Units and Equivalent Unit Calculations for Desk Products' Assembly Department") for direct materials, direct labor, and overhead. Figure 3.7 "Assigning Costs to Products in Desk Products' Assembly Department" shows how this is done.

Figure 3.7 Assigning Costs to Products in Desk Products' Assembly Department

	Direct Materials	Direct Labor	Overhead	Total
Costs assigned to units transferred out	$ 120,000[a]	$ 80,000[a]	$ 48,000[a]	$ 248,000
Costs assigned to ending WIP inventory	90,000[b]	30,000[b]	18,000[b]	138,000
Total costs accounted for				$386,000[c]

[a] The total cost assigned to units transferred out equals the cost per equivalent unit times the number of equivalent units. For example, the cost assigned to direct materials of $120,000 = 4,000 equivalents units × $30 per equivalent unit

[b] The total cost assigned to units in ending inventory equals the cost per equivalent unit times the number of equivalent units. For example, the cost assigned to direct materials of $90,000 = 3,000 equivalent units × $30 per equivalent unit

[c] This must match total costs to be accounted for shown in Figure 3.5 "Summary of Costs to Be Accounted for in Desk Products' Assembly Department". Although not an issue in this example, rounding the cost per equivalent unit may cause minor differences between the two amounts.

Figure 4.7 "Assigning Costs to Products in Desk Products' Assembly Department" shows that total costs of $248,000 are assigned to units completed and transferred out and that $138,000 in costs are assigned to ending WIP inventory.

On completion of step 4, it is important to reconcile the total costs to be accounted for shown at the bottom of Figure 3.5 "Summary of Costs to Be Accounted for in Desk Products' Assembly Department" with the total costs accounted for shown at the bottom of Figure 3.7 "Assigning Costs to Products in Desk Products' Assembly Department". The two balances must match (note that small discrepancies may exist due to rounding the cost per equivalent unit). This reconciliation relates back to the basic cost flow equation as follows:

Beginning balance + Transfers in=Transfers out + Ending balance (BB) + (TI) Costs to be accounted for ($386,000*)= (TO) + (EB) Costs accounted for($386,000**)

**From Figure 3.5 "Summary of Costs to Be Accounted for in Desk Products' Assembly Department".

***From Figure 3.7 "Assigning Costs to Products in Desk Products' Assembly Department".

Although the examples in this chapter have been created in a way that minimizes rounding errors, always round the cost per equivalent unit calculations in step 3 to the nearest thousandth (e.g., if the cost per equivalent unit is $2.3739, round this to $2.374 rather than to $2). Although rounding differences still may occur, this will minimize the size of rounding errors when attempting to reconcile costs to be accounted for (step 2) with costs accounted for (step 4).

Journalizing Costs Assigned to Units Completed and Transferred

Question: Once the four-step process is complete, a journal entry must be made to record the transfer of costs out of the Assembly department and into the Finishing department. How do we record the costs associated with units completed and transferred out?

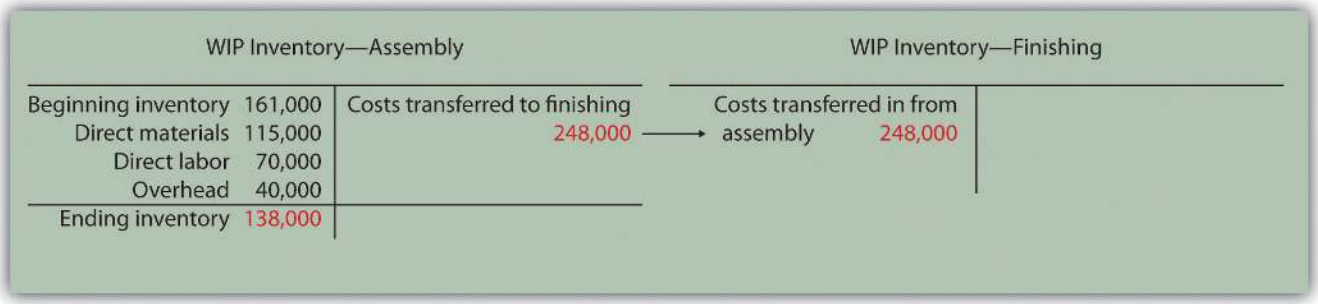
Answer: At Desk Products, Inc., 4,000 units were transferred from the Assembly department to the Finishing department. Costs totaling $248,000 were assigned to these units as shown in Figure 3.7 "Assigning Costs to Products in Desk Products' Assembly Department". The journal entry to record this at the end of May is as follows:

WIP inventory—*finishing*	248,000	
WIP inventory—*assembly*		248,000

(Note that this was journal entry number four, presented without dollar amounts earlier in the chapter.)

Figure 3.8 “Flow of Costs through the Work-in-Process Inventory T-Account of Desk Products’ Assembly Department” shows the flow of costs through the work-in-process inventory T-account for the Assembly department. Note that four key steps were performed for the Assembly department to determine the costs assigned to (1) completed units transferred out to the Finishing department ($248,000) and (2) units in Assembly’s WIP inventory ($138,000). Both amounts are highlighted.

Figure 3.8 Flow of Costs through the Work-in-Process Inventory T-Account of Desk Products’ Assembly Department



Business in Action 3.4

The Production Process for **Hershey’s** Chocolate

Hershey Foods Corp. is best known for its chocolate products, including brands like Almond Joy, **Hershey’s** Kisses, and Reese’s. **Hershey’s** products are sold in more than 90 countries worldwide. According to **Hershey**, more than 80 million Kiss-shaped products are made every day!

Several sequential stages of production are required to produce chocolate at **Hershey**:

1. **Fermentation.** Cocoa beans are placed in large heaps for one week to allow the cocoa flavor to develop.
2. **Roasting.** The cocoa beans are roasted at very high temperatures.
3. **Hulling.** A hulling machine separates the shell from the inside of the bean (called the *nib*).
4. **Milling.** The nibs are ground into chocolate liquor (a liquid with a pure chocolate flavor that contains no alcohol).
5. **Mixing.** The chocolate liquor is mixed with cocoa butter, sugar, and milk. This mixture is dried into a brown powder, called *chocolate crumb*, and processed into chocolate paste.
6. **Molding.** Machines are used to fill more than 1,000 molds per minute with chocolate. The chocolate is then chilled to form solid candy.
7. **Packaging.** The candy is wrapped, packaged, and ready to be shipped.

Hershey likely uses a process costing system since it produces identical units of product in batches employing a consistent process. Process costing systems require the use of work-in-process inventory accounts for each process. Thus **Hershey** would track production costs using separate work-in-process inventory accounts for each stage of production.

Source: **Hershey’s**, “Home Page,” http://www.hersheys.com.

Key Takeaways

- Four steps are used to assign product costs to (1) completed units transferred out and (2) units in work-in-process inventory at the end of the period.
- The four-step process must be performed for each processing department and results in a journal entry to record the costs assigned to units transferred out.

Check yourself

Kelley Paint Company uses the weighted average method to account for costs of production. Kelley manufactures base paint in two separate departments—Mixing and Packaging. The following information is for the Mixing department for the month of March.

- A total of 40,000 units (measured in gallons) were in beginning WIP inventory. All were completed and transferred out during March.
- A total of 70,000 units were started during March. Of the 70,000 units started,
  - 20,000 units were completed and transferred out to the Packaging department (100 percent complete with respect to direct materials, direct labor, and overhead), and
  - 50,000 units were partially completed and remained in ending WIP inventory on March 31 (90 percent complete for direct materials, 70 percent complete for direct labor, and 30 percent complete for overhead, which is applied based on machine hours).
- Costs in beginning WIP inventory totaled $229,000 (= $98,000 in direct materials + $41,000 in direct labor + $90,000 in overhead).
- Costs incurred during March totaled $165,000 (= $70,000 in direct materials + $35,000 in direct labor + $60,000 in overhead).

Required:

1. Use the four key steps to assign costs to units completed and transferred out and to units in ending WIP inventory for the Mixing department.
2. Prepare the journal entry necessary at the end of March to record the transfer of costs associated with units completed and transferred to the Packaging department.

Solution to Review Problem 4.4

1. The four steps are as follows:

   Step 1. Summarize the physical flow of units and compute the equivalent units for direct materials, direct labor, and overhead.

Flow of Units	
Units to Be Accounted For	
Units in beginning WIP inventory, March 1	40,000 *(BB)*
Units started during March	70,000 *(TI)*
Total units to be accounted for	110,000
	BB + TI = TO + EB
Units Accounted For	
Units completed and transferred out	60,000[a] *(TO)*
Units in ending WIP Inventory	50,000 *(EB)*
Total units accounted for	110,000

Equivalent Units

Equivalent Units Calculations	Physical Units[b]	Direct Materials	Direct Labor	Overhead
Units Accounted For				
Units completed and transferred out	60,000	60,000[c]	60,000[c]	60,000[c]
Units in ending WIP Inventory	50,000	45,000[d]	35,000[d]	15,000[d]
Total units accounted for	110,000	105,000	95,000	75,000

[a] 60,000 units = 40,000 from beginning WIP inventory + 20,000 started and completed in March.

[b] This column represents actual physical units accounted for *before* converting to equivalent units.

[c] Equivalent units = number of physical units × percentage of completion. Units completed and transferred out are 100 percent complete. Thus equivalent units are the same as the physical units.

[d] Equivalent units = number of physical units × percentage of completion. For direct materials, 45,000 equivalent units = 50,000 physical units × 90 percent complete; for direct labor, 35,000 equivalent units = 50,000 physical units × 70 percent complete; for overhead, 15,000 equivalent units = 50,000 physical units × 30 percent complete.

Step 2. Summarize the costs to be accounted for (separated into direct materials, direct labor, and overhead).

Costs to Be Accounted For	Direct Materials	Direct Labor	Overhead	Total
Costs in beginning WIP inventory[e]	$ 98,000	$ 41,000	$ 90,000	$ 229,000
Costs incurred during May[e]	70,000	35,000	60,000	165,000
Total costs to be accounted for	$ 168,000	$ 76,000	$ 150,000	$ 394,000

[e] Information is given.

Step 3. Calculate the cost per equivalent unit.

	Direct Materials	Direct Labor	Overhead	Total
Total costs to be accounted for (step 2)	$168,000	$ 76,000	$ 150,000	
Total equivalent units accounted for (step 1)	÷ 105,000	÷ 95,000	÷ 75,000	
Cost per equivalent unit	$ 1.60	$ 0.80	$ 2.00	$ 4.40

Step 4. Use the cost per equivalent unit to assign costs to (1) completed units transferred out and (2) units in ending WIP inventory.

	Direct Materials	Direct Labor	Overhead	Total
Costs assigned to units transferred out	$ 96,000[f]	$ 48,000[f]	$ 120,000[f]	$ 264,000
Costs assigned to ending WIP Inventory	72,000[g]	28,000[g]	30,000[g]	130,000
Total costs accounted for				$ 394,000[h]

[f] Total costs assigned to units transferred out equals the cost per equivalent unit times the number of equivalent units. For example, costs assigned for direct materials of $96,000 = 60,000 equivalents units (from step 1) × $1.60 per equivalent unit (from step 3).

[g] Total costs assigned to ending WIP inventory equals the cost per equivalent unit times the number of equivalent units. For example, costs assigned for direct materials of $72,000 = 45,000 equivalent units (from step 1) × $1.60 per equivalent unit (from step 3).

[h] This must match total costs to be accounted for in step 2, as shown in the following:

Beginning balance + Transfers in=Transfers out + Ending balance (BB) + (TI) Costs to be accounted for (394,000 from step 2)= (TO) + (EB) Costs accounted for($394,000 from step 4)

2. As shown in step 4, $264,000 in total costs are assigned to units completed and transferred out. The entry to record this is as follows:

Work in process inventory—*packaging*	264,000	
Work in process inventory—*mixing*		264,000

3.5 Preparing a Production Cost Report

Learning Objectives

1. Prepare a production cost report for a processing department.

Question: The results of the four key steps are typically presented in a production cost report. The production cost report *summarizes the production and cost activity within a department for a reporting period. It is simply a formal summary of the four steps performed to assign costs to units transferred out and units in ending work-in-process (WIP) inventory. What does the production cost report look like for the Assembly department at Desk Products, Inc.?*

Answer: The production cost report for the month of May for the Assembly department appears in Figure 3.9 “Production Cost Report for Desk Products’ Assembly Department”. Notice that each section of this report corresponds with one of the four steps described earlier. We provide references to the following illustrations so you can review the detail supporting calculations.

Figure 3.9 Production Cost Report for Desk Products’ Assembly Department

Desk Products, Inc.
Assembly Department Production Cost Report: Weighted Average Method
Month Ended May 31

Step 1: Summary of physical units and equivalent unit calculations

Units to Be Accounted For[b]	Physical Units
Units in beginning WIP inventory	3,000
Units started during May	6,000
Total units to be accounted for	9,000

		Equivalent Units		
Units Accounted For[c]	**Physical Units**	**Direct Materials**	**Direct Labor**	**Overhead**
Units completed and transferred out	4,000	4,000	4,000	4,000
Units in ending WIP inventory	5,000	3,000	1,500	1,500
Total units accounted for	9,000	7,000	5,500	5,500

Step 2: Summary of costs to be accounted for

Costs to Be Accounted For[d]	Direct Materials	Direct Labor	Overhead	Total
Costs in beginning WIP inventory	$ 95,000	$ 40,000	$ 26,000	$ 161,000
Costs incurred during May	115,000	70,000	40,000	225,000
Total costs to be accounted for	$ 210,000	$ 110,000	$ 66,000	$ 386,000[a]

Step 3: Calculation of cost per equivalent unit[e]

	Direct Materials	Direct Labor	Overhead	Total
Total costs to be accounted for	$ 210,000	$ 110,000	$ 66,000	
Total equivalent units accounted for	÷ 7,000	÷ 5,500	÷ 5,500	
Cost per equivalent unit	$ 30	$ 20	$ 12	$ 62

Step 4: Assign costs to units transferred out and units in ending WIP inventory.[f]

	Direct Materials	Direct Labor	Overhead	Total
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Costs assigned to units transferred out	$ 120,000	$ 80,000	$ 48,000	$ 248,000
Costs assigned to ending WIP inventory	90,000	30,000	18,000	138,000
Total costs accounted for				$ 386,000[a]

[a] Total costs to be accounted for (step 2) must equal total costs accounted for (step 4).

[b] Data are given.

[c] This section comes from Figure 3.4 “Flow of Units and Equivalent Unit Calculations for Desk Products’ Assembly Department”.

[d] This section comes from Figure 3.5 “Summary of Costs to Be Accounted for in Desk Products’ Assembly Department”.

[e] This section comes from Figure 3.6 “Calculation of the Cost per Equivalent Unit for Desk Products’ Assembly Department”.

[f] This section comes from Figure 3.7 “Assigning Costs to Products in Desk Products’ Assembly Department”.

How Do Managers Use Production Cost Report Information?

Question: Although the production cost report provides information needed to transfer costs from one account to another, managers also use this report for decision-making purposes. What important questions can be answered using the production cost report?

Answer: A production cost report helps managers answer several important questions:

- How much does it cost to produce each unit of product for each department?
- Which production cost is the highest—direct materials, direct labor, or overhead?
- Where are we having difficulties in the production process? In any particular departments?
- Are we seeing any significant changes in unit costs for direct materials, direct labor, or overhead? If so, why?
- How many units flow through each processing department each month?
- Are improvements in the production process being reflected in the cost per unit from one month to the next?

Beware of Fixed Costs

Question: Why might the per unit cost data provided in the production cost report be misleading?

Answer: When using information from the production cost report, managers must be careful not to assume that all production costs are variable costs. The CEO of Desk Products, Inc., Ann Watkins, was told that the Assembly department cost for each desk totaled $62 for the month of May (from Figure 3.9 “Production Cost Report for Desk Products’ Assembly Department”, step 3). However, if the company produces more or fewer units than were produced in May, the unit cost will change. This is because the $62 unit cost includes both variable and fixed costs (see Principles of Managerial Accounting 1 for a detailed discussion of fixed and variable costs).

Assume direct materials and direct labor are variable costs. In the Assembly department, the variable costs per unit associated with direct materials and direct labor of $50 (= $30 direct materials + $20 direct labor) will remain the same regardless of the level of production, within the relevant range. However, the remaining unit product cost of $12 associated with overhead must be analyzed further to determine the amount that is variable (e.g., indirect materials) and the amount that is fixed (e.g., factory rent). Managers must understand that fixed costs *per unit* will change depending on the level of production. More specifically, Ann Watkins must understand that the $62 unit cost in the Assembly department provided in the production cost report will change depending on the level of production. Principles of Managerial Accounting 1 provides a detailed presentation of how cost information can be separated into fixed and variable components for the purpose of providing managers with more useful information.

Key Takeaways

- The four key steps of assigning costs to units transferred out and units in ending WIP inventory are formally presented in a production cost report. The production cost report summarizes the production and cost activity within a processing department for a reporting period. A separate report is prepared for each processing department. Rounding the cost per equivalent unit to the nearest thousandth will minimize rounding differences when reconciling costs to be accounted for in step 2 with costs accounted for in step 4.

Computer Application

Using Excel to Prepare a Production Cost Report

Managers typically use computer software to prepare production cost reports. They do so for several reasons:

- Once the format is established, the template can be used from one period to the next.
- Formulas underlie all calculations, thereby minimizing the potential for math errors and speeding up the process.
- Changes can be made easily without having to redo the entire report.
- Reports can be easily combined to provide a side-by-side analysis from one period to the next.

Review Figure 3.9 “Production Cost Report for Desk Products’ Assembly Department” and then ask yourself: “How can I use Excel to help prepare this report?” Answers will vary widely depending on your experience with Excel. However, Excel has a few basic features that can make the job of creating a production cost report easier. For example, you can use formulas to sum numbers in a column (note that each of the four steps presented has column totals) and to calculate the cost per equivalent unit. Also you can establish a separate line to double-check that

- the *units to be accounted for* match the *units accounted for*; and
- the *total costs to be accounted for* match the *total costs accounted for*.

For those who want to add more complex features, the basic data (e.g., the data in Table 3.2 “Production Information for Desk Products’ Assembly Department”) can be entered at the top of the spreadsheet and pulled down to the production cost report where necessary.

An example of how to use Excel to prepare a production cost report follows. Notice that the basic data are at the top of the spreadsheet, and the rest of the report is driven by formulas. Each month, the data at the top are changed to reflect the current month’s activity, and the production cost report takes care of itself.

Data Entry Section				
Unit Information		**Percent Complete**		
	Units (board feet)	Direct materials	Direct labor	Overhead
Units in beginning WIP Inventory (all completed this period)	3,000	n/a	n/a	n/a
Units started and completed during the period	1,000	100%	100%	100%
Units started and ***partially*** completed during the period	5,000	60%	30%	30%
Cost Information		Direct materials	Direct labor	Overhead
Costs in beginning WIP Inventory		$95,000	$40,000	$26,000
Costs incurred during the period		$115,000	$70,000	$40,000

This is where the data is entered for each period.

Desk Products Incorporated				
Assembly Department Production Cost Report				
Month Ending May 31				
Step 1: Summary of Physical Units and Equivalent Unit Calculations				
Units to be accounted for	Physical Units			
Units in beginning WIP Inventory	3,000			
Units started during the period	6,000			
Total units to be accounted for	9,000			
		Equivalent Units		
Units accounted for	Physical Units	Direct materials	Direct labor	Overhead
Units completed and transferred out	4,000	4,000	4,000	4,000
Units in ending WIP Inventory	5,000	3,000	1,500	1,500
Total units accounted for	9,000	7,000	5,500	5,500
check: total units to be accounted for = total units accounted for? If so, amount = 0 ---->				0
Step 2: Summary of Costs to be Accounted for				
Costs to be accounted for	Direct materials	Direct labor	Overhead	Total
Costs in beginning WIP Inventory	$95,000	$40,000	$26,000	$161,000
Costs incurred during the period	115,000	70,000	40,000	225,000
Total costs to be accounted for	$210,000	$110,000	$66,000	$386,000
check: total costs to be accounted for = total costs accounted for? If so, amount = $0 ---->				$0
Step 3: Calculation of Cost per Equivalent Unit				
	Direct materials	Direct labor	Overhead	Total
Total costs to be accounted for (a)	$210,000	$110,000	$66,000	
Total equivalent units accounted for (b)	7,000	5,500	5,500	
Cost per equivalent unit (a) / (b)	$30	$20	$12	$62
Step 4: Assign Costs to Units Transferred Out and Units in Ending WIP Inventory				
	Direct materials	Direct labor	Overhead	Total
Costs assigned to units transferred out	$120,000	$80,000	$48,000	$248,000
Costs assigned to ending WIP Inventory	90,000	30,000	18,000	138,000
Total costs accounted for				$386,000

This is the production cost report. No data entry is necessary since all information is driven by formulas and comes from the data entry section above.

Check Yourself

Using the information in the earlier check yourself box toprepare a production cost report for the Mixing department of Kelley Paint Company for the month ended March 31. (Hint: You have already completed the four key steps. Simply summarize the

information in a production cost report as shown in Figure 3.9 “Production Cost Report for Desk Products’ Assembly Department”.)

Solution

(See solutions to earlier exercise for detailed calculations.)

Kelley Paint Company
Mixing Department Production Cost Report: Weighted Average Method
Month Ended March 31

Step 1: Summary of physical units and equivalent unit calculations

Units to Be Accounted For	Physical Units
Units in beginning WIP inventory	40,000
Units started during March	70,000
Total units to be accounted for	110,000

		Equivalent Units		
Units Accounted For	**Physical Units**	**Direct Materials**	**Direct Labor**	**Overhead**
Units completed and transferred out	60,000	60,000	60,000	60,000
Units in ending WIP inventory	50,000	45,000	35,000	15,000
Total units accounted for	110,000	105,000	95,000	75,000

Step 2: Summary of costs to be accounted for

Costs to Be Accounted For	Direct Materials	Direct Labor	Overhead	Total
Costs in beginning WIP inventory	$ 98,000	$ 41,000	$ 90,000	$229,000
Costs incurred during March	70,000	35,000	60,000	165,000
Total costs to be accounted for	$168,000	$ 76,000	$150,000	$394,000

Step 3: Calculation of cost per equivalent unit

	Direct Materials	Direct Labor	Overhead	Total
Total costs to be accounted for	$168,000	$ 76,000	$150,000	
Total equivalent units accounted for	÷ 105,000	÷ 95,000	÷ 75,000	
Cost per equivalent unit	$ 1.60	$ 0.80	$ 2.00	$ 4.40

Amounts must match (unless rounding differences occur).

Step 4: Assign costs to units transferred out and units in ending WIP inventory.

	Direct Materials	Direct Labor	Overhead	Total
Costs assigned to units transferred out	$ 96,000	$ 48,000	$120,000	$264,000
Costs assigned to ending WIP inventory	72,000	28,000	30,000	130,000

Total costs accounted for				$394,000

End-of-Chapter Exercises

Questions

1. Which types of companies use a process costing system to account for product costs? Provide at least three examples of products that would require the use of a process costing system.
2. Describe the similarities between a process costing system and a job costing system.
3. Describe the differences between a process costing system and a job costing system.
4. Review "Business in Action 3.1" What are the three stages of production at **Coca-Cola**, and what account is used to track production costs for each stage?
5. What are *transferred-in costs*?
6. Explain the difference between *physical units* and *equivalent units*.
7. Explain the concept of equivalent units assuming the weighted average method is used.
8. Explain why direct materials, direct labor, and overhead might be at different stages of completion at the end of a reporting period.
9. Review "Business in Action 3.2" Why do colleges convert the actual number of students attending school to a full-time equivalent number of students?
10. Describe the four key steps shown in a production cost report assuming the weighted average method is used.
11. What two important amounts are determined in step 4 of the production cost report?
12. Describe the basic cost flow equation and explain how it is used to reconcile units to be accounted for with units accounted for.
13. Describe the basic cost flow equation and explain how it is used to reconcile costs to be accounted for with costs accounted for.
14. Review "Business in Action 3.3" Describe the last two stages of the production process at **Hershey**.
15. How does a company determine the number of production cost reports to be prepared for each reporting period?
16. What is a production cost report, and how is it used by management?
17. Explain how the cost per equivalent unit might be misleading to managers, particularly when a significant change in production is anticipated.

Brief Exercises

19. **Product Costing at Desk Products, Inc.** Refer to the dialogue presented at the beginning of the chapter.

    Required:

    1. Why was the owner of Desk Products, Inc., concerned about the Assembly department product cost of each desk?
    2. What did the accountant, John Fuller, promise by the end of the week?

20. **Job Costing Versus Process Costing.** For each firm listed in the following, identify whether it would use job costing or process costing.

    1. Chewing gum manufacturer
    2. Custom automobile restorer
    3. Facial tissue manufacturer
    4. Accounting services provider
    5. Electrical services provider
    6. Pool builder
    7. Cereal producer
    8. Architectural design provider

21. **Process Costing Journal Entries.** Assume a company has two processing departments—Molding and Packaging. Transactions for the month are shown as follows.

    1. The Molding department requisitioned direct materials totaling $2,000 to be used in production.
    2. Direct labor costs totaling $3,500 were incurred in the Molding department, to be paid the next month.
    3. Manufacturing overhead costs applied to products in the Molding department totaled $2,500.
    4. The cost of goods transferred from the Molding department to the Packaging department totaled $10,000.

5. Manufacturing overhead costs applied to products in the Packaging department totaled $1,800.

Required:

Prepare journal entries to record transactions **1** through **5**.

22. **Calculating Equivalent Units.** Complete the requirements for each item in the following.
    1. A university has 500 students enrolled in classes. Each student attends school on a part-time basis. On average, each student takes three-quarters of a full load of classes. Calculate the number of full-time equivalent students (i.e., calculate the number of equivalent units).
    2. A total of 10,000 units of product remain in the Assembly department at the end of the year. Direct materials are 80 percent complete and direct labor is 40 percent complete. Calculate the equivalent units in the Assembly department for direct materials and direct labor.
    3. A local hospital has 60 nurses working on a part-time basis. On average, each nurse works two-thirds of a full load. Calculate the number of full-time equivalent nurses (i.e., calculate the number of equivalent units).
    4. A total of 6,000 units of product remain in the Quality Testing department at the end of the year. Direct materials are 75 percent complete and direct labor is 20 percent complete. Calculate the equivalent units in the Quality Testing department for direct materials and direct labor.

23. **Calculating Cost per Equivalent Unit.** The following information pertains to the Finishing department for the month of June.

	Direct Materials	**Direct Labor**	**Overhead**
Total costs to be accounted for	$100,000	$200,000	$300,000
Total equivalent units accounted for	10,000 units	8,000 units	8,000 units

Required:

Calculate the cost per equivalent unit for direct materials, direct labor, overhead, and in total. Show your calculations.

24. **Assigning Costs to Completed Units and to Units in Ending WIP Inventory.** The following information is for the Painting department for the month of January.

	Direct Materials	**Direct Labor**	**Overhead**
Cost per equivalent unit	$2.10	$1.50	$3.80
Equivalent units completed and transferred out	3,000 units	3,000 units	3,000 units
Equivalent units in ending WIP inventory	1,000 units	1,200 units	1,200 units

Required:

1. Calculate the costs assigned to units completed and transferred out of the Painting department for direct materials, direct labor, overhead, and in total.
2. Calculate the costs assigned to ending WIP inventory for the Painting department for direct materials, direct labor, overhead, and in total.

Exercises:

25. **Assigning Costs to Products: Weighted Average Method.** Sydney, Inc., uses the weighted average method for its process costing system. The Assembly department at Sydney, Inc., began April with 6,000 units in work-in-process inventory, all of which were completed and transferred out during April. An additional 8,000 units were started during the month, 3,000 of

which were completed and transferred out during April. A total of 5,000 units remained in work-in-process inventory at the end of April and were at varying levels of completion, as shown in the following.

Direct materials	40 percent complete
Direct labor	30 percent complete
Overhead	50 percent complete

The following cost information is for the Assembly department at Sydney, Inc., for the month of April.

	Direct Materials	**Direct Labor**	**Overhead**	**Total**
Beginning WIP inventory	$300,000	$350,000	$250,000	$900,000
Incurred during the month	$180,000	$200,000	$170,000	$550,000

Required:

1. Determine the units to be accounted for and units accounted for; then calculate the equivalent units for direct materials, direct labor, and overhead. (Hint: This requires performing step 1 of the four-step process.)
2. Calculate the cost per equivalent unit for direct materials, direct labor, and overhead. (Hint: This requires performing step 2 and step 3 of the four-step process.)
3. Assign costs to units transferred out and to units in ending WIP inventory. (Hint: This requires performing step 4 of the four-step process.)
4. Confirm that total costs to be accounted for (from step 2) equals total costs accounted for (from step 4). Note that minor differences may occur due to rounding the cost per equivalent unit in step 3.
5. Explain the meaning of equivalent units.

26. **Production Cost Report: Weighted Average Method.** Refer to Exercise 25. Prepare a production cost report for Sydney, Inc., for the month of April using the format shown in Figure 3.9 “Production Cost Report for Desk Products’ Assembly Department”.

27. **Process Costing Journal Entries.** Silva Piping Company produces PVC piping in two processing departments—Fabrication and Packaging. Transactions for the month of July are shown as follows.

    1. Direct materials totaling $15,000 are requisitioned and placed into production—$7,000 for the Fabrication department and $8,000 for the Packaging department.
    2. Direct labor costs (wages payable) are incurred by each department as follows:

Fabrication	$4,500
Packaging	$6,700

    3. Manufacturing overhead costs are applied to each department as follows:

Fabrication	$20,000
Packaging	$14,000

    4. Products with a cost of $22,000 are transferred from the Fabrication department to the Packaging department.
    5. Products with a cost of $35,000 are completed and transferred from the Packaging department to the finished goods warehouse.
    6. Products with a cost of $31,000 are sold to customers.

Required:

1. Prepare journal entries to record each of the previous transactions.
2. In general, how does the process costing system used here differ from a job costing system?

Problems

28. Production Cost Report: Weighted Average Method. Calvin Chemical Company produces a chemical used in the production of silicon wafers. Calvin Chemical uses the weighted average method for its process costing system. The Mixing department at Calvin Chemical began the month of June with 5,000 units (gallons) in work-in-process inventory, all of which were completed and transferred out during June. An additional 15,000 units were started during the month, 11,000 of which were completed and transferred out during June. A total of 4,000 units remained in work-in-process inventory at the end of June and were at varying levels of completion, as shown in the following.

Direct materials	60 percent complete
Direct labor	40 percent complete
Overhead	40 percent complete

The cost information is as follows:

Costs in beginning work-in-process inventory

Direct materials	$8,000
Direct labor	$3,000
Overhead	$2,800

Costs incurred during the month

Direct materials	$21,000
Direct labor	$ 8,500
Overhead	$ 7,200

Required:

1. Prepare a production cost report for the Mixing department at Calvin Chemical Company for the month of June.
2. Confirm that total costs to be accounted for (from step 2) equals total costs accounted for (from step 4). Note that minor differences may occur due to rounding the cost per equivalent unit in step 3.
3. According to the production cost report, what is the total cost per equivalent unit for the work performed in the Mixing department? Which of the three product cost components is the highest, and what percent of the total does this product cost represent?

29. Production Cost Report: Weighted Average Method. Quality Confections Company manufactures chocolate bars in two processing departments, Mixing and Packaging, and uses the weighted average method for its process costing system. The table that follows shows information for the Mixing department for the month of March.

Unit Information (Measured in Pounds)	**Mixing**
Beginning work-in-process inventory	8,000
Started or transferred in during the month	230,000
Ending work-in-process inventory: 80 percent materials, 70 percent labor, and 60 percent overhead	6,000
Cost Information	
Beginning Work-in-Process Inventory	
Direct materials	$ 3,000
Direct labor	$ 1,500
Overhead	$ 2,200
Costs Incurred during the Period	
Direct materials	$103,000
Direct labor	$ 55,000
Overhead	$ 81,000

Required:

1. Prepare a production cost report for the Mixing department for the month of March.
2. Confirm that total costs to be accounted for (from step 2) equals total costs accounted for (from step 4); minor differences may occur due to rounding the cost per equivalent unit in step 3.
3. According to the production cost report, what is the total cost per equivalent unit for the work performed in the Mixing department? Which of the three product cost components is the highest, and what percent of the total does this product cost represent?

30. Production Cost Report and Journal Entries: Weighted Average Method. Wood Products, Inc., manufactures plywood in two processing departments, Milling and Sanding, and uses the weighted average method for its process costing system. The table that follows shows information for the Milling department for the month of April.

Unit Information (Measured in Feet)	**Milling**
Beginning work-in-process inventory	24,000
Started or transferred in during the month	110,000
Ending work-in-process inventory: 80 percent materials, 70 percent labor, and 60 percent overhead	32,000
Cost Information	
Beginning Work-in-Process Inventory	
Direct materials	$ 9,000
Direct labor	$ 3,000
Overhead	$ 3,200
Costs Incurred during the Period	
Direct materials	$45,000
Direct labor	$14,000
Overhead	$16,000

Required:

1. Prepare a production cost report for the Milling department for the month of April.
2. Confirm that total costs to be accounted for (from step 2) equals total costs accounted for (from step 4); minor differences may occur due to rounding the cost per equivalent unit in step 3.
3. For the Milling department at Wood Products, Inc., prepare journal entries to record:
    1. The cost of direct materials placed into production during the month (from step 2).
    2. Direct labor costs incurred during the month but not yet paid (from step 2).
    3. The application of overhead costs during the month (from step 2).
    4. The transfer of costs from the Milling department to the Sanding department (from step 4).

One Step Further: Skill-Building Cases

31. Internet Project: Production Company Plant Tour. Using the Internet, find a company that provides a virtual tour of its production processes. Document your findings by completing the following requirements.

Required:

1. Summarize each step in the production process.
2. Which type of costing system (job or process) would you expect the company to use? Why?

- **32 Process Costing at Coca-Cola.** Refer to "Business in Action 3.1".

  Required:

  1. What type of costing system does **Coca-Cola** use? Explain.
  2. What is the purpose of preparing a production cost report? What information results from preparing a production cost report for the mixing and blending department at **Coca-Cola**?
  3. Based on the information provided, what is the minimum number of production cost reports that **Coca-Cola** prepares each reporting period? Explain.

- **33 Group Activity: Job or Process Costing?** Form groups of two to four students. Each group should determine whether a process costing or job costing system is most likely used to calculate product costs for each item listed in the following and should be prepared to explain its answers.

  1. Jetliners produced by **Boeing**
  2. Gasoline produced by **Shell Oil Company**
  3. Audit of **Intel** by **Ernst & Young**
  4. Oreo cookies produced by **Nabisco Brands, Inc.**
  5. Frosted Mini-Wheats produced by **Kellogg Co.**
  6. Construction of suspension bridge in Puget Sound, Washington, by **Bechtel Group, Inc.**
  7. Aluminum foil produced by **Alcoa, Inc.**
  8. Potato chips produced by **Frito-Lay, Inc.**

Comprehensive Cases

34. Ethics: Manipulating Percentage of Completion Estimates. Computer Tech Corporation produces computer keyboards, and its fiscal year ends on December 31. The weighted average method is used for the company's process costing system. As the controller of Computer Tech, you present December's production cost report for the Assembly department to the president of the company. The Assembly department is the last processing department before goods are transferred to finished goods inventory. All 160,000 units completed and transferred out during the month were sold by December 31.

The board of directors at Computer Tech established a compensation incentive plan that includes a substantial bonus for the president of the company if annual net income before taxes exceeds $2,000,000. Preliminary figures show current year net income before taxes totaling $1,970,000, which is short of the target by $30,000. The president approaches you and asks you to increase the percentage of completion for the 40,000 units in ending WIP inventory to 90 percent for direct materials and to 95 percent for direct labor and overhead. Even though you are confident in the percentages used to prepare the production cost report, which appears as follows, the president insists that his change is minor and will have little impact on how investors and creditors view the company.

	A	B	C	D	E	F	G
1		**Data Entry Section**					
2		**Unit Information**		**Percent Complete**			
3			**Units**	Direct materials	Direct labor	Overhead	
4		Units in beginning WIP Inventory (all completed this period)	50,000	n/a	n/a	n/a	
5		Units started and completed during the period	110,000	100%	100%	100%	
6		Units started and ***partially*** completed during the period	40,000	60%	40%	40%	
7							
8		**Cost Information**		Direct materials	Direct labor	Overhead	
9		Costs in beginning WIP Inventory		$80,000	$30,000	$28,000	
10		Costs incurred during the period		$210,000	$85,000	$72,000	
11							
12							
13		**Computer Tech Company**					
14		**Assembly Department Production Cost Report**					
15		**Month Ending December 31**					
16		**Step 1: Summary of Physical Units and Equivalent Unit Calculations**					
17		Units to be accounted for	Physical Units				
18		Units in beginning WIP Inventory	50,000				
19		Units started during the period	150,000				
20		Total units to be accounted for	200,000				
21							
22				**Equivalent Units**			
23		Units accounted for	Physical Units	Direct materials	Direct labor	Overhead	
24		Units completed and transferred out	160,000	160,000	160,000	160,000	
25		Units in ending WIP Inventory	40,000	24,000	16,000	16,000	
26		Total units accounted for	200,000	184,000	176,000	176,000	
27		*check: total units to be accounted for = total units accounted for? If so, amount = 0 ---->*				0	
28		**Step 2: Summary of Costs to be Accounted for**					
29		Costs to be accounted for	Direct materials	Direct labor	Overhead	Total	
30		Costs in beginning WIP Inventory	$80,000	$30,000	$28,000	$138,000	
31		Costs incurred during the period	210,000	85,000	72,000	367,000	
32		Total costs to be accounted for	$290,000	$115,000	$100,000	$505,000	
33		*check: total costs to be accounted for = total costs accounted for? If so, amount = $0 ---->*				$0	
34		**Step 3: Calculation of Cost per Equivalent Unit**					
35			Direct materials	Direct labor	Overhead	Total	
36		Total costs to be accounted for (a)	$290,000	$115,000	$100,000		
37		Total equivalent units accounted for (b)	184,000	176,000	176,000		
38		Cost per equivalent unit (a) / (b)	$1.5761	$0.6534	$0.5682	$2.7977	
39							
40		**Step 4: Assign Costs to Units Transferred Out and Units in Ending WIP Inventory**					
41			Direct materials	Direct labor	Overhead	Total	
42		Costs assigned to units transferred out	$252,176	$104,544	$90,912	$447,632	
43		Costs assigned to ending WIP Inventory	37,826	10,454	9,091	57,372	
44		Rounding difference				(4)	
45		Total costs accounted for				$505,000	
46							

Required:

1. Why is the president asking you to increase the percentage of completion estimates?
2. Prepare another production cost report for Computer Tech Company that includes the president's revisions. Indicate what impact the president's request will have on cost of goods sold and on net income (ignore income taxes in your calculations).
3. As the controller of the company, how would you handle the president's request? (If necessary, review the presentation of ethics in Principles of Managerial Accounting 1 for additional information.)

35. Ethics: Increasing Production to Boost Profits. Pacific Siding, Inc., produces synthetic wood siding used in the construction of residential and commercial buildings. Pacific Siding's fiscal year ends on March 31, and the weighted average method is used for the company's process costing system.

Financial results for the first 11 months of the current fiscal year (through February 28) are well below expectations of management, owners, and creditors. Halfway through the month of March, the chief executive officer and chief financial officer asked the controller to estimate the production results for the month of March in the form of a production cost report (the company only has one production department). This report is shown as follows.

	A	B	C	D	E	F	G
1		**Data Entry Section**					
2		**Unit Information**		**Percent Complete**			
3			**Units (board feet)**	Direct materials	Direct labor	Overhead	
4		Units in beginning WIP Inventory (all completed this period)	250,000	n/a	n/a	n/a	
5		Units started and completed during the period	140,000	100%	100%	100%	
6		Units started and ***partially*** completed during the period	70,000	40%	60%	30%	
7							
8		**Cost Information**		Direct materials	Direct labor	Overhead	
9		Costs in beginning WIP Inventory		$76,000	$90,000	$150,000	
10		Costs incurred during the period		$55,000	$75,000	$135,000	
11							
12							
13		**Pacific Siding Incorporated**					
14		***Preliminary* Production Cost Report**					
15		**Month Ending March 31**					
16		**Step 1: Summary of Physical Units and Equivalent Unit Calculations**					
17		Units to be accounted for	Physical Units				
18		Units in beginning WIP Inventory	250,000				
19		Units started during the period	210,000				
20		Total units to be accounted for	460,000				
21							
22				**Equivalent Units**			
23		Units accounted for	Physical Units	Direct materials	Direct labor	Overhead	
24		Units completed and transferred out	390,000	390,000	390,000	390,000	
25		Units in ending WIP Inventory	70,000	28,000	42,000	21,000	
26		Total units accounted for	460,000	418,000	432,000	411,000	
27		*check: total units to be accounted for = total units accounted for? If so, amount = 0 ---->*				0	
28		**Step 2: Summary of Costs to be Accounted for**					
29		Costs to be accounted for	Direct materials	Direct labor	Overhead	Total	
30		Costs in beginning WIP Inventory	$76,000	$90,000	$150,000	$316,000	
31		Costs incurred during the period	55,000	75,000	135,000	265,000	
32		Total costs to be accounted for	$131,000	$165,000	$285,000	$581,000	
33		*check: total costs to be accounted for = total costs accounted for? If so, amount = $0 ---->*				$0	
34		**Step 3: Calculation of Cost per Equivalent Unit**					
35			Direct materials	Direct labor	Overhead	Total	
36		Total costs to be accounted for (a)	$131,000	$165,000	$285,000		
37		Total equivalent units accounted for (b)	418,000	432,000	411,000		
38		Cost per equivalent unit (a) / (b)	$0.3134	$0.3819	$0.6934	$1.3888	
39							
40		**Step 4: Assign Costs to Units Transferred Out and Units in Ending WIP Inventory**					
41			Direct materials	Direct labor	Overhead	Total	
42		Costs assigned to units transferred out	$122,226	$148,941	$270,426	$541,593	
43		Costs assigned to ending WIP Inventory	8,775	16,040	14,561	39,376	
44		Rounding difference				31	
45		Total costs accounted for				$581,000	
46							

Armed with the preliminary production cost report for March, and knowing that the company's production is well below capacity, the CEO and CFO decide to produce as many units as possible for the last half of March even though sales are *not* expected to increase any time soon. The production manager is told to push his employees to get as far as possible with production, thereby increasing the percentage of completion for ending WIP inventory. However, since the production process takes three weeks to complete, all the units produced in the last half of March will be in WIP inventory at the end of March.

Required:

1. Explain how the CEO and CFO expect to increase profit (net income) for the year by boosting production at the end of March.
2. Using the following assumptions, prepare a revised estimate of production results in the form of a production cost report for the month of March.

   Assumptions based on the CEO and CFO's request to boost production

   1. Units started and partially completed during the period will increase to 225,000 (from the initial estimate of 70,000). This is the projected ending WIP inventory at March 31.
   2. Percentage of completion estimates for units in ending WIP inventory will increase to 80 percent for direct materials, 85 percent for direct labor, and 90 percent for overhead.
   3. Costs incurred during the period will increase to $95,000 for direct materials, $102,000 for direct labor, and $150,000 for overhead (most overhead costs are fixed).
   4. All units completed and transferred out during March are sold by March 31.
3. Compare your new production cost report with the one prepared by the controller. How much do you expect profit to increase as a result of increasing production during the last half of March? (Ignore income taxes in your calculations.)
4. Is the request made by the CEO and CFO ethical? Explain your answer.

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Chapter 4 How Do Managers Evaluate Performance Using Cost Variance Analysis?

Jerry Feltz, president and owner of Jerry's Ice Cream, is discussing the results of operations for the year with the company's management group: Tom, the sales manager; Lynn, the production manager; and Michelle, the treasurer and controller.

Jerry:
Good work, everyone! It looks as if our sales this past year exceeded the budget! We were expecting to sell 200,000 gallons of ice cream, but it turns out we sold 210,000 gallons. Credit goes to our sales staff for their hard work!

Tom:
Thanks, Jerry. We have a great group of salespeople and a terrific product.

Jerry:
I agree. I am concerned, however, about our direct labor and direct materials costs. We expected a 5 percent increase in these costs over the original budget since sales were 5 percent higher than anticipated. However, our cost overruns far exceeded the 5 percent increase. We've got to get a handle on both of these costs.

Lynn:
This doesn't sound right. My production crew used fewer materials than was budgeted, and the average time it took to make each unit was also less than expected. This should cause materials and labor costs to be lower than expected, not higher.

Jerry:
Michelle, are you sure we have the right information here?

Michelle:
Absolutely. Total costs for direct labor and direct materials were higher than budgeted, even after considering the increase in sales.

Jerry:
Can you give me more detail as to how this happened? I want to know what caused the increase in costs and how to prevent this from taking place in the future.

Michelle:
Can I have a week to pull the information together?

Jerry:
You've got it.

Jerry is evaluating the performance of his company by comparing actual costs to budgeted costs. This is the *control* phase of budgeting. We covered the *planning* phase of budgeting in Principles of Managerial Accounting 1 by showing how Jerry's Ice Cream prepared a master budget. The focus of this chapter is on the control phase and how to calculate and analyze cost variances.

4.1 Flexible Budgets

Learning Objectives

1. Understand how flexible budgets are used to evaluate performance.

Question: The master budget in our earlier class was prepared for only one level of activity (activity was measured by the number of units sold, which was budgeted at 200,000 units). Although this works well in the planning phase of budgeting, it is not appropriate for the control phase. Actual sales rarely match budgeted sales. When actual sales differ from budgeted sales, it is

inappropriate and perhaps unfair to evaluate employee performance by comparing actual results to the master budget. If actual sales volume is higher than the master budget, variable costs should be higher than the master budget. The opposite is true as well. How do organizations modify the master budget to adjust for actual sales?

Answer: Organizations use a modified budget called a *flexible budget*. A flexible budget is simply a revised master budget based on the *actual* activity level. It represents what costs *should be* given a certain level of activity. The master budget at Jerry's Ice Cream was based on sales of 200,000 units and production of 200,400 units. Because actual sales totaled 210,000 units, the flexible budget should be based on 210,000 units of activity. (It should be noted that in the earlier text we presented an example with budgeted sales of 200,000 units and budgeted production of 200,400 units resulting from differing beginning and ending finished goods inventory amounts. In this chapter, we assume beginning and ending finished goods inventory are the same, and therefore units produced and sold will be the same. Thus we assume actual sales and actual production total 210,000 units.)

Question: Imagine being the production manager at Jerry's Ice Cream, and you are evaluated based on the quantity of direct materials used in production. Would it be fair to compare the materials used to produce 210,000 units with the master budget showing the materials that should have been used to produce 200,400 units?

Answer: Probably not. The budget should be adjusted upward to reflect the actual number of units produced before a comparison is made, thus the term *flexible budget*. As we develop the process of cost variance analysis, we will use flexible budget information. That is, we will revise the master budget for direct materials, direct labor, and variable manufacturing overhead to reflect actual sales volume of 210,000 units. However, we must first describe the concept of *standard cost*.

Key Takeaways

- A flexible budget is a revised master budget that represents expected costs given actual sales. Costs in the flexible budget are compared to actual costs to evaluate performance.

Check Yourself

What is a flexible budget, and why do companies use a flexible budget to evaluate production managers?

Solution

A flexible budget is a revised master budget based on the **actual** activity level achieved for a period. The master budget is established before the period begins for planning purposes, and the flexible budget is established after the period ends for control and evaluation purposes. Production managers are evaluated using the flexible budget because the usage of direct materials, direct labor, and manufacturing overhead will depend on the actual number of units produced.

4.2 Standard Costs

Learning Objective

1. Explain how standard costs are established.

Question: Companies often use standard costs for planning and control purposes. What are standard costs?

Answer: Standard costs are costs that management expects to incur to provide a good or service. They serve as the "standard" by which performance will be evaluated. For example, fast-food restaurants have a standard for the length of time it should take to serve a drive-through-window customer. Phone directory operators have a standard length of time it should take to provide a phone number to a customer. Manufacturing companies have a standard quantity of direct materials to be used to produce one unit of product.

The Difference between Standard Costs and Budgeted Costs

Question: What is the difference between standard costs and budgeted costs?

Answer: The term *standard cost* refers to a specific cost per unit. *Budgeted cost* refers to costs in total given a certain level of activity. Standard variable production costs at Jerry's Ice Cream are shown in Figure 4.1 "Standard Costs at Jerry's Ice Cream".

Figure 4.1 Standard Costs at Jerry's Ice Cream

	Standard Cost Per Unit
Direct materials (2 pounds per unit at $1 per pound)*	$2.00
Direct labor (0.10 hours at $13 per hour)**	1.30
Variable overhead (0.10 direct labor hours** at $5 per hour)†	0.50
Standard variable production cost per unit	$3.80

*Direct materials standards come from the direct materials purchases budget presented in Principles of Managerial Accounting 1

**Direct labor standards come from the direct labor budget presented in earlier text

† Variable overhead costs are applied to products based on direct labor hours. Variable overhead cost per direct labor hour is calculated by dividing total variable overhead costs of $100,200 by 20,040 total direct labor hours (from the direct labor budget in earlier text), which results in a standard variable overhead rate of $5 per direct labor hour.

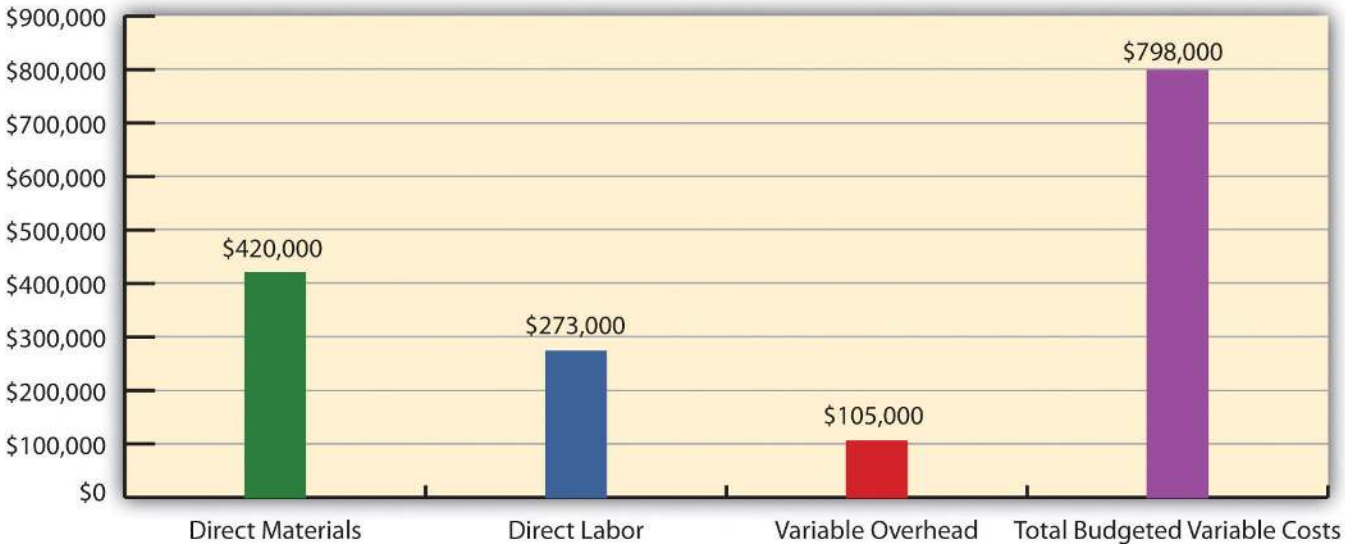
These standard costs can then be used to establish a flexible budget based on a given level of activity. For example, let's use Jerry's *actual* sales of 210,000 units. The variable production costs expected to produce these units are shown in the flexible budget in Figure 4.2 "Flexible Budget for Variable Production Costs at Jerry's Ice Cream".

Figure 4.2 Flexible Budget for Variable Production Costs at Jerry's Ice Cream

	Flexible Budget at 210,000 Units
Direct materials ($2.00 per unit × 210,000 units)	$420,000
Direct labor ($1.30 per unit × 210,000 units)	273,000
Variable overhead ($0.50 per unit × 210,000 units)	105,000
Total budgeted variable production costs at 210,000 units	$798,000

The standard cost presented in Figure 4.1 "Standard Costs at Jerry's Ice Cream" shows the variable production costs expected to produce *one unit*. The flexible budget in Figure 4.2 "Flexible Budget for Variable Production Costs at Jerry's Ice Cream" uses the standard cost information to show the variable production costs expected *in total* given a certain level of activity (210,000 units in this example). Later in the chapter, we compare the flexible budget presented in Figure 4.3 "Flexible Budget" to actual results and analyze the difference. The flexible budget graph presented in Figure 4.3 "Flexible Budget" shows that direct materials have the highest variable production cost at $420,000, followed by direct labor at $273,000 and variable overhead at $105,000.

Figure 4.3 Flexible Budget



Establishing Standard Cost

Question: What are the components needed to establish a standard cost for direct materials, direct labor, and variable manufacturing overhead?

Answer: Notice in Figure 4.1 "Standard Costs at Jerry's Ice Cream" that direct materials has two separate standards necessary to calculate the standard cost: standard *quantity* to produce 1 unit of product (2 pounds) and standard *price* ($1 per pound). Direct labor has two separate standards as well: standard *hours* to produce 1 unit of product (0.10 hours) and standard *rate* ($13 per hour). Variable manufacturing overhead also has 2 separate standards: standard *hours* to produce 1 unit of product (0.10 direct labor hours) and standard *rate* ($5 per hour). Thus there are two separate standards necessary to establish each standard cost or six standards in total to establish a standard cost for direct materials, direct labor, and variable manufacturing overhead.

As we explain next, there are many approaches to establishing these six standards for direct materials, direct labor, and variable manufacturing overhead (we discuss *fixed* manufacturing overhead at the end of this chapter).

Direct Materials Standard Quantity and Standard Price

Question: How do organizations determine the standard quantity and standard price for direct materials?

Answer: The standard quantity for direct materials represents the materials required to complete one good unit of product (i.e., a product with no defects), and it includes an allowance for waste and spoilage. For Jerry's Ice Cream, the standard quantity of materials needed for each gallon of product is given in the recipe. Jerry's adds a certain amount to the recipe quantity for waste and spoilage. Similar to this approach, companies might find the standard quantity in the product specifications outlined by product engineers. Some companies review historical production information to determine quantities used in the past and use this information to set standard quantities for the future.

The standard price for direct materials represents the final delivered cost of the materials and includes items such as shipping and insurance. The standard price for materials at Jerry's comes from the purchase contract negotiated with the company's supplier. As an alternative to this approach, companies might use historical data or look at price trends in the marketplace.

As shown in Figure 4.1 "Standard Costs at Jerry's Ice Cream", for Jerry's Ice Cream, the standard quantity of direct materials is 2 pounds per unit, and the standard price is $1 per pound. Thus the standard cost per unit for direct materials is $2, calculated as follows:

$2 standard cost per unit = 2 pounds per unit × $1 per pound

Direct Labor Standard Hours and Standard Rate

Question: How do organizations determine the standard hours and standard rate for direct labor?

Answer: The standard hours for direct labor represents the direct labor time required to complete one good unit of product and includes an allowance for breaks and production inefficiencies such as machine downtime. Jerry's Ice Cream established this standard using historical information. In addition to this approach, companies might use time and motion studies performed by engineers who observe production workers and analyze the time required to perform production activities.

The standard rate for direct labor represents the average cost of wages and benefits for each hour of direct labor work performed. Jerry's Ice Cream looked at past payroll records to determine this standard. Companies also review labor contracts to estimate the costs associated with direct labor.

As shown in Figure 4.1 "Standard Costs at Jerry's Ice Cream", for Jerry's Ice Cream, the standard hours for direct labor is 0.10, and the standard rate is $13 per hour. Thus the standard cost per unit for direct labor is $1.30, calculated as follows:

$1.30 standard cost per unit = 0.10 direct labor hours per unit × $13 per hour

Variable Manufacturing Overhead Standard Quantity and Standard Rate

Question: How do organizations determine the standard quantity and standard rate for variable manufacturing overhead?

Answer: The standard quantity for variable manufacturing overhead represents the time required to complete one unit of product. This time is often measured in direct labor hours or machine hours, depending on how the company chooses to allocate overhead (recall that we covered the choice of allocation base at length in Chapter 1 "How Is Job Costing Used to Track Production Costs?"). Jerry's Ice Cream uses direct labor hours to allocate variable manufacturing overhead, so we apply the same standard quantity used for direct labor.

The standard rate for variable manufacturing overhead represents the variable portion of the predetermined overhead rate used to allocate overhead costs to products (see Chapter 1 "How Is Job Costing Used to Track Production Costs?" for further discussion of predetermined overhead rates).

As shown in Figure 4.1 "Standard Costs at Jerry's Ice Cream", for Jerry's Ice Cream, the standard quantity of direct labor hours is 0.10, and the standard rate (predetermined overhead rate) is $5 per direct labor hour. Thus the standard cost per unit for variable manufacturing overhead is $0.50, calculated as follows:

$0.50 standard cost per unit = 0.10 direct labor hours per unit × $5 per hour

Ideal Standards and Attainable Standards

Question: In the process of establishing standards, managers must decide between using ideal *standards or* attainable *standards. What is the difference between these two standards?*

Answer: Ideal standards are set assuming production conditions are perfect. For example, ideal standards assume machines never break down, employees are never ill, and materials are never wasted. Although ideal standards may provide motivation for workers to strive for excellence, these standards can also have a negative impact because they may be impossible to achieve.

As an alternative to ideal standards, most managers use *attainable standards*. Attainable standards take into consideration the likelihood of encountering problems in production such as machine downtime, electricity outages, materials waste, and employee illnesses. Most managers feel attainable standards have a positive behavioral impact on workers because the standards are reasonable and attainable under normal production conditions. We assume the use of attainable standards throughout this chapter.

Controlling Operations through Standards

Question: How are standards used to control operations?

Answer: Companies typically use standards to analyze the difference between budgeted costs and actual costs. The process of analyzing differences between standard costs and actual costs is called variance analysis. Managerial accountants perform variance analysis for costs including direct materials, direct labor, and manufacturing overhead.

Standard costs are also used to determine product costs. Companies using standard costing systems are able to estimate product costs without having to wait for actual product cost data, and they often record transactions using standard cost information. The appendix shows how this process works using journal entries.

Key Takeaways

- Standard costs are costs management expects to incur to provide a good or service. Manufacturing companies often establish standard costs for direct labor, direct materials, and manufacturing overhead. Standard cost information comes from a number of sources such as historical data, product specifications outlined by product engineers, contracts with suppliers, and labor union contracts.

Check Yourself

Carols Cookies produces and sells cookies all through the United States. We established a master budget indicating Carol expects to use 1.5 pounds of direct materials for each unit produced at a cost of $2 per pound (1 unit = 1 batch of cookies). Each unit produced will require 0.20 direct labor hours at a cost of $12 per hour. Variable manufacturing overhead is applied based on direct labor hours at a rate of $3.50 per hour. Last year's sales were expected to total 400,000 units.

Carol just received last year's actual results showing sales of 390,000 units.

1. Calculate the standard cost per unit for direct materials, direct labor, and variable manufacturing overhead using the format shown in Figure 4.1 "Standard Costs at Jerry's Ice Cream".
2. Prepare a flexible budget based on actual sales for direct materials, direct labor, and variable manufacturing overhead using the format shown in Figure 4.2 "Flexible Budget for Variable Production Costs at Jerry's Ice Cream".

Solution

	Standard Cost per Unit
Direct materials (1.5 pounds per unit at $2.00 per pound)	$3.00
Direct labor (0.20 hours at $12.00 per hour)	2.40
Variable overhead (0.20 direct labor hours at $3.50 per hour)	0.70
Standard variable production cost per unit	$6.10

1.

	Flexible Budget at 390,000 Units
Direct materials ($3.00 per unit × 390,000 units)	$1,170,000
Direct labor ($2.40 per unit × 390,000 units)	936,000
Variable overhead ($0.70 per unit × 390,000 units)	273,000
Total budgeted variable production costs at 390,000 units	$2,379,000

2.

4.3 Direct Materials Variance Analysis

Learning Objectives

1. Calculate and analyze direct materials variances.

Question: In the dialogue at the beginning of the chapter, the president of Jerry's Ice Cream was concerned about significant cost overruns for direct materials. We cannot simply explain these costs by saying that "we paid too much for materials" or "too many materials were used in production." Variances must be calculated to identify the exact cause of the cost overrun. What variances are used to analyze the difference between actual direct material costs and standard direct material costs?

Answer: The difference between actual costs and standard (or budgeted) costs is typically explained by two separate variances: the *materials price variance* and *materials quantity variance*. The materials price variance is the difference between actual costs for materials *purchased* and budgeted costs based on the standards. The materials quantity variance is the difference between the actual quantity of materials *used* in production and budgeted materials that should have been used in production based on the standards.

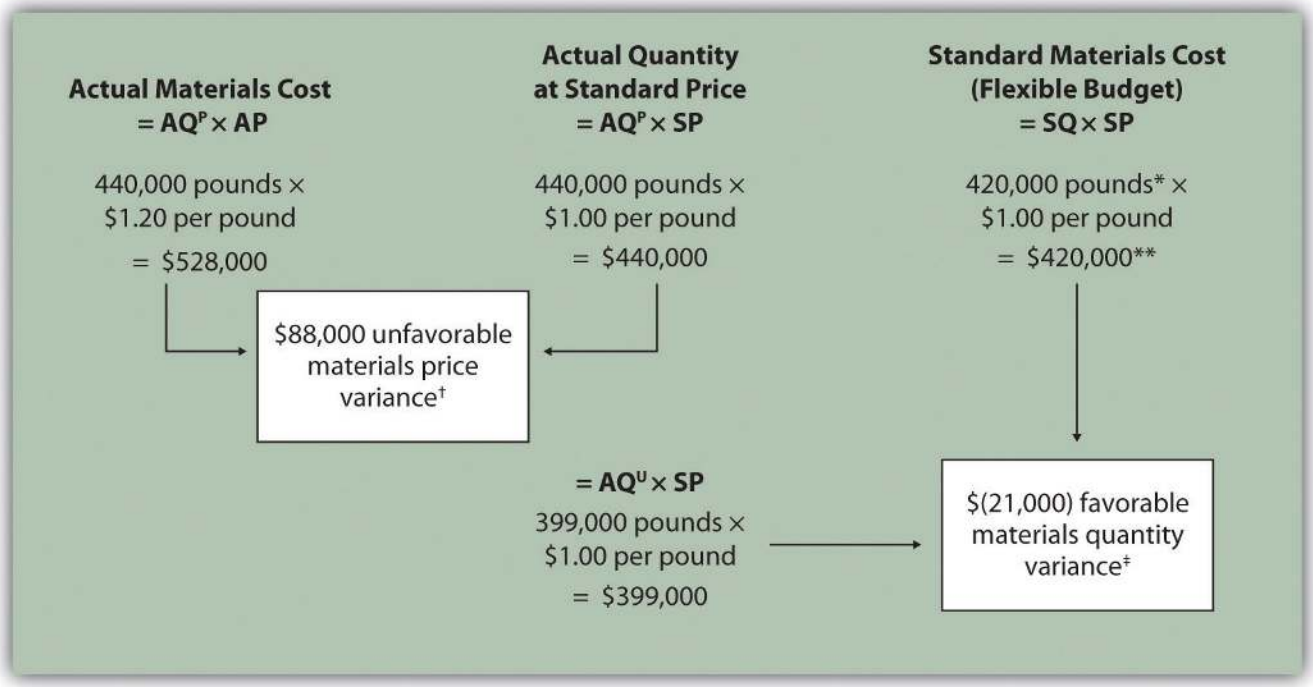
To this point, we have provided the data for Jerry's Ice Cream necessary to calculate standard costs. However, you must also have the *actual* materials cost and materials quantity data to calculate the variances described previously. The actual data for the year are as follows:

Sales volume	210,000 units
Direct materials purchased	440,000 pounds
Cost of direct materials purchased	$1.20 per pound
Direct materials used in production	399,000 pounds

Recall from that the direct materials standard price for Jerry's is $1 per pound, and the standard quantity of direct materials is 2 pounds per unit. Figure 4.4 "Direct Materials Variance Analysis for Jerry's Ice Cream" shows how to calculate the materials price

and quantity variances given the actual results and standards information. Review this figure carefully before moving on to the next section where these calculations are explained in detail.

Figure 4.4 Direct Materials Variance Analysis for Jerry's Ice Cream



Note: AQ^P = Actual quantity of materials purchased. AP = Actual price of materials. AQ^U = Actual quantity of materials used in production. SP = Standard price of materials. SQ = Standard quantity of materials for actual level of activity.

*Standard quantity of 420,000 pounds = Standard of 2 pounds per unit × 210,000 actual units produced and sold.

**$420,000 standard direct materials cost matches the flexible budget presented earlier

† $88,000 unfavorable materials price variance = $528,000 – $440,000. Variance is unfavorable because the actual price of $1.20 is higher than the expected (budgeted) price of $1.

‡ $(21,000) favorable materials quantity variance = $399,000 – $420,000. Variance is favorable because the actual quantity of materials used in production of 399,000 pounds is lower than the expected (budgeted) quantity of 420,000 pounds.

Direct Materials Price Variance Calculation

Question: The materials price variance answers the question, did we spend more or less on direct materials than expected? If the variance is unfavorable, we spent more than expected. If the variance is favorable, we spent less than expected. How is the materials price variance calculated?

Answer: As shown in Figure 4.4 "Direct Materials Variance Analysis for Jerry's Ice Cream", the materials price variance is the difference between the actual quantity of materials *purchased* at the actual price and the actual quantity of materials purchased at the standard price:

Key Equation

Materials price variance = $(AQ^P \times AP) – (AQ^P \times SP)$

Materials price variance=(AQP×AP)−(AQP×SP)=(440,000×$1.20)−(440,000×$1.00)=$88,000 unfavorable

Alternative Calculation. Since we are holding the *actual quantity* constant and evaluating the difference between actual price and standard price, the materials price variance calculation can be simplified as follows:

Key Equation

Materials price variance = (AP – SP) × AQ^P

Materials price variance=(AP−SP)×AQP=($1.20−$1.00)×440,000=$88,000 unfavorable

Note that both approaches—the direct materials price variance calculation and the alternative calculation—yield the same result.

When labeling the variances calculated in this chapter, notice that all positive variances are unfavorable and all negative variances are favorable (i.e., unfavorable cost variances *increase* expected costs and favorable cost variances *decrease* expected costs). As you calculate variances, you should think through the variance to confirm whether it is favorable or unfavorable. For example, the materials price variance calculation presented previously shows the actual price paid for materials was $1.20 per pound and the standard price was $1. Clearly, this is unfavorable because the actual price was higher than the expected (budgeted) price.

Direct Materials Quantity Variance Calculation

Question: The materials quantity variance answers the question, did we use more or fewer direct materials in production than expected? If the variance is unfavorable, we used more than expected. If the variance is favorable, we used fewer than expected. How is the materials quantity variance calculated?

Answer: As shown in Figure 4.4 “Direct Materials Variance Analysis for Jerry’s Ice Cream”, the materials quantity variance is the difference between the actual quantity of materials *used in production* at the standard price and the standard quantity of materials allowed at the standard price:

Key Equation

Materials quantity variance = (AQ^U × SP) – (SQ × SP)

Materials quantity variance=(AQU×SP)−(SQ×SP)=(399,000×$1.00)−(420,000×$1.00)=($21,000) favorable

The standard quantity of 420,000 pounds is the quantity of materials allowed given actual production. For Jerry’s Ice Cream, the standard quantity of materials per unit of production is 2 pounds per unit. Thus the standard quantity (SQ) of 420,000 pounds is 2 pounds per unit × 210,000 units produced and sold.

Alternative Calculation. Since we are holding the *standard price* constant and evaluating the difference between actual quantity used and standard quantity, the materials quantity variance calculation can be simplified as follows:

Key Equation

Materials quantity variance = (AQ^U – SQ) × SP

Materials quantity variance=(AQU−SQ)×SP=(399,000−420,000)×$1.00=($21,000) favorable

Note that both approaches—the direct materials quantity variance calculation and the alternative calculation—yield the same result.

The materials quantity variance calculation presented previously shows the actual quantity used in production of 399,000 pounds is lower than the expected (budgeted) quantity of 420,000 pounds. Clearly, this is *favorable* because the actual quantity used was lower than the expected (budgeted) quantity.

Possible Causes of Direct Materials Variances

Question: The managerial accountant at Jerry’s Ice Cream will likely investigate the cause of the unfavorable materials price variance of $88,000. This will lead to discussions with the purchasing department. What might have caused the $88,000 unfavorable materials price variance?

Answer: The left panel of Figure 4.5 “Possible Causes of Direct Materials Variances for Jerry’s Ice Cream” contains some possible explanations for this variance.

Figure 4.5 Possible Causes of Direct Materials Variances for Jerry’s Ice Cream

Unfavorable Materials Price Variance	Favorable Materials Quantity Variance
• High demand for materials caused a supplier to raise prices. • The shutdown of a key supplier caused materials shortages and higher prices. • The purchasing agent was ineffective in negotiating the lowest price. • Higher-quality materials were purchased at a higher price.	• Higher-quality materials reduced waste and spoilage. • An employee training program improved the efficient use of materials. • New production techniques promoted more efficient use of materials. • Improved maintenance of production equipment reduced waste of materials.

Whatever the cause of this unfavorable variance, Jerry's Ice Cream will likely take action to improve the cost problem identified in the materials price variance analysis. This is why we use the term *control phase of budgeting* to describe variance analysis. Through variance analysis, companies are able to identify problem areas (material costs for Jerry's) and consider alternatives to controlling costs in the future.

Question: Jerry's Ice Cream might also choose to investigate the $21,000 favorable materials quantity variance. Although this could be viewed as good news for the company, management may want to know why this favorable variance occurred. What might have caused the $21,000 favorable materials quantity variance?

Answer: The right panel of Figure 4.5 "Possible Causes of Direct Materials Variances for Jerry's Ice Cream" contains some possible explanations for this variance.

Notice how the cause of one variance might influence another variance. For example, the unfavorable price variance at Jerry's Ice Cream might have been a result of purchasing high-quality materials, which in turn led to less waste in production and a favorable quantity variance. This also might have a positive impact on direct labor, as less time will be spent dealing with materials waste.

Note 10.26 "Business in Action 10.2" illustrates just how important it is to track direct materials variances accurately.

Business in Action 4.1

The Effect of Rising Materials Costs on Auto Suppliers

In the first six months of 2004, steel prices increased 76 percent, from $350 a ton to $617 a ton. For auto suppliers that use hundreds of tons of steel each year, this had the unexpected effect of increasing expenses and reducing profits. For example, a major producer of automotive wheels had to reduce its annual earnings forecast by $10,000,000 to $15,000,000 as a result of the increase in steel prices.

Most auto part suppliers operate with very small margins. **GR Spring and Stamping, Inc.**, a supplier of stampings to automotive companies, was generating pretax profit margins of about 3 percent prior to the increase in steel prices. Profit margins have been cut in half since steel prices began rising.

These thin margins are the reason auto suppliers examine direct materials variances so carefully. Any unexpected increase in steel prices will likely cause significant unfavorable materials price variances, which will lead to lower profits. Auto part suppliers that rely on steel will continue to scrutinize materials price variances and materials quantity variances to control costs, particularly in a period of rising steel prices.

Source: Brett Clanton, "Steel Costs Slam Auto Suppliers," *The Detroit News*, June 29, 2004, http://www.detnews.com.

Clarification of Favorable Versus Unfavorable

Question: Why are variances labeled favorable or unfavorable?

Answer: The terms *favorable* and *unfavorable* relate to the impact the variance has on budgeted operating profit. A favorable variance has a positive impact on operating profit. An unfavorable variance has a negative impact on operating profit. Companies using a standard cost system ultimately credit favorable variances and debit unfavorable variances to income statement accounts. The appendix to this chapter describes this process in further detail.

Key Takeaways

- Standard costs are used to establish the flexible budget for direct materials. The flexible budget is compared to actual costs, and the difference is shown in the form of two variances. The *materials price variance* focuses on the price paid for materials, and it is defined as the difference between the actual quantity of materials purchased at the actual price and the actual quantity of materials purchased at the standard price. The *materials quantity variance* focuses on the quantity of materials used in production. It is defined as the difference between the actual quantity of materials used in production and budgeted materials that should have been used in production based on the standards.

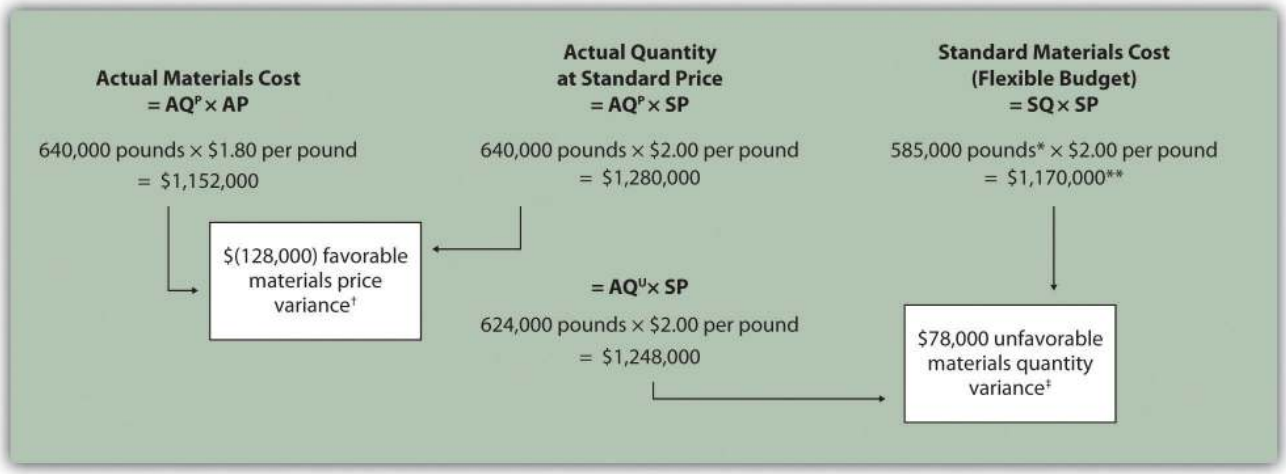
Check Yourself

Carol's Cookies expected to use 1.5 pounds of direct materials to produce 1 unit (batch) of product at a cost of $2 per pound. Actual results are in for last year, which indicates 390,000 batches of cookies were sold. The company purchased 640,000 pounds of materials at $1.80 per pound and used 624,000 pounds in production.

1. Calculate the materials price and quantity variances.
2. Use the formula approach to calculating the materials price and quantity variances, and compare the result to the result in part **1**. (Hint: the variances should match.)
3. Suggest several possible reasons for the materials price and quantity variances.

Solution

1. As shown in the following, the materials price variance is $(128,000) favorable, and the materials quantity variance is $78,000 unfavorable.



Note: AQ^P = Actual quantity of materials purchased. AP = Actual price of materials. AQ^U = Actual quantity of materials used in production. SP = Standard price of materials. SQ = Standard quantity of materials for actual level of activity.

*Standard quantity of 585,000 pounds = Standard of 1.5 pounds per unit × 390,000 actual units produced and sold.

$1,170,000 standard direct materials cost matches the flexible budget presented in an earlier check yourself, part **2.

† $(128,000) favorable materials price variance = $1,152,000 – $1,280,000. Variance is favorable because the actual price of $1.80 is lower than the expected (budgeted) price of $2

‡ $78,000 unfavorable materials quantity variance = $1,248,000 – $1,170,000. Variance is unfavorable because the actual quantity of materials used in production of 624,000 pounds is higher than the expected (budgeted) quantity of 585,000 pounds.

2. Alternative direct materials variance calculations:

   Materials price variance=(AP−SP)×AQP=($1.80−$2.00)×640,000=($128,000) favorable (same as part 1)
   Materials quantity variance=(AQU− SQ)×SP=(624,000− 585,000)×$2.00=$78,000 unfavorable (same as part 1)

3. *Possible causes of favorable materials price variance are*

   - The supplier had excess materials on hand and lowered prices to sell off inventory;
   - New suppliers entered the market, which resulted in an excess supply of materials and lower prices;
   - Carol's Cookies' purchasing agent is a strong negotiator and was able to negotiate lower prices than anticipated;
   - Lower-quality materials were purchased at a lower price.

   Possible causes of unfavorable materials quantity variance are

   - Lower-quality materials resulted in more waste and spoilage;
   - New, inexperienced employees were hired, resulting in more waste;

4.4 Direct Labor Variance Analysis

Learning Objectives

1. Calculate and analyze direct labor variances.

Question: In addition to investigating the causes of cost overruns for direct materials, the president of Jerry's Ice Cream wants to know why there were cost overruns for direct labor. What variances are used to analyze these types of direct labor cost overruns?

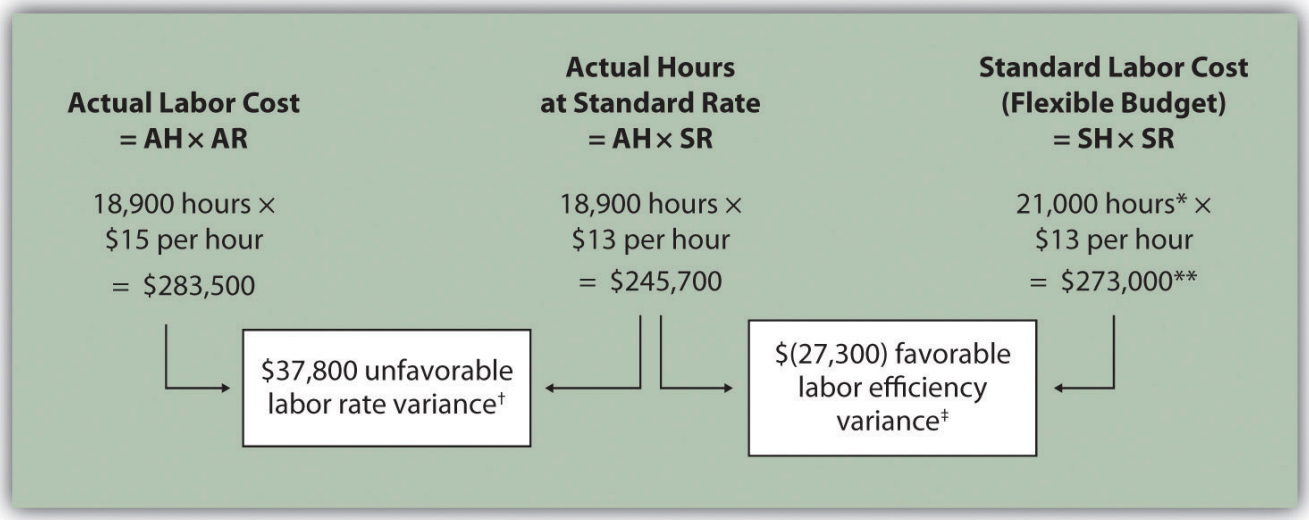
Answer: Similar to direct materials variances, direct labor variance analysis involves two separate variances: the *labor rate variance* and *labor efficiency variance*. The labor rate variance is the difference between actual costs for direct labor and budgeted costs based on the standards. The labor efficiency variance is the difference between the actual number of direct labor hours worked and budgeted direct labor hours that should have been worked based on the standards.

At Jerry's Ice Cream, the actual data for the year are as follows:

Sales volume	210,000 units
Direct labor hours worked	18,900 hours
Cost of direct labor	$15 per hour

Recall from Figure 4.1 "Standard Costs at Jerry's Ice Cream" that the standard rate for Jerry's is $13 per direct labor hour and the standard direct labor hours is 0.10 per unit. Figure 4.6 "Direct Labor Variance Analysis for Jerry's Ice Cream" shows how to calculate the labor rate and efficiency variances given the actual results and standards information. Review this figure carefully before moving on to the next section where these calculations are explained in detail.

Figure 4.6 Direct Labor Variance Analysis for Jerry's Ice Cream



Note: AH = Actual hours of direct labor. AR = Actual rate incurred for direct labor. SR = Standard rate for direct labor. SH = Standard hours of direct labor for actual level of activity.

*Standard hours of 21,000 = Standard of 0.10 hours per unit × 210,000 actual units produced and sold.

**$273,000 standard direct labor cost matches the flexible budget presented in Figure 4.2 "Flexible Budget for Variable Production Costs at Jerry's Ice Cream".

† $37,800 unfavorable labor rate variance = $283,500 – $245,700. Variance is unfavorable because the actual rate of $15 is higher than the expected (budgeted) rate of $13.

‡ $(27,300) favorable labor efficiency variance = $245,700 – $273,000. Variance is favorable because the actual hours of 18,900 are lower than the expected (budgeted) hours of 21,000.

Direct Labor Rate Variance Calculation

Question: The direct labor rate variance answers the question, did we spend more or less on direct labor than expected? If the variance is unfavorable, we spent more than expected. If the variance is favorable, we spent less than expected. How is the labor rate variance calculated?

Answer: As shown in Figure 4.6 "Direct Labor Variance Analysis for Jerry's Ice Cream", the labor rate variance is the difference between the actual hours worked at the actual rate and the actual hours worked at the standard rate:

Key Equation

Labor rate variance = (AH × AR) − (AH × SR)

Labor rate variance=(AH×AR)−(AH×SR)=(18,900×$15)−(18,900×$13)= $37,800 unfavorable

Alternative Calculation. Because we are holding the *actual hours* constant and evaluating the difference between actual rate and standard rate, the labor rate variance calculation can be simplified as follows:

Key Equation

Labor rate variance = (AR − SR) × AH

Labor rate variance=(AR−SR)×AH=($15−$13)×18,900= $37,800 unfavorable

Note that both approaches—direct labor rate variance calculation and the alternative calculation—yield the same result.

As with direct materials variances, all positive variances are unfavorable, and all negative variances are favorable. The labor rate variance calculation presented previously shows the actual rate paid for labor was $15 per hour and the standard rate was $13. This results in an *unfavorable* variance since the actual rate was higher than the expected (budgeted) rate.

Direct Labor Efficiency Variance Calculation

Question: The direct labor efficiency variance answers the question, did we use more or less direct labor hours in production than expected? If the variance is unfavorable, we used more than expected. If the variance is favorable, we used less than expected. How is the labor efficiency variance calculated?

Answer: As shown in Figure 4.6 "Direct Labor Variance Analysis for Jerry's Ice Cream", the labor efficiency variance is the difference between the actual hours worked at the standard rate and the standard hours at the standard rate:

Key Equation

Labor efficiency variance = (AH × SR) − (SH × SR)

Labor efficiency variance=(AH×SR)−(SH×SR)=(18,900×$13)−(21,000×$13)=($27,300) favorable

The 21,000 standard hours are the hours allowed given actual production. For Jerry's Ice Cream, the standard allows for 0.10 labor hours per unit of production. Thus the 21,000 standard hours (SH) is 0.10 hours per unit × 210,000 units produced.

Alternative Calculation. Because we are holding the *standard rate* constant and evaluating the difference between actual hours worked and standard hours, the labor efficiency variance calculation can be simplified as follows:

Key Equation

Labor efficiency variance = (AH − SH) × SR

Labor efficiency variance=(AH−SH)× SR=(18,900−21,000)×$13=($27,300) favorable

Note that both approaches—the direct labor efficiency variance calculation and the alternative calculation—yield the same result.

The labor efficiency variance calculation presented previously shows that 18,900 in actual hours worked is lower than the 21,000 budgeted hours. Clearly, this is *favorable* since the actual hours worked was lower than the expected (budgeted) hours.

Possible Causes of Direct Labor Variances

Question: The managerial accountant at Jerry's Ice Cream is interested in finding the cause of the unfavorable labor rate *variance of $37,800. Jerry's Ice Cream might also choose to investigate the $27,300 favorable labor* efficiency *variance. Although this could be viewed as good news for the company, management may want to know why this favorable variance occurred. What might have caused the $37,800 unfavorable labor rate variance and $27,300 favorable labor efficiency variance?*

Answer: Figure 4.7 "Possible Causes of Direct Labor Variances for Jerry's Ice Cream" contains some possible explanations for the labor rate variance (left panel) and labor efficiency variance (right panel).

Figure 4.7 Possible Causes of Direct Labor Variances for Jerry's Ice Cream

Unfavorable Labor Rate Variance	Favorable Labor Efficiency Variance
• Higher mix of skilled workers caused hourly rates to be higher than expected. • An unexpected increase in demand caused the direct labor workforce to work overtime, requiring the company to pay overtime wages. • A new labor contract increased wages for the direct labor workforce.	• A higher mix of skilled workers made more efficient use of labor hours. • An employee training program improved the efficient use of time. • New production techniques promoted more efficient use of time. • High-quality materials resulted in less time spent working with materials waste.

As mentioned earlier, the cause of one variance might influence another variance. For example, many of the explanations shown in Figure 4.7 “Possible Causes of Direct Labor Variances for Jerry’s Ice Cream” might also apply to the favorable materials quantity variance.

We have demonstrated how important it is for managers to be aware not only of the cost of labor, but also of the differences between budgeted labor costs and actual labor costs. This awareness helps managers make decisions that protect the financial health of their companies.

Follow-Up Meeting at Jerry’s Ice Cream

Jerry (president and owner), Tom (sales manager), Lynn (production manager), and Michelle (treasurer and controller) were at the meeting described at the opening of this chapter. Michelle was asked to find out why direct labor and direct materials costs were higher than budgeted, even after factoring in the 5 percent increase in sales over the initial budget. Lynn was surprised to learn that direct labor and direct materials costs were so high, particularly since actual materials used and actual direct labor hours worked were below budget.

The group met again a week later to discuss the issue.

Jerry:
Michelle, what do you have for us?

Michelle:
My staff has been working hard to identify why direct materials and direct labor costs were higher than expected. First, I would like to confirm that these costs were indeed higher than anticipated.

Lynn:
I still don’t see how this can be. My production crew was as efficient with their time and materials as they’ve ever been.

Michelle:
You’re right, Lynn. Our variance analysis shows a favorable direct materials quantity variance, which relates directly to the amount of materials used, and a favorable direct labor efficiency variance, which relates directly to the efficiency of our production workers. Both variances are good news.

Jerry:
Then why are our direct labor and direct materials costs so high?

Michelle:
The answer relates directly to the price we paid for materials, and the hourly rates we paid for labor. Both were higher than expected. We expected to pay $1 per pound for direct materials, but actually paid $1.20 per pound. In addition, we expected to pay $13 an hour for direct labor when in fact we actually paid $15 an hour. This means we paid 20 percent more than expected for direct materials, which is $0.20 divided by $1, and 15 percent more than expected for direct labor, which is $2 divided by $13.

Lynn:
I do recall Tony over in purchasing telling me he obtained some premium materials for our ice cream, and I know we hired some relatively experienced workers who were paid a bit more than the normal starting rate.

Tom:
This might explain why our customers were thrilled about our product. The materials were high quality and the production workers really knew their stuff!

Jerry:
While I like the end result of a higher-quality product and increased sales, we must do a better job of controlling costs. Perhaps Tony can negotiate a better price for materials. I don't mind paying our employees a higher wage based on their experience, but let's make sure we get some efficiency savings in the process to help offset the higher wages. Michelle, can we continue to monitor material and labor costs?

Michelle:
Yes. I'll have my staff analyze material and labor variances monthly, and I'll have a report ready at the end of each month for you and Lynn.

Jerry:
Excellent! Lynn, let our production crew know they are doing a fine job, and continue to encourage them to find ways to improve the efficiency of production. I'll talk with Tony about the possibility of getting a better deal on materials.

As stated earlier, variance analysis is the *control* phase of budgeting. Using variance analysis for direct materials and direct labor, Jerry's Ice Cream was able to identify strong points in its operations (quantity of materials used and efficiency of direct labor workforce), and perhaps more important, Jerry's was able to identify problem areas (price paid for materials and wages paid to employees). This information gives the management a way to monitor and control production costs. Next, we calculate and analyze variable manufacturing overhead cost variances.

Key Takeaways

- Standard costs are used to establish the flexible budget for direct labor. The flexible budget is compared to actual costs, and the difference is shown in the form of two variances. The *labor rate variance* focuses on the wages paid for labor and is defined as the difference between actual costs for direct labor and budgeted costs based on the standards. The *labor efficiency variance* focuses on the quantity of labor hours used in production. It is defined as the difference between the actual number of direct labor hours worked and budgeted direct labor hours that should have been worked based on the standards.

Check Yourself

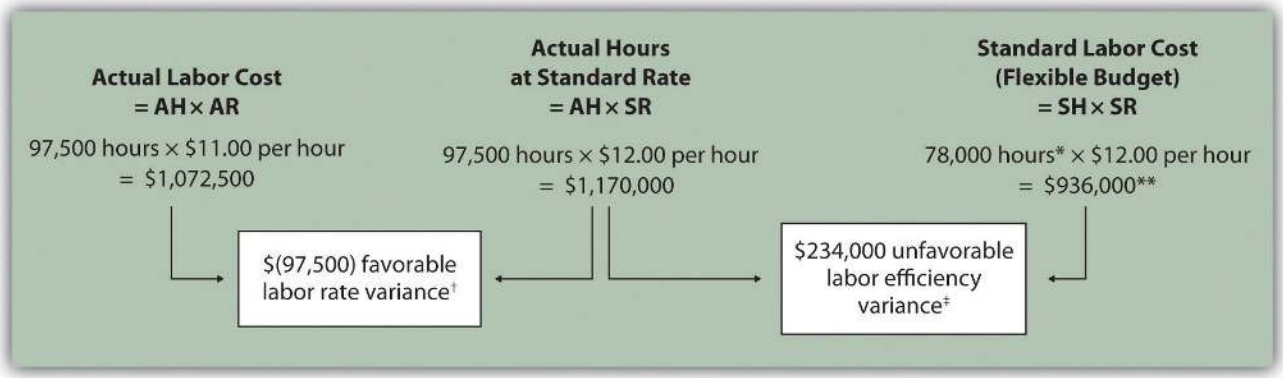
Carol's Cookies expected to use 0.20 direct labor hours to produce 1 unit (batch) of product at a cost of $12 per hour. Actual results are in for last year, which indicates 390,000 batches of cookies were sold. The company's direct labor workforce worked 97,500 hours at $11 per hour.

1. Calculate the labor rate and efficiency variances using the format shown in Figure 4.6 "Direct Labor Variance Analysis for Jerry's Ice Cream".
2. Use the alternative approach to calculating the labor rate and efficiency variances, and compare the result to the result in part **1**. (Hint: the variances should match.)

3. Suggest several possible reasons for the labor rate and efficiency variances.

Solution

1. As shown in the following, the labor rate variance is $(97,500) favorable, and the labor efficiency variance is $234,000 unfavorable.



Note: AH = Actual hours of direct labor. AR = Actual rate incurred for direct labor. SR = Standard rate for direct labor. SH = Standard hours of direct labor for actual level of activity.

*Standard hours of 78,000 = Standard of 0.20 hours per unit × 390,000 actual units produced and sold.

$936,000 standard direct labor cost matches the flexible budget presented earlier, part **2.

† $(97,500) favorable labor rate variance = $1,072,500 – $1,170,000. Variance is favorable because the actual rate of $11 is lower than the expected (budgeted) rate of $12.

‡ $234,000 unfavorable labor efficiency variance = $1,170,000 – $936,000. Variance is unfavorable because the actual hours of 97,500 are higher than the expected (budgeted) hours of 78,000.

2. The following are alternative direct labor variance calculations:

   Labor rate variance=(AR−SR)×AH=($11−$12)×97,500=($97,500) favorable (same as part 1)
   Labor efficiency variance=(AH−SH)×SR=(97,500−78,000)×$12=$234,000 unfavorable (same as part 1)

3. *Possible causes of favorable labor rate variance are*

   - A higher mix of newly hired and unskilled workers caused hourly rates to be lower than anticipated;
   - Product demand was lower than expected, thereby reducing the amount of overtime initially anticipated;
   - A new labor contract was negotiated at lower pay rates than anticipated.

   Possible causes of unfavorable labor efficiency variance are

   - A higher mix of unskilled workers than anticipated caused inefficiencies;
   - Cutbacks in training reduced the expected efficiency of direct labor workers;
   - Old equipment breaking down caused workers to waste time waiting for repairs.

4.5 Variable Manufacturing Overhead Variance Analysis

Learning Objectives

1. Calculate and analyze variable manufacturing overhead variances.

Question: Similar to direct materials and direct labor variances, variable manufacturing overhead variance analysis involves two separate variances. What are the two variances used to analyze the difference between actual variable overhead costs and standard

variable overhead costs?

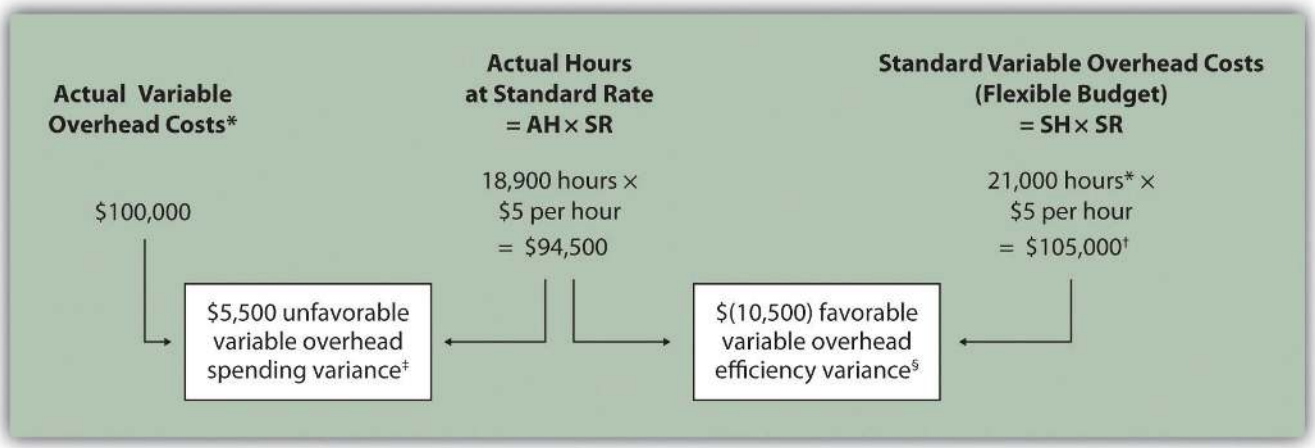
Answer: The two variances used to analyze this difference are the *spending variance* and *efficiency variance*. The variable overhead spending variance is the difference between actual costs for variable overhead and budgeted costs based on the standards. For a company that allocates variable manufacturing overhead to products based on direct labor hours, the variable overhead efficiency variance is the difference between the number of direct labor hours actually worked and what should have been worked based on the standards.

At Jerry's Ice Cream, the actual data for the year are as follows:

Sales volume	210,000 units
Direct labor hours worked	18,900 hours
Total cost of variable overhead	$100,000

Recall from Figure 4.1 "Standard Costs at Jerry's Ice Cream" that the variable overhead standard rate for Jerry's is $5 per direct labor hour and the standard direct labor hours is 0.10 per unit. Figure 4.8 "Variable Manufacturing Overhead Variance Analysis for Jerry's Ice Cream" shows how to calculate the variable overhead spending and efficiency variances given the actual results and standards information. Review this figure carefully before moving on to the next section where these calculations are explained in detail.

Figure 4.8 Variable Manufacturing Overhead Variance Analysis for Jerry's Ice Cream



Note: AH = Actual hours of direct labor. (This measure will depend on the allocation base that the company uses. Jerry's uses direct labor hours to allocate variable manufacturing overhead, so AH refers to actual direct labor hours.) SR = Standard variable manufacturing overhead rate per direct labor hour. SH = Standard hours of direct labor for actual level of activity.

*Since variable overhead is not purchased per direct labor hour, the actual rate (AR) is not used in this calculation. Simply use the total cost of variable manufacturing overhead instead.

**Standard hours of 21,000 = Standard of 0.10 hours per unit × 210,000 actual units produced and sold.

† $105,000 standard variable overhead costs matches the flexible budget presented in Figure 4.2 "Flexible Budget for Variable Production Costs at Jerry's Ice Cream".

‡ $5,500 unfavorable variable overhead spending variance = $100,000 – $94,500. Variance is unfavorable because the actual variable overhead costs are higher than the expected costs given actual hours of 18,900.

§ $(10,500) favorable variable overhead efficiency variance = $94,500 – $105,000. Variance is favorable because the actual hours of 18,900 are lower than the expected (budgeted) hours of 21,000.

Variable Overhead Spending Variance Calculation

Question: How is the variable overhead spending variance calculated?

Answer: As shown in Figure 4.8 "Variable Manufacturing Overhead Variance Analysis for Jerry's Ice Cream", the variable overhead spending variance is the difference between what is actually paid for variable overhead and what should have been paid according to the standards:

Key Equation

Variable overhead spending variance = Actual costs − (AH × SR)

Variable overhead spending variance=Actual costs−(AH×SR)=$100,000−(18,900×$5)= $5,500 unfavorable

As with direct materials and direct labor variances, all positive variances are unfavorable, and all negative variances are favorable. Note that there is no alternative calculation for the variable overhead spending variance because variable overhead costs are not purchased per direct labor hour. Thus actual rate (AR) is not used for this variance.

This variance is unfavorable for Jerry's Ice Cream because actual costs of $100,000 are higher than expected costs of $94,500.

Variable Overhead Efficiency Variance Calculation

Question: How is the variable overhead efficiency variance calculated?

Answer: As shown in Figure 4.8 "Variable Manufacturing Overhead Variance Analysis for Jerry's Ice Cream", the variable overhead efficiency variance is the difference between the actual hours worked at the standard rate and the standard hours at the standard rate:

Key Equation

Variable overhead efficiency variance = (AH × SR) − (SH × SR)

Variable overhead efficiency variance=(AH×SR)−(SH×SR)=(18,900×$5)−(21,000×$5)=($10,500) favorable

The 21,000 standard hours are the hours allowed given actual production (= 0.10 standard hours allowed per unit × 210,000 units produced). Since actual direct labor hours worked total 18,900, the variable manufacturing overhead costs should be lower than initially anticipated at 21,000 standard hours. (This assumes variable overhead costs are truly driven by direct labor hours!) This results in a favorable variable overhead efficiency variance.

Alternative Calculation. Since we are holding the *standard rate* constant and evaluating the difference between actual hours worked and standard hours, the variable overhead efficiency variance calculation can be simplified as follows:

Key Equation

Variable overhead efficiency variance = (AH − SH) × SR

Variable overhead efficiency variance=(AH−SH)×SR=(18,900−21,000)×$5=($10,500) favorable

Note that both approaches—the variable overhead efficiency variance calculation and the alternative calculation—yield the same result.

The variable overhead efficiency variance calculation presented previously shows that 18,900 in actual hours worked is lower than the 21,000 budgeted hours. Again, this variance is *favorable* because working fewer hours than expected should result in lower variable manufacturing overhead costs.

Possible Causes of Variable Manufacturing Overhead Variances

Question: The managerial accountant at Jerry's Ice Cream is interested in finding the cause of the unfavorable variable overhead spending variance of $5,500. The spending variance can result from variances in the cost of variable overhead items and the usage of these items. What might have caused the $5,500 unfavorable variable overhead spending variance?

Answer: The left panel of Figure 4.9 “Possible Causes of Variable Manufacturing Overhead Variances for Jerry’s Ice Cream” contains some possible explanations for Jerry’s unfavorable overhead spending variance.

Figure 4.9 Possible Causes of Variable Manufacturing Overhead Variances for Jerry’s Ice Cream

Unfavorable Variable Overhead Spending Variance	Favorable Variable Overhead Efficiency Variance
• A higher mix of skilled indirect labor workers increased hourly rates above expected rates. • A national oil shortage increased factory utility costs above expected costs. • A shutdown of a key supplier increased indirect materials costs.	• A higher mix of skilled direct labor workers made more efficient use of labor hours. • An employee training program improved the efficient use of time. • New production techniques promoted more efficient use of time. • High-quality materials resulted in fewer defective products and more efficient use of time.

Question: Jerry’s Ice Cream might also choose to investigate the $10,500 favorable variable overhead efficiency variance. What might have caused the $10,500 favorable variable overhead efficiency variance?

Answer: The focus here is on the activity base used to allocate overhead. Since Jerry’s uses direct labor hours as the activity base, the possible explanations for this variance are linked to efficiencies or inefficiencies in the use of direct labor. The right panel of Figure 4.9 “Possible Causes of Variable Manufacturing Overhead Variances for Jerry’s Ice Cream” contains some possible explanations for this variance.

Again, this analysis is appropriate assuming direct labor hours truly drives the use of variable overhead activities. That is, we assume that an increase in direct labor hours will increase variable overhead costs and that a decrease in direct labor hours will decrease variable overhead costs.

Business in Action 4.2

Hiding Fraud in Overhead Accounts

The controller of a small, closely held manufacturing company embezzled close to $1,000,000 over a 3-year period. With annual revenues of $30,000,000 and less than 100 employees, the company certainly felt the impact of losing $1,000,000.

The forensic accountant who investigated the fraud identified several suspicious transactions, all of which were charged to the manufacturing overhead account. To prevent this type of fraud in the future, the forensic accountant recommended that “significant manufacturing overhead variances be analyzed both within and across time periods to identify anomalies.” Apparently, the company was not closely monitoring manufacturing overhead variances when the fraud occurred.

Source: John B. MacArthur, Bobby E. Waldrup, and Gary R. Fane, “Caution: Fraud Overhead,” *Strategic Finance*, October 2004, 28–32.

Key Takeaways

- Standard costs are used to establish the flexible budget for variable manufacturing overhead. The flexible budget is compared to actual costs, and the difference is shown in the form of two variances. The *variable overhead spending variance* represents the difference between actual costs for variable overhead and budgeted costs based on the standards. The *variable overhead*

efficiency variance is the difference between the actual activity level in the allocation base (often direct labor hours or machine hours) and the budgeted activity level in the allocation base according to the standards.

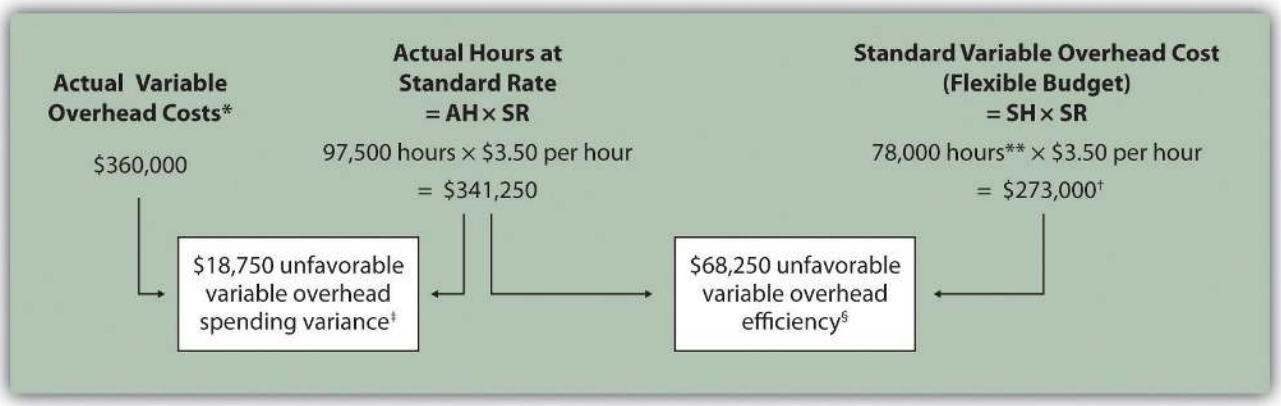
Check Yourself

Carol's Cookies expected to use 0.20 direct labor hours to produce 1 unit (batch) of product, and the variable overhead rate is $3.50 per hour. Actual results are in for last year, which indicates 390,000 batches of cookies were produced and sold. The company's direct labor workforce worked 97,500 hours, and variable overhead costs totaled $360,000.

1. Calculate the variable overhead spending and efficiency variances using the format shown in Figure 4.8 "Variable Manufacturing Overhead Variance Analysis for Jerry's Ice Cream".
2. Suggest several possible reasons for the variable overhead spending and efficiency variances.

Solution

1. As shown in the following, the variable overhead spending variance is $18,750 unfavorable, and the variable overhead efficiency variance is $68,250 unfavorable.



AH = Actual hours of direct labor. SR = Standard variable manufacturing overhead rate per direct labor hour. SH = Standard hours of direct labor for actual level of activity.

*Since variable overhead is not purchased per direct labor hour, the actual rate (AR) is not used in this calculation. Simply use the total cost of variable manufacturing overhead instead.

**Standard hours of 78,000 = Standard of 0.20 hours per unit × 390,000 actual units produced and sold.

† $273,000 standard variable overhead costs match the flexible budget presented **earlier**.

‡ $18,750 unfavorable variable overhead spending variance = $360,000 – $341,250. Variance is unfavorable because the actual variable overhead costs are higher than the expected costs given actual hours of 97,500.

§ $68,250 unfavorable variable overhead efficiency variance = $341,250 – $273,000. Variance is unfavorable because the actual hours of 97,500 are higher than the expected (budgeted) hours of 78,000.

2. *Possible causes of unfavorable variable overhead spending variance are*

   - A higher mix of skilled indirect labor workers caused hourly rates to be higher than anticipated;
   - Utility costs to run the machines were higher than anticipated due to a nationwide increase in energy costs;
   - A shortage in available indirect materials caused costs to increase unexpectedly.

   Possible causes of unfavorable variable overhead efficiency variance are

   - A higher mix of unskilled workers than anticipated caused inefficiencies;
   - Cutbacks in training reduced the expected efficiency of direct labor workers;
   - Old equipment breaking down caused workers to waste time waiting for repairs.

4.6 Determining Which Cost Variances to Investigate

Learning Objectives

1. Determine which variances to investigate.

Question: Companies rarely investigate all variances because there is a cost associated with identifying the causes of variances. This cost involves employees who spend time talking with personnel from areas including purchasing and production to determine why variances occurred and how to control costs in the future. What can managers do to reduce the cost of investigating variances?

Answer: Managers typically establish criteria to determine which variances to focus on rather than simply investigating all variances. This is called *management by exception*. Management by exception describes managers who focus solely on variances that are significant.

Question: Figure 4.10 "Comparison of Variable and Fixed Manufacturing Overhead Variance Analysis for Jerry's Ice Cream" summarizes the cost variances calculated for Jerry's Ice Cream. If you were in charge of investigating variances at Jerry's Ice Cream, how would you determine which variances to focus on and which to ignore?

Figure 4.10 Summary of Cost Variances at Jerry's Ice Cream

Cost Variances for the Year		
Direct materials price variance*	$88,000	Unfavorable
Direct materials quantity variance*	(21,000)	Favorable
Direct labor rate variance**	37,800	Unfavorable
Direct labor efficiency variance**	(27,300)	Favorable
Variable overhead spending variance†	5,500	Unfavorable
Variable overhead efficiency variance†	(10,500)	Favorable
Total variable production cost variance	$72,500	Unfavorable

*From Figure 4.4 "Direct Materials Variance Analysis for Jerry's Ice Cream".

**From Figure 4.6 "Direct Labor Variance Analysis for Jerry's Ice Cream".

† From Figure 4.8 "Variable Manufacturing Overhead Variance Analysis for Jerry's Ice Cream".

Answer: Some managers might review all unfavorable variances. However, the variable overhead spending variance of $5,500 is not very significant relative to the other variances and may not be worth investigating. Also, by focusing solely on unfavorable variances, managers might overlook problems that may result from favorable variances.

Another approach might be to investigate all favorable and unfavorable variances above a certain minimum level, calculated as a percent of the flexible budget amount. For example, management could establish a policy to investigate all variances at or above 10 percent of the flexible budget amount for each cost. At Jerry's Ice Cream, this would mean investigating all variances at or above $42,000 for direct materials (= 10 percent × $420,000), $27,300 for direct labor (= 10 percent × $273,000), and $10,500 for variable overhead (= 10 percent × $105,000). Based on this policy, the following variances would be investigated:

- Unfavorable direct materials price variance of $88,000 (≥ $42,000 minimum)
- Unfavorable direct labor rate variance of $37,800 (≥ $27,300 minimum)
- Favorable direct labor efficiency variance of $(27,300) (≥ $27,300 minimum)

- Favorable variable overhead efficiency variance of $(10,500) (≥ $10,500 minimum)

Many companies calculate and investigate variances weekly, monthly, or quarterly and focus on trends. In this case, they may only investigate variances that are unfavorable and increasing over time.

Whatever the approach, managers understand that investigating variances requires resources. Thus managers must establish an efficient and cost-effective approach to analyzing variances by weighing the benefits derived from investigating variances against the costs incurred to perform the analysis.

Key Takeaways

- Companies often establish criteria to use in determining which variances to investigate. Some might investigate all variances above a certain dollar amount. Others might investigate variances that are above a certain percentage of the flexible budget. Or management might combine the two and investigate variances above a certain dollar amount and above a certain percentage of the flexible budget.

Check Yourself

Use the solutions to earlier Check Yourself exercises:

1. Calculate the total variable production cost variance for Carol's Cookies using the format shown in Figure 4.10 "Summary of Cost Variances at Jerry's Ice Cream".
2. Assume management investigates all variances at or above 15 percent of the flexible budget amount (e.g., all direct materials variances at or above 15 percent of the direct materials flexible budget are investigated). Identify which of the six variances calculated for direct materials, direct labor, and variable manufacturing overhead management should investigate.

Solution

1. See the following figure.

Cost Variances for the Year		
Direct materials price variance*	$ (128,000)	Favorable
Direct materials quantity variance*	78,000	Unfavorable
Direct labor rate variance**	(97,500)	Favorable
Direct labor efficiency variance**	234,000	Unfavorable
Variable overhead spending variance†	18,750	Unfavorable
Variable overhead efficiency variance†	68,250	Unfavorable
Total variable production cost variance	$ 173,500	Unfavorable

*From earlier.

**From earlier.

† From earlier.

2. Based on this policy, the following variances would be investigated:
   - **Direct Materials.** Neither variance would be investigated as both variances fall below $175,500 (= 15 percent of $1,170,000 standard cost).

- **Direct Labor.** The unfavorable direct labor efficiency variance of $234,000 would be investigated because it falls above $140,400 (= 15 percent of $936,000 standard cost).
- **Variable Overhead.** The unfavorable variable overhead efficiency variance of $68,250 would be investigated because it falls above $40,950 (= 15 percent of $273,000 standard cost).

4.7 Using Variance Analysis with Activity-Based Costing

Learning Objective

1. Explain how to use cost variance analysis with activity-based costing.

Question: As discussed in Chapter 2 "How Does an Organization Use Activity-Based Costing to Allocate Overhead Costs?", activity-based costing focuses on identifying activities required to make a product, forming cost pools for each activity, and allocating overhead costs to products based on the products' use of each activity. Rather than establishing one standard variable overhead rate and standard quantity based on one cost driver, activity-based costing establishes several standard variable overhead rates and quantities, each having its own cost driver. How would variance analysis be implemented for a company that uses activity-based costing?

Answer: Regardless of whether a company uses the traditional costing approach or an activity-based costing approach, the process of performing variance analysis is the same. Similar to the traditional costing approach, the variable overhead *spending variance* for activity-based costing is calculated *for each activity* as follows:

Key Equation

Variable overhead spending variance = Actual cost − (AQ × SR)

The variable overhead *efficiency variance* is calculated *for each activity* using activity-based costing as follows:

Key Equation

Variable overhead efficiency variance = (AQ × SR) − (SQ × SR)

Instead of using AH and SH to represent actual hours and standard hours as we did earlier in the chapter, we use AQ and SQ to represent actual quantity and standard quantity for various activities used in activity-based costing.

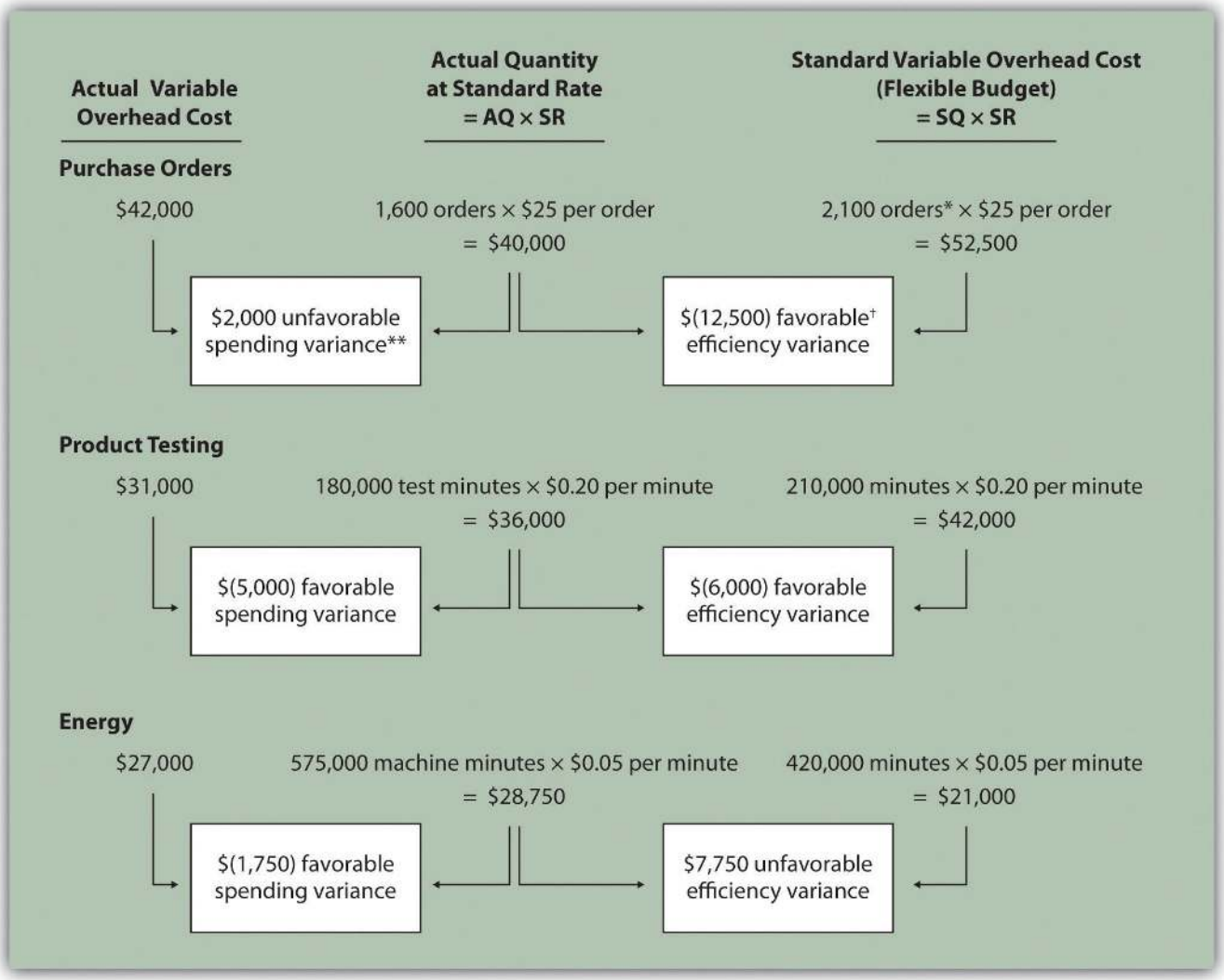
Let's work through an example of variance analysis using activity-based costing. Suppose Jerry's Ice Cream identified three significant activities and established three standard rates to allocate variable manufacturing overhead instead of one rate based on direct labor hours. Information for the three activities for last year is:

Activity	Standard Rate	Standard Quantity per Unit Produced	Actual Costs	Actual Quantity
Purchase orders	$25 per purchase order	0.01 orders per unit	$42,000	1,600 purchase orders
Product testing	$0.20 per test minute	1 minute per unit	$31,000	180,000 test minutes
Energy	$0.05 per minute of machine time	2 minutes per unit	$27,000	575,000 minutes of machine time

Recall that Jerry's produced 210,000 units for the year. Figure 4.11 "Variable Overhead Variance Analysis for Jerry's Ice Cream Using Activity-Based Costing" shows the resulting variable overhead variance analysis. Notice that the format for our analysis is the same as what was done previously. The variance calculations are also the same except variances are calculated for three activities rather than one. Note that total actual variable overhead costs remain at $100,000, but they are simply broken out into 3

activities ($100,000 = $42,000 for purchase orders + $31,000 for product testing + $27,000 for energy costs). Also, the flexible budget presented in Figure 4.11 "Variable Overhead Variance Analysis for Jerry's Ice Cream Using Activity-Based Costing", totaling $115,500, differs from the flexible budget presented earlier since Jerry's is using a different cost system in this example, which often results in different budgeted amounts ($115,500 = $52,500 purchase orders + $42,000 product testing + $21,000 energy).

Figure 4.11 Variable Overhead Variance Analysis for Jerry's Ice Cream Using Activity-Based Costing



Note: AQ = Actual quantity of activity. SR = Standard variable manufacturing overhead rate per unit of activity. SQ = Standard quantity of activity given actual production of 210,000 units.

*Standard quantity of 2,100 purchase orders = Standard of 0.01 purchase orders per unit × 210,000 actual units produced.

**$2,000 unfavorable variable overhead spending variance = $42,000 −$40,000. Variance is unfavorable because the actual variable overhead cost is higher than the expected cost given actual quantity of 1,600 purchase orders.

† $(12,500) favorable variable overhead efficiency variance = $40,000 – $52,500. Variance is favorable because the 1,600 actual purchase orders are lower than the 2,100 expected (budgeted) purchase orders.

This type of costing system and resulting variance analysis provides management with further information regarding variable overhead costs and variances. As discussed earlier, management often establishes criteria to decide which variances to investigate. Assume that management of Jerry's Ice Cream chooses to investigate the $7,750 unfavorable efficiency variance associated with energy. The management would like to know why 575,000 minutes of actual machine time were used instead of the expected

420,000 minutes. Perhaps the machines were operating poorly due to cutbacks in maintenance, or maybe new employees were not as efficient using the machines. Whatever the cause, Jerry's has identified the issue by integrating its activity-based costing system with the cost variance analysis concepts discussed in this chapter.

Key Takeaways

- Using cost variance analysis with activity-based costing is much like using cost variance analysis with traditional costing. Both utilize a spending variance and an efficiency variance. However, activity-based costing requires calculating a spending and efficiency variance for each activity rather than only one activity base typically used in traditional costing.

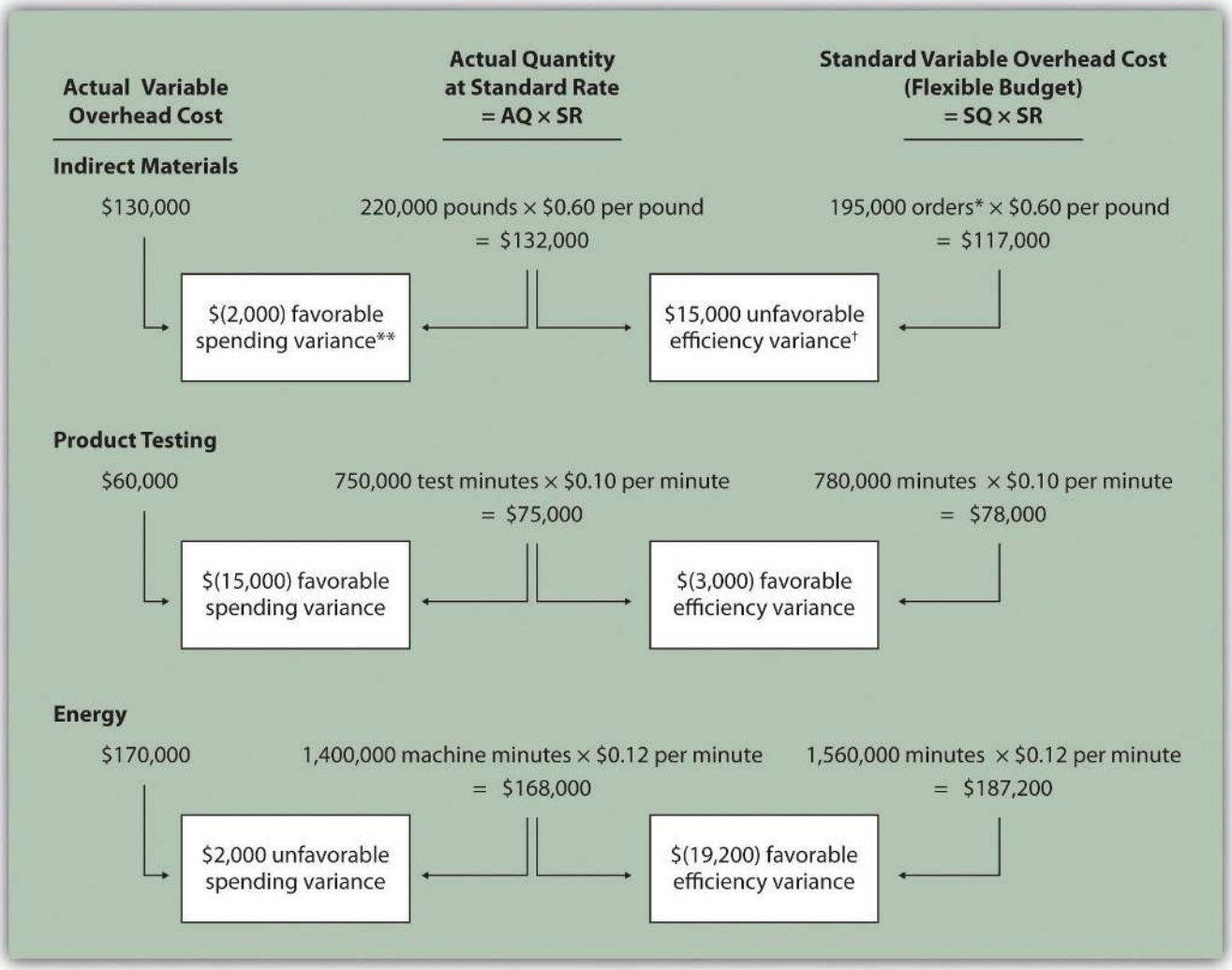
Check Yourself

Assume Carol's Cookies uses activity-based costing to allocate variable manufacturing overhead costs instead of one rate based on direct labor hours. Carol identified three activities with the following information for last year.

Activity	**Standard Rate**	**Standard Quantity per Unit Produced**	**Actual Costs**	**Actual Quantity**
Indirect materials	$0.60 per pound	0.5 pounds per unit	$130,000	220,000 pounds
Product testing	$0.10 per test minute	2 minutes per unit	$ 60,000	750,000 test minutes
Energy	$0.12 per minute of machine time	4 minutes per unit	$170,000	1,400,000 minutes of machine time

Recall that Carol's Cookies produced and sold 390,000 units for the year. Prepare a variance analysis for Carol's Cookies using the format shown in Figure 4.11 "Variable Overhead Variance Analysis for Jerry's Ice Cream Using Activity-Based Costing".

Solution



Note: AQ = Actual quantity of activity. SR = Standard variable manufacturing overhead rate per unit of activity. SQ = Standard quantity of activity given actual production of 210,000 units.

*Standard quantity of 195,000 pounds = Standard of 0.5 pounds per unit × 390,000 actual units produced.

**$(2,000) favorable variable overhead spending variance = $130,000 – $132,000. Variance is favorable because the actual variable overhead cost is lower than the expected cost given actual quantity of 220,000 pounds.

† $15,000 unfavorable variable overhead efficiency variance = $132,000 – $117,000. Variance is unfavorable because the 220,000 actual pounds is higher than the 195,000 expected (budgeted) pounds.

4.8 Fixed Manufacturing Overhead Variance Analysis

Learning Objective

1. Calculate and analyze fixed manufacturing overhead variances.

Question: Many organizations also analyze fixed manufacturing overhead variances. Recall that manufacturing companies are required to assign fixed manufacturing overhead costs to products for financial reporting purposes (this is called absorption costing). It is common for companies such as Jerry's Ice Cream to apply fixed manufacturing overhead costs to products based on direct labor hours, machine hours, or some other activity. Companies using a standard costing system apply fixed overhead based

on a standard dollar amount per unit produced (this calculation is shown in the footnote to Figure 4.12 "Fixed Manufacturing Overhead Information for Jerry's Ice Cream"). Assume Jerry's uses direct labor hours to assign fixed overhead costs to products shown in Figure 4.12 "Fixed Manufacturing Overhead Information for Jerry's Ice Cream". How is this information used to perform fixed overhead cost variance analysis?

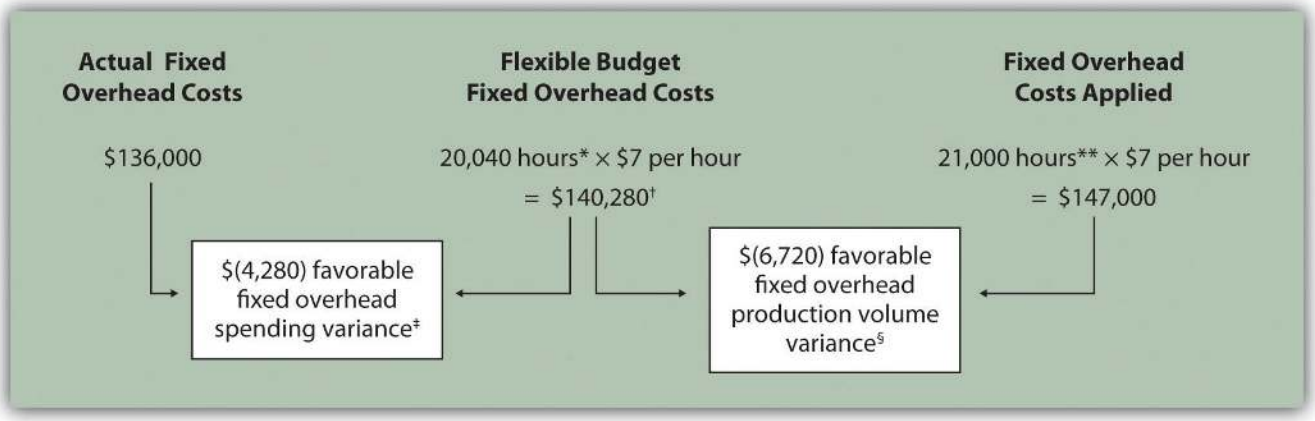
Answer: It is important to start by noting that fixed overhead in the master budget is the same as fixed overhead in the flexible budget because, by definition, fixed costs do not change with changes in units produced. Thus budgeted fixed overhead costs of $140,280 shown in Figure 4.12 "Fixed Manufacturing Overhead Information for Jerry's Ice Cream" will remain the same even though Jerry's actually produced 210,000 units instead of the master budget expectation of 200,400 units.

Figure 4.12 Fixed Manufacturing Overhead Information for Jerry's Ice Cream

Budgeted fixed overhead costs	$140,280	
Budgeted direct labor hours	÷ 20,040	hours
Standard cost per direct labor hours*	$ 7	per hour
Standard direct labor hours per unit	0.10	hours
Actual production	210,000	units
Actual fixed overhead costs	$136,000	
*Standard fixed manufacturing overhead cost can also be stated on a per unit basis as follows:		
Standard cost per direct labor hour	$ 7.00	
Standard direct labor hours per unit	× 0.10	
Standard fixed overhead cost per unit	$ 0.70	

Fixed manufacturing overhead variance analysis involves two separate variances: the *spending variance* and the *production volume variance*. We show both variances in Figure 4.13 "Fixed Manufacturing Overhead Variance Analysis for Jerry's Ice Cream", and provide further detail following the figure.

Figure 4.13 Fixed Manufacturing Overhead Variance Analysis for Jerry's Ice Cream



*From earlier text, the direct labor budget is 20,040 budgeted direct labor hours = 200,400 units budgeted to be produced × 0.10 direct labor hours per unit.

**Standard hours of 21,000 = 210,000 actual units produced and sold × Standard of 0.10 hours per unit.

† $140,280 is the original budget presented in the manufacturing overhead budget shown in the last text. The flexible budget amount for fixed overhead does not change with changes in production, so this amount remains the same regardless of actual production.

‡ $(4,280) favorable fixed overhead spending variance = $136,000 – $140,280. Variance is favorable because the actual fixed overhead costs are lower than the budgeted costs.

§ $(6,720) favorable fixed overhead volume variance = $140,280 – $147,000. Variance is favorable because the volume of goods produced and sold was higher than expected.

Fixed Overhead Spending Variance Calculation

Question: How is the fixed overhead spending variance calculated?

Answer: As shown in Figure 4.13 “Fixed Manufacturing Overhead Variance Analysis for Jerry’s Ice Cream”, Jerry’s Ice Cream incurred $136,000 in fixed overhead costs for the year. Budgeted fixed overhead costs totaled $140,280. Thus the spending variance is calculated as follows:

Key Equation

Fixed overhead spending variance = Actual costs − Budgeted costs

Fixed overhead spending variance=Actual costs − Budgeted costs=$136,000−$140,280=($4,280) favorable

Because fixed overhead costs are not typically driven by activity, Jerry’s cannot attribute any part of this variance to the efficient (or inefficient) use of labor. In fact, there is no efficiency variance for fixed overhead. Instead, Jerry’s must review the detail of actual and budgeted costs to determine why the favorable variance occurred. For example, factory rent, supervisor salaries, or factory insurance may have been lower than anticipated. Further investigation of detailed costs is necessary to determine the exact cause of the fixed overhead spending variance.

Fixed Overhead Production Volume Variance Calculation

Question: How is the fixed overhead production volume variance calculated?

Answer: Before discussing the production volume variance, a word of caution: do not equate the fixed overhead production volume variance with the variable overhead efficiency variance. *There is no efficiency variance for fixed manufacturing overhead* because, by definition, fixed costs do not change with changes in the activity base. The fixed overhead volume variance is solely a result of the difference in budgeted production and actual production. The fixed overhead production volume variance is the difference

between the budgeted and applied fixed overhead costs. As shown in Figure 4.13 “Fixed Manufacturing Overhead Variance Analysis for Jerry’s Ice Cream”, Jerry’s Ice Cream budgeted $140,280 in fixed overhead costs for the year. Fixed overhead costs applied totaled $147,000. Thus the production volume variance is calculated as follows:

Key Equation

Fixed overhead production volume variance = Budgeted costs − Applied costs

Fixed overhead production volume variance=Budgeted costs − Applied costs=$140,280−$147,000=($6,720) favorable

The fixed overhead production volume variance is a direct result of the difference in volume (units) between budgeted production and actual production. All other variables are held constant including standard direct labor hours per unit (0.10) and standard rate per direct labor hour ($7). Thus an alternative approach to this calculation can be used assuming the standard fixed overhead cost per unit is $0.70 (= 0.10 direct labor hours per unit × $7 per direct labor hour):

Key Equation

Fixed overhead productionvolume variance=Standard fixed overheadcost per unit×(Budgeted unitsproduced−Actual unitsproduced)

Fixed overhead productionvolume variance=Standard fixed overheadcost per unit×(Budgeted unitsproduced−Actual unitsproduced) ($6,720) favorable= $0.70×(200,400budgeted units−210,000actual units)

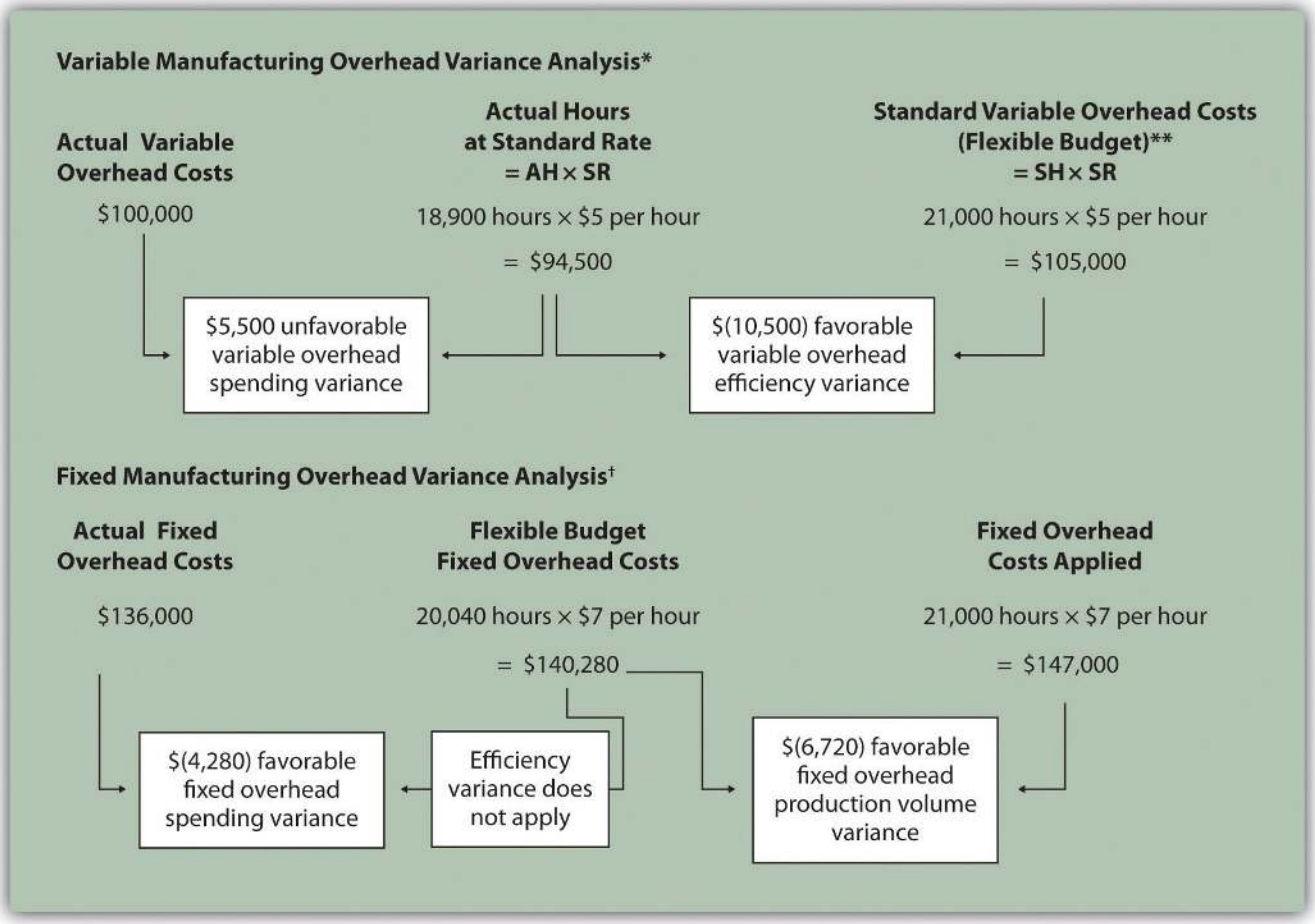
The fixed overhead production volume variance is favorable because the company produced and sold more units than anticipated.

Comparison of Fixed and Variable Overhead Variances

Question: What are the similarities and differences between the fixed and variable overhead variances?

Answer: Figure 4.14 “Comparison of Variable and Fixed Manufacturing Overhead Variance Analysis for Jerry’s Ice Cream” summarizes the similarities and differences between variable and fixed overhead variances. Notice that the efficiency variance is not applicable to the fixed overhead variance analysis.

Figure 4.14 Comparison of Variable and Fixed Manufacturing Overhead Variance Analysis for Jerry’s Ice Cream



*Information is from Figure 4.8 “Variable Manufacturing Overhead Variance Analysis for Jerry’s Ice Cream”.

**For variable manufacturing overhead, the flexible budget is the same as variable overhead applied to production.

† Information is from Figure 4.13 “Fixed Manufacturing Overhead Variance Analysis for Jerry’s Ice Cream”.

Key Takeaways

- Two variances are calculated and analyzed when evaluating fixed manufacturing overhead. The *fixed overhead spending variance* is the difference between actual and budgeted fixed overhead costs. The *fixed overhead production volume variance* is the difference between budgeted and applied fixed overhead costs. There is no efficiency variance for fixed manufacturing overhead.

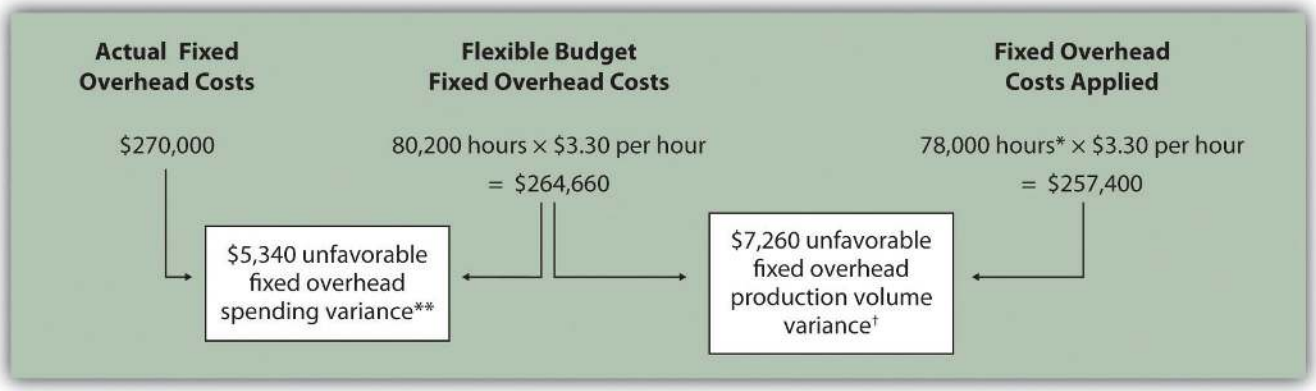
Exercises

This review problem is based on the budget information presented in review problems from an earlier text and variance analysis information presented in earlier check yourself problems. The following information is for Carol’s Cookies:

Budgeted fixed overhead costs	$264,660
Budgeted direct labor hours	÷ 80,200
Standard cost per direct labor hours	$ 3.30
Standard direct labor hours per unit	0.20
Actual production	390,000 units
Actual fixed overhead costs	$270,000

Calculate the fixed overhead spending and production volume variances using the format shown in Figure 4.13 "Fixed Manufacturing Overhead Variance Analysis for Jerry's Ice Cream".

Solution



*Standard hours of 78,000 = 390,000 actual units produced and sold *x* standard of 0.20 hours per unit.

**$5,340 unfavorable fixed overhead spending variance = $270,000 – $264,660. Variance is unfavorable because the actual fixed overhead costs are higher than the budgeted costs.

† $7,260 unfavorable fixed overhead volume variance = $264,660 – $257,400. Variance is unfavorable because the volume of goods produced and sold was lower than expected.

4.9 Appendix: Recording Standard Costs and Variances

Learning Objectives

1. Explain how to record standard costs and variances using journal entries.

This chapter has focused on performing variance analysis to evaluate and control operations. Standard costing systems assist in this process and often involve recording transactions using standard cost information. When accountants use a standard costing system to record transactions, companies are able to quickly identify variances. In addition, inventory and related cost of goods sold are valued using standard cost information, which simplifies the bookkeeping process.

Recording Direct Materials Transactions

Question: In Figure 4.4 "Direct Materials Variance Analysis for Jerry's Ice Cream", we calculated two variances for direct materials at Jerry's Ice Cream: materials price variance and materials quantity variance. How are these variances recorded for transactions related to direct materials?

Answer: Two journal entries are needed to record direct materials transactions that include these variances. An example of each is shown next. (Typically, many more journal entries would be made throughout the year for direct materials. For the purposes of this example, we will make one journal entry for each variance to summarize the activity for the year.)

Materials Price Variance

The entry to record the *purchase* of direct materials and related price variance shown in Figure 4.4 "Direct Materials Variance Analysis for Jerry's Ice Cream" is

Dr. raw materials inventory (440,000 pounds × $1.00 per pound)	440,000	
Dr. materials price variance ($88,000 unfavorable)	88,000	
Cr. accounts payable (440,000 pounds × $1.20 per pound)		528,000

Notice that the raw materials inventory account contains the actual quantity of direct materials purchased at the standard price. Accounts payable reflects the actual cost, and the materials price variance account shows the unfavorable variance. Unfavorable variances are recorded as debits and favorable variances are recorded as credits. Variance accounts are temporary accounts that are closed out at the end of the financial reporting period. We show the process of closing out variance accounts at the end of this appendix.

Materials Quantity Variance

The entry to record the *use* of direct materials in production and related quantity variance shown in Figure 4.4 "Direct Materials Variance Analysis for Jerry's Ice Cream" is

Dr. work in process inventory (420,000 pounds × $1.00 per pound)	420,000	
Cr. materials quantity variance ($21,000 favorable)		21,000
Cr. raw materials inventory (399,000 pounds × $1.00 per pound)		399,000

Work-in-process inventory reflects the standard quantity of direct materials allowed at the standard price. The reduction in raw materials inventory reflects the actual quantity used at the standard price, and the materials quantity variance account shows the favorable variance.

Recording Direct Labor Transactions

Question: In Figure 4.6 "Direct Labor Variance Analysis for Jerry's Ice Cream", we calculated two variances for direct labor at Jerry's Ice Cream: labor rate variance and labor efficiency variance. How are these variances recorded for transactions related to direct labor?

Answer: Because labor is not inventoried for later use like materials, only one journal entry is needed to record direct labor transactions that include these variances. (Again, many more journal entries would typically be made throughout the year for direct labor. For the purposes of this example, we will make one journal entry to summarize the activity for the year.)

Labor Rate and Efficiency Variances

The entry to record the cost of direct labor and related variances shown in Figure 4.6 "Direct Labor Variance Analysis for Jerry's Ice Cream" is

Dr. work in process inventory (21,000 hours × $13 per hour)	273,000	
Dr. labor rate variance ($37,800 unfavorable)	37,800	
Cr. labor efficiency variance ($27,300 favorable)		27,300
Cr. wages payable (18,900 hours × $15 per hour)		283,500

Work-in-process inventory reflects the standard hours of direct labor allowed at the standard rate. The labor rate and efficiency variances represent the difference between work-in-process inventory (at the standard cost) and actual costs recorded in wages payable.

Recording Manufacturing Overhead Transactions

Question: As discussed in Chapter 1 "How Is Job Costing Used to Track Production Costs?", the manufacturing overhead account is debited for all actual overhead expenditures and credited when overhead is applied to products. At the end of the period, the balance in manufacturing overhead, representing overapplied or underapplied overhead, is closed out to cost of goods sold. This overapplied or underapplied balance can be explained by combining the four overhead variances summarized in this chapter in Figure 4.14 "Comparison of Variable and Fixed Manufacturing Overhead Variance Analysis for Jerry's Ice Cream". How are these variances recorded for transactions related to manufacturing overhead?

Answer: Based on the information at the left side of Figure 4.14 "Comparison of Variable and Fixed Manufacturing Overhead Variance Analysis for Jerry's Ice Cream", the entry to record actual overhead expenditures is

Dr. manufacturing overhead ($100,000 variable + $136,000 fixed)	236,000	
Cr. various accounts		236,000

The credit goes to several different accounts depending on the nature of the expenditure. For example, if the expenditure is for indirect materials, the credit goes to accounts payable. If the expenditure is for indirect labor, the credit goes to wages payable.

The next entry reflects overhead applied to products. This information comes from the right side of Figure 4.14 "Comparison of Variable and Fixed Manufacturing Overhead Variance Analysis for Jerry's Ice Cream".

Dr. work in process inventory ($105,000 variable + $147,000 fixed)	252,000	
Cr. manufacturing overhead		252,000

At this point, manufacturing overhead has a $16,000 credit balance, which represents overapplied overhead ($16,000 = $252,000 applied overhead – $236,000 actual overhead). The following summary of fixed and variable overhead variances shown in Figure 4.14 "Comparison of Variable and Fixed Manufacturing Overhead Variance Analysis for Jerry's Ice Cream" explains the overapplied amount of $16,000:

Variable overhead spending variance	$ 5,500	Unfavorable
Variable overhead efficiency variance	(10,500)	Favorable
Fixed overhead spending variance	(4,280)	Favorable
Fixed overhead production volume variance	(6,720)	Favorable
Total overapplied overhead	$ (16,000)	Favorable

Recording Finished Goods Transactions

Question: Review all the debits to work-in-process inventory throughout this appendix and you will see the following costs (all recorded at standard cost):

Raw materials	$420,000
Direct labor	273,000
Manufacturing overhead	252,000
Total	$945,000

How are these costs transferred from work-in-process inventory to finished good inventory when the goods are completed?

Answer: When the 210,000 units are completed, the following entry is made to transfer the costs out of work-in-process inventory and into finished goods inventory.

Dr. finished goods inventory	945,000	
Cr. work in process inventory		945,000

Note that the standard cost per unit was established at $4.50, which includes variable manufacturing costs of $3.80 (see Figure 4.1 “Standard Costs at Jerry’s Ice Cream”) and fixed manufacturing costs of $0.70 (see footnote to Figure 4.12 “Fixed Manufacturing Overhead Information for Jerry’s Ice Cream”). Total production of 210,000 units × Standard cost of $4.50 per unit equals $945,000; the same amount you see in the entry presented previously.

Recording Cost of Goods Sold Transactions

Question: How do we record the costs associated with products that are sold?

Answer: When finished product is sold, the following entry is made:

Dr. costs of goods sold	945,000	
Cr. finished goods inventory		945,000

Note that the entry shown previously uses standard costs, which means cost of goods sold is stated at standard cost until the next entry is made.

Closing Manufacturing Overhead and Variance Accounts

Question: At the end of the period, Jerry's Ice Cream has balances remaining in manufacturing overhead along with all the variance accounts. These accounts must be closed out at the end of the period. How is this accomplished?

Answer: These accounts are closed out to cost of goods sold, after which point cost of goods sold will reflect *actual* manufacturing costs for the products sold during the period. The following entry is made to accomplish this goal:

Dr. cost of goods sold	61,500*	
Dr. materials quantity variance	21,000	
Dr. labor efficiency variance	27,300	
Dr. manufacturing overhead	16,000	
Cr. materials price variance		88,000
Cr. labor rate variance		37,800

*$61,500 = $88,000 + $37,800 – $21,000 – $27,300 – $16,000.

Key Takeaways

- In a standard costing system, all inventory accounts reflect standard cost information. The difference between standard and actual data are recorded in the variance accounts and the manufacturing overhead account, which are ultimately closed out to cost of goods sold at the end of the period.

End-of-Chapter Exercises

Questions

1. Explain how a flexible budget differs from a master budget.
2. Assume you are the production manager for a manufacturing company that anticipated selling 40,000 units of product for the master budget and actually sold 50,000 units. Why would you prefer to be evaluated using a flexible budget for direct labor rather than the master budget?
3. What is a standard cost, and how does it differ from a budgeted cost?
4. How are standards established for direct materials, direct labor, and variable manufacturing overhead?
5. Explain what management is trying to evaluate in reviewing the materials price variance and materials quantity variance. Be sure to include the formula for each variance in your explanation.
6. Explain what management is trying to evaluate in reviewing the labor rate variance and labor efficiency variance. Be sure to include the formula for each variance in your explanation.
7. Explain how an unfavorable labor rate variance might cause a favorable labor efficiency variance and favorable materials quantity variance.
8. The production manager just received a report indicating an unfavorable labor rate variance. Further investigation reveals that the sales department accepted a large rush order. Who should be held responsible for the unfavorable variance? Explain.
9. Are favorable variances always a result of good management decisions? Explain.
10. Do most companies investigate all variances? Explain.
11. How is variable overhead variance analysis similar for companies using activity-based costing and companies using traditional costing?
12. What causes the fixed overhead production volume variance?
13. **(Appendix).** Why are direct materials and direct labor variance accounts needed in a standard costing system? What happens to these accounts at the end of the period?

Brief Exercises

14. Analyzing Costs at Jerry's Ice Cream. Refer to the dialogue at Jerry's Ice Cream presented at the beginning of the chapter. What happened with direct labor and direct materials costs at Jerry's Ice Cream? What did Jerry, the owner, ask Michelle to do?

15. **Direct Materials Standard Cost and Flexible Budget.** Manhattan Company produces high-quality chairs. Each chair requires a standard quantity of 10 board feet of wood at $5 per board foot. Production for July totaled 3,000 units. Calculate (a) standard cost per unit for direct materials and (b) flexible budget amount for direct materials for the month of July.
16. **Direct Labor Standard Cost and Flexible Budget.** Manhattan Company produces high-quality chairs. Each chair requires a standard quantity of 8 direct labor hours at $15 per hour. Production for July totaled 3,000 units. Calculate (a) standard cost per unit for direct labor and (b) flexible budget amount for direct labor for the month of July.
17. **Variable Overhead Standard Cost and Flexible Budget.** Manhattan Company produces high-quality chairs. Variable manufacturing overhead is applied at a standard rate of $10 per machine hour. Each chair requires a standard quantity of three machine hours. Production for July totaled 3,000 units. Calculate (a) standard cost per unit for variable overhead and (b) flexible budget amount for variable overhead for the month of July.
18. **Materials Price Variance.** Sweets Company produces boxes of chocolate. The company expects to pay $5 a pound for chocolate. Sweets purchased 4,000 pounds of chocolate during the month of April for $4.80 per pound. Calculate the materials price variance for the month of April.
19. **Materials Quantity Variance.** Sweets Company produces boxes of chocolate. A standard of 2 pounds of material is expected to be used for each box produced, at a cost of $5 per pound. Sweets produced 1,000 boxes of chocolate during the month of April and used 2,200 pounds of chocolate. Calculate the materials quantity variance for the month of April.
20. **Labor Rate Variance.** Tech Company produces computer servers. The company's standards show an expected direct labor rate of $20 per hour. Tech's direct labor workforce worked 3,200 hours to produce 300 units during the month of August and was paid $22 per direct labor hour. Calculate the labor rate variance for the month of August.
21. **Labor Efficiency Variance.** Tech Company produces computer servers. The company's standards show that each server will require 10 hours of direct labor at $20 per hour. Tech produced 300 units during the month of August and direct labor hours totaled 3,200 for the month. Calculate the labor efficiency variance for the month of August.
22. **Variable Overhead Spending Variance.** Tech Company produces computer servers. Variable overhead is allocated to each server based on a standard of $100 per machine hour. A total of 850 machine hours were used during the month of August and variable overhead costs totaled $96,000. Calculate the variable overhead spending variance for the month of August.
23. **Variable Overhead Efficiency Variance.** Tech Company produces computer servers. Variable overhead is allocated to each server based on a standard of $100 per machine hour and 3 machine hours per server. A total of 850 machine hours were used during the month of August to produce 300 servers. Calculate the variable overhead efficiency variance for the month of August.
24. **Investigating Variances.** Fiber Optic, Inc., investigates all variances above 10 percent of the flexible budget. The flexible budget for direct materials is $50,000. The direct materials price variance is $4,000 unfavorable and the direct materials quantity variance is $(6,000) favorable. Which variances should be investigated according to company policy? Show calculations to support your answer.
25. **Spending Variance Using Activity-Based Costing.** Albany, Inc., uses activity-based costing to allocate variable manufacturing overhead costs to products. One of the activities used to allocate these costs is product testing. The standard rate is $15 per test hour. The cost for this activity during June totaled $2,000, and actual test time during June totaled 120 hours. Calculate the spending variance for this activity for the month of June, and clearly label whether the variance is favorable or unfavorable.
26. **Fixed Overhead Spending Variance.** Sampson Company applies fixed manufacturing overhead costs to products based on direct labor hours. Budgeted direct labor hours for the month of January totaled 30,000 hours, with a standard cost per direct labor hour of $12. Actual fixed overhead costs totaled $350,000 for January. Calculate the fixed overhead spending variance for January, and clearly label whether the variance is favorable or unfavorable.
27. **(Appendix) Journalizing the Purchase of Raw Materials.** Mill Company purchased 40,000 pounds of raw materials on account for $3.40 per pound. The standard price is $3 per pound. Prepare a journal entry to record this transaction assuming the company uses a standard costing system.

Exercises:

28. Standard Cost and Flexible Budget. Hal's Heating produces furnaces for commercial buildings. The company's master budget shows the following standards information.

Expected production for January	300 furnaces
Direct materials	3 heating elements at $40 per element
Direct labor	35 hours per furnace at $18 per hour
Variable manufacturing overhead	35 direct labor hours per furnace at $15 per hour

Required:

1. Calculate the standard cost per unit for direct materials, direct labor, and variable manufacturing overhead using the format shown in Figure 4.1 "Standard Costs at Jerry's Ice Cream".
2. Assume Hal's Heating produced 320 furnaces during January. Prepare a flexible budget for direct materials, direct labor, and variable manufacturing overhead using the format shown in Figure 4.2 "Flexible Budget for Variable Production Costs at Jerry's Ice Cream".

29. Materials and Labor Variances. Hal's Heating produces furnaces for commercial buildings. (This is the same company as the previous exercise. This exercise can be assigned independently.)

For direct materials, the standard price for a heating element part is $40. A standard quantity of 3 heating elements is expected to be used in each furnace produced. During January, Hal's Heating purchased 1,000 heating elements for $38,000 and used 980 heating elements to produce 320 furnaces.

For direct labor, Hal's Heating established a standard number of direct labor hours at 35 hours per furnace. The standard rate is $18 per hour. A total of 10,000 direct labor hours were worked during January, at a cost of $190,000, to produce 320 furnaces.

Required:

1. Calculate the materials price variance and materials quantity variance using the format shown in Figure 4.4 "Direct Materials Variance Analysis for Jerry's Ice Cream". Clearly label each variance as favorable or unfavorable.
2. Calculate the labor rate variance and labor efficiency variance using the format shown in Figure 4.6 "Direct Labor Variance Analysis for Jerry's Ice Cream". Clearly label each variance as favorable or unfavorable.

30. **Variable Overhead Variances.** Hal's Heating produces furnaces for commercial buildings. (This is the same company as the previous exercises. This exercise can be assigned independently.) The company applies variable manufacturing overhead at a standard rate of $15 per direct labor hour. The standard quantity of direct labor is 35 hours per unit. Variable overhead costs totaled $190,000 for the month of January. A total of 10,000 direct labor hours were worked during January to produce 320 furnaces.

    Required:

    Calculate the variable overhead spending variance and variable overhead efficiency variance using the format shown in Figure 4.8 "Variable Manufacturing Overhead Variance Analysis for Jerry's Ice Cream". Clearly label each variance as favorable or unfavorable.

31. **Fixed Overhead Variance Analysis.** Hal's Heating produces furnaces for commercial buildings. (This is the same company as the previous exercises. This exercise can be assigned independently.) The company applies fixed manufacturing overhead costs to products based on direct labor hours. Information for the month of January appears as follows. Hal's expected to produce and sell 300 units for the month.

Budgeted fixed overhead costs	$ 231,000
Budgeted direct labor hours	÷ 10,500
Standard cost per direct labor hour	$ 22
Standard direct labor hours per unit	35
Actual production	320 units
Actual fixed overhead costs	$ 217,000

Required:

Calculate the fixed overhead spending variance and production volume variance using the format shown in Figure 4.13 "Fixed Manufacturing Overhead Variance Analysis for Jerry's Ice Cream". Clearly label each variance as favorable or unfavorable.

32. **Journalizing Direct Materials and Direct Labor Transactions (Appendix).** Hal's Heating produces furnaces for commercial buildings. (This is the same company as the previous exercises. This exercise can be assigned independently.)

    Direct materials and direct labor variances for the month of January are shown as follows.

Materials price variance	$(2,000) favorable
Materials quantity variance	$ 800 unfavorable
Labor rate variance	$ 10,000 unfavorable
Labor efficiency variance	$(21,600) favorable

Required:

1. The company purchased 1,000 elements during the month for $38 each. Assuming a standard price of $40 per element, prepare a journal entry to record the purchase of raw materials for the month.
2. The company used 980 elements in production for the month, and the flexible budget shows the company expected to use 960 elements. Assuming a standard price of $40 per element, prepare a journal entry to record the usage of raw materials in production for the month.
3. The company used 10,000 direct labor hours during the month with an actual rate of $19 per hour. The flexible budget shows the company expected to use 11,200 direct labor hours at a standard rate of $18 per hour. Prepare a journal entry to record direct labor costs for the month.

33. **Investigating Variances.** Quality Tables, Inc., produces high-end coffee tables. Standard cost information for each table is presented as follows.

Direct materials	$350
Direct labor	250
Variable overhead	100
Total	$700

Quality Tables produced and sold 2,000 tables for the year and encountered the following production variances:

Direct materials price variance	$ (79,000)	Favorable
Direct materials quantity variance	40,000	Unfavorable
Direct labor rate variance	97,500	Unfavorable
Direct labor efficiency variance	(35,000)	Favorable
Variable overhead spending variance	16,250	Unfavorable
Variable overhead efficiency variance	(19,000)	Favorable
Total variable production cost variance	$ 20,750	Unfavorable

Required:

Company policy is to investigate all unfavorable variances above 10 percent of the flexible budget amount for direct materials, direct labor, and variable overhead.

1. Identify the variances that should be investigated according to company policy. Show calculations to support your answer.
2. What potential weakness exists in the company's current policy?

34. **Variance Analysis with Activity-Based Costing.** Assume Mammoth Company uses activity-based costing to allocate variable manufacturing overhead costs to products. The company identified three activities with the following information for last quarter.

Activity	Standard Rate	Standard Quantity per Unit Produced	Actual Costs	Actual Quantity
Indirect materials	$2.40 per yard	7 yards per unit	$691,650	265,000 yards
Product testing	$1.50 per test minute	5 minutes per unit	$301,000	215,000 test minutes
Indirect labor	$4.50 per direct labor hour	4 hours per unit	$930,000	180,000 direct labor hours

Required:

Assume Mammoth Company produced 40,000 units last quarter. Prepare a variance analysis using the format shown in Figure 4.11 "Variable Overhead Variance Analysis for Jerry's Ice Cream Using Activity-Based Costing". Clearly label each variance as favorable or unfavorable.

Problems

35. Variance Analysis for Direct Materials, Direct Labor, and Variable Overhead. Rain Gear, Inc., produces rain jackets. The master budget shows the following standards information and indicates the company expected to produce and sell 28,000 units for the year.

Direct materials	4 yards per unit at $3 per yard
Direct labor	2 hours per unit at $10 per hour
Variable manufacturing overhead	2 direct labor hours per unit at $4 per hour

Rain Gear actually produced and sold 30,000 units for the year. During the year, the company purchased 130,000 yards of material for $429,000 and used 118,000 yards in production. A total of 65,000 labor hours were worked during the year at a cost of $637,000. Variable overhead costs totaled $231,000 for the year.

Required:

1. Calculate the materials price variance and materials quantity variance using the format shown in Figure 4.4 “Direct Materials Variance Analysis for Jerry’s Ice Cream”. Clearly label each variance as favorable or unfavorable.
2. Calculate the labor rate variance and labor efficiency variance using the format shown in Figure 4.6 “Direct Labor Variance Analysis for Jerry’s Ice Cream”. Clearly label each variance as favorable or unfavorable.
3. Calculate the variable overhead spending variance and variable overhead efficiency variance using the format shown in Figure 4.8 “Variable Manufacturing Overhead Variance Analysis for Jerry’s Ice Cream”. Clearly label each variance as favorable or unfavorable.
4. Company policy is to investigate all variances greater than 10 percent of the flexible budget amount for each of the three variable production costs: direct materials, direct labor, and variable overhead. Identify which of the six variances calculated in requirements **a** through **c** should be investigated.
5. Provide two possible explanations for each variance identified in requirement **d**.

36. Fixed Overhead Variance Analysis. (This problem is a continuation of the previous problem but can also be worked independently.) Rain Gear, Inc., produces rain jackets and applies fixed manufacturing overhead costs to products based on direct labor hours. Information for the year appears as follows. Rain Gear expected to produce and sell 28,000 units for the year.

Budgeted fixed overhead costs	$280,000
Budgeted direct labor hours	÷ 56,000
Standard cost per direct labor hour	$ 5
Standard direct labor hours per unit	2
Actual production	30,000 units
Actual fixed overhead costs	$295,000

Required:

1. Calculate the fixed overhead spending variance and production volume variance using the format shown in Figure 4.13 “Fixed Manufacturing Overhead Variance Analysis for Jerry’s Ice Cream”. Clearly label each variance as favorable or unfavorable.
2. Company policy is to investigate all variances greater than 5 percent of the flexible budget amount. Identify whether either of the two fixed overhead variances calculated in requirement **a** should be investigated.
3. Provide one possible explanation for variance(s) identified in requirement **b**.

37. Journalizing Direct Materials, Direct Labor, and Overhead Transactions (Appendix). Complete the following requirements for Rain Gear, Inc., using your solutions to the previous two problems.

Required:

1. Prepare a journal entry to record the purchase of raw materials.
2. Prepare a journal entry to record the use of raw materials.
3. Prepare a journal entry to record direct labor costs.
4. Prepare a journal entry to record actual variable and fixed manufacturing overhead expenditures.
5. Prepare a journal entry to record variable and fixed manufacturing overhead applied to products.
6. Based on the entries shown in requirements **a** through **e**, prepare a journal entry to transfer all work-in-process inventory costs to finished goods inventory.
7. Assume all finished goods are sold during the period. Prepare a journal entry to transfer all finished goods inventory costs to cost of goods sold.
8. Based on the entries shown in requirements **a** through **g**, close manufacturing overhead and all variance accounts to cost of goods sold.

38. Variance Analysis for Direct Materials, Direct Labor, and Variable Overhead; Journalizing Direct Materials and Direct Labor Transactions (Includes Appendix). Prefab Pools Company produces large prefabricated in-ground swimming pools made of a specialized plastic material. The master budget shows the following standards information and indicates the company expected to produce and sell 600 units for the month of April.

Direct materials	500 pounds per unit at $7 per pound
Direct labor	46 hours per unit at $12 per hour
Variable manufacturing overhead	46 direct labor hours per unit at $30 per hour

Prefab Pools actually produced and sold 580 units for the month. During the month, the company purchased 330,000 pounds of material for $2,277,000 and used 295,800 pounds in production. A total of 25,520 labor hours were worked during the month at a cost of $313,896. Variable overhead costs totaled $790,000 for the month.

Required:

1. Calculate the materials price variance and materials quantity variance using the format shown in Figure 4.4 “Direct Materials Variance Analysis for Jerry’s Ice Cream”. Clearly label each variance as favorable or unfavorable.
2. Calculate the labor rate variance and labor efficiency variance using the format shown in Figure 4.6 “Direct Labor Variance Analysis for Jerry’s Ice Cream”. Clearly label each variance as favorable or unfavorable.
3. Calculate the variable overhead spending variance and variable overhead efficiency variance using the format shown in Figure 4.8 “Variable Manufacturing Overhead Variance Analysis for Jerry’s Ice Cream”. Clearly label each variance as favorable or unfavorable.
4. Company policy is to investigate all variances at or above 2 percent of the flexible budget for direct materials and 4 percent for direct labor and variable overhead. Identify which of the six variances calculated in requirements **a** through **c** should be investigated.
5. Provide two possible explanations for each variance identified in requirement **d**.
6. Based on your answer to requirement **a**, prepare a journal entry to record the purchase of raw materials.
7. Based on your answer to requirement **a**, prepare a journal entry to record the usage of raw materials.
8. Based on your answer to requirement **b**, prepare a journal entry to record direct labor costs.

39. Fixed Overhead Variance Analysis. (This problem is a continuation of the previous problem but can be worked independently.) Prefab Pools Company produces prefabricated in-ground swimming pools and applies fixed manufacturing overhead costs to products based on direct labor hours. Information for the month of April appears as follows. Prefab Pools expected to produce and sell 600 units for the month.

Budgeted fixed overhead costs	$966,000
Budgeted direct labor hours	÷ 27,600
Standard cost per direct labor hour	$ 35
Standard direct labor hours per unit	46
Actual production	580 units
Actual fixed overhead costs	$910,000

Required:

1. Calculate the fixed overhead spending variance and production volume variance using the format shown in Figure 413 “Fixed Manufacturing Overhead Variance Analysis for Jerry’s Ice Cream”. Clearly label each variance as favorable or unfavorable.
2. Company management has asked you to investigate the cause of the fixed overhead spending variance calculated in requirement **a**. Provide one possible explanation for this variance.

40. Variance Analysis for Direct Materials, Direct Labor, Variable Overhead, and Fixed Overhead. Equipment Products, Inc., produces large ladders made of a specialized metal material. The master budget shows the following standards information and indicates the company expected to produce and sell 4,000 units for the month of May.

Direct materials	60 pounds per unit at $3 per pound
Direct labor	8 hours per unit at $14 per hour
Variable manufacturing overhead	8 direct labor hours per unit at $6 per hour

Equipment Products actually produced and sold 4,400 units for the month. During the month, the company purchased 300,000 pounds of material for $960,000 and used 286,000 pounds in production. A total of 30,800 labor hours were worked during the month at a cost of $462,000. Variable overhead costs totaled $195,000 for the month.

With regards to fixed manufacturing overhead, the company also applies these overhead costs to products based on direct labor hours. Fixed manufacturing overhead information for the month of May appears as follows.

Budgeted fixed overhead costs	$ 864,000
Budgeted direct labor hours	÷ 32,000
Standard cost per direct labor hour	$ 27
Actual fixed overhead costs for May	$ 990,000

Required:

1. Calculate the materials price variance and materials quantity variance using the format shown in Figure 4.4 “Direct Materials Variance Analysis for Jerry’s Ice Cream”. Clearly label each variance as favorable or unfavorable.
2. Calculate the labor rate variance and labor efficiency variance using the format shown in Figure 4.6 “Direct Labor Variance Analysis for Jerry’s Ice Cream”. Clearly label each variance as favorable or unfavorable.
3. Calculate the variable overhead spending variance and variable overhead efficiency variance using the format shown in Figure 4.8 “Variable Manufacturing Overhead Variance Analysis for Jerry’s Ice Cream”. Clearly label each variance as favorable or unfavorable.
4. Company policy is to investigate all variances greater than 10 percent of the flexible budget amount for each of the 3 variable production costs: direct materials, direct labor, and variable overhead. Identify which of the six variances calculated in requirements **a** through **c** should be investigated.
5. Provide two possible explanations for each variance identified in requirement **d**.
6. Calculate the fixed overhead spending variance and production volume variance using the format shown in Figure 4.13 “Fixed Manufacturing Overhead Variance Analysis for Jerry’s Ice Cream”. Clearly label each variance as favorable or unfavorable.

41. Variance Analysis with Activity-Based Costing. Assume Spindle Company uses activity-based costing to allocate variable manufacturing overhead costs to products. The company identified three activities with the following information for last quarter.

Activity	Standard Rate	Standard Quantity per Unit Produced	Actual Costs	Actual Quantity
Indirect materials	$5 per yard	14 yards per unit	$4,850,000	990,000 yards
Product testing	$3 per test minute	10 minutes per unit	$2,000,000	650,000 test minutes
Indirect labor	$9 per direct labor hour	6 hours per unit	$3,800,000	410,000 direct labor hours

Required:

1. Assume Spindle Company produced 70,000 units last quarter. Prepare a variance analysis using the format shown in Figure 4.11 “Variable Overhead Variance Analysis for Jerry’s Ice Cream Using Activity-Based Costing”. Clearly label each variance as favorable or unfavorable.
2. Company policy is to investigate all variances above 5 percent of the flexible budget amount for each activity. Identify the variances that should be investigated according to company policy. Show calculations to support your answer.

One Step Further: Skill-Building Cases

42. Group Activity: Setting Standards. Form groups of two to four students. Each group is to complete the following requirements.

Required:

1. Define and discuss the differences between ideal standards and attainable standards.
2. Assume your group works for a company that produces wood desks and you are in the process of creating attainable direct material and direct labor standards. Provide specific examples of the items that might be included in (1) the standard quantity and standard price for direct materials and (2) the standard hours and standard rate for direct labor. Explain where this information might be obtained, and identify specific production inefficiencies your group included in creating these standards that would not be included in ideal standards.
3. Discuss the findings of your group with the class. (Optional: your instructor may ask you to submit your findings in writing.)

43. Ethics and Setting Standards. Wilkes Golf, Inc., produces golf carts that are sold throughout the world. The company’s management is in the process of establishing the standard hours of direct labor required to complete one golf cart. Assume you are the production supervisor, and you receive a bonus for each quarter that shows a favorable labor efficiency variance. That is, you receive a bonus for each quarter showing actual direct labor hours that are fewer than budgeted direct labor hours.

The management has asked for your input in establishing the standard number of direct labor hours required to complete one golf cart.

Required:

1. As the production supervisor, describe the ethical conflict you face when asked to help with establishing direct labor hour standards.
2. How might the management of Wilkes Golf, Inc., avoid this conflict and still achieve the goal of obtaining reliable direct labor hour information?

44. Using Excel to Perform Budget Versus Actual Analysis. The management of Home Products, Inc., prepared the following budgeted income statement for the year ending December 31, 2012.

	A	B	C
1	**Home Products, Inc.**		
2	**Budgeted Income Statement**		
3	**Year Ending December 31, 2012**		
4			
5		**Budget**	
6	Sales	$ 3,600,000	
7	Variable cost of goods sold	1,600,000	
8	Variable selling and administrative expenses	480,000	
9	Contribution margin	$ 1,520,000	
10	Fixed cost of goods sold	1,160,000	
11	Fixed selling and administrative expenses	240,000	
12	Net profit	$ 120,000	
13			

At the end of 2012, the company prepared the following income statement showing actual results:

	A	B	C
1	**Home Products, Inc.**		
2	**Income Statement**		
3	**Year Ending December 31, 2012**		
4			
5		**Actual Results**	
6	Sales	$ 3,610,000	
7	Variable cost of goods sold	1,736,000	
8	Variable selling and administrative expenses	500,000	
9	Contribution margin	$ 1,374,000	
10	Fixed cost of goods sold	990,000	
11	Fixed selling and administrative expenses	255,000	
12	Net profit	$ 129,000	
13			

Required:

Prepare an Excel spreadsheet comparing the actual results to budgeted amounts using the format shown as follows, and comment on the results.

	A	B	C	D	E	F
1	**Home Products, Inc.**					
2	**Income Statement Variance Analysis**					
3	**Year Ending December 31, 2012**					
4					**(Favorable)**	
5		**Actual**	**Budget**	**Variance**	**Unfavorable**	
6	Sales					
7	Variable cost of goods sold					
8	Variable selling and administrative expenses					
9	Contribution margin					
10	Fixed cost of goods sold					
11	Fixed selling and administrative expenses					
12	Net profit					
13						

Comprehensive Case

45. Variable Production Cost Variance Analysis. Iron Products, Inc., produces prefabricated iron fencing used in commercial construction. Variable overhead is applied to products based on direct labor hours. The company uses a just-in-time production system and thus has insignificant inventory levels at the end of each month. The income statement for the month of November comparing actual results with the flexible budget based on actual sales of 2,000 units is shown as follows.

Iron Products, Inc.
Income Statement
(budget versus actual)

	Actual	Budget	Variance	
Sales	$ 1,805,000	$ 1,800,000	$ (5,000)	Favorable
Variable cost of goods sold	867,400	800,000	67,400	Unfavorable
Variable selling and administrative expenses	250,000	240,000	10,000	Unfavorable
Contribution margin	687,600	760,000	72,400	Unfavorable
Fixed cost of goods sold	575,000	580,000	(5,000)	Favorable
Fixed selling and administrative expenses	117,000	120,000	(3,000)	Favorable
Net profit	$ (4,400)	$ 60,000	$ 64,000	Unfavorable

Iron Products is disappointed with the actual results and has hired you as a consultant to provide further information as to why the company has been struggling to meet budgeted net profit. Your review of the previously presented budget versus actual analysis identifies variable cost of goods sold as the main culprit. The unfavorable variance for this line item is $67,400.

After further research, you are able to track down the following standard cost information for variable production costs:

	Standard Cost per Unit
Direct materials (50 pounds per unit at $5 per pound)	$250
Direct labor (3 hours at $20 per hour)	60
Variable overhead (3 direct labor hours at $30 per hour)	90
Standard variable production cost per unit	$400

Actual production information related to variable cost of goods sold for the month of November is as follows:

- 2,000 units were produced and sold.
- 110,000 pounds of material were purchased and used at a total cost of $528,000.
- 5,600 direct labor hours were used during the month at a total cost of $134,400.
- Variable overhead costs totaled $205,000.

Required:

1. Calculate the materials price variance and materials quantity variance using the format shown in Figure 4.4 “Direct Materials Variance Analysis for Jerry’s Ice Cream”. Clearly label each variance as favorable or unfavorable.

2. Calculate the labor rate variance and labor efficiency variance using the format shown in Figure 4.6 “Direct Labor Variance Analysis for Jerry’s Ice Cream”. Clearly label each variance as favorable or unfavorable.
3. Calculate the variable overhead spending variance and variable overhead efficiency variance using the format shown in Figure 4.8 “Variable Manufacturing Overhead Variance Analysis for Jerry’s Ice Cream”. Clearly label each variance as favorable or unfavorable.
4. List each of the six variances calculated in requirements **a**, **b**, and **c**, and total the variances to show one net variance. Clearly label the net variance as favorable or unfavorable. Explain how this net variance relates to variable cost of goods sold on the income statement.
5. Identify the highest favorable variance and highest unfavorable variance from the six listed in requirement **d**, and provide one possible cause of each variance.

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Chapter 5 How Do Managers Evaluate Performance in Decentralized Organizations?

Mandy Dwyer is the president and CEO of Game Products, Inc., a producer of games and sporting goods sold to a variety of retail stores. Game Products, Inc., has three divisions: Sporting Goods, Board Games, and Computer Games. Each division is relatively autonomous with a separate manager, who independently oversees each division. Mandy Dwyer is reviewing the results of the most recent fiscal year with Larry Meske, the company's CFO:

Mandy:
In reviewing our segmented income statement, it looks like the Board Games division had a terrific year. Profits increased substantially over last year, more than either of the other two divisions, and overall profit for this division is well above the other two. Carla Klesko, the Board Games division manager, is to be commended for her fine work! We should consider revising her compensation plan to increase her annual bonus based on these results.

Larry:
Not so quick, Mandy. I agree that the Board Games division has successfully increased profits, but we must consider more than just the bottom line (profits) in determining how substantial the increase is in comparison to the other divisions.

Mandy:
What do you have in mind?

Larry:
For starters, we should consider what resources were invested in the Board Games division, and determine the return produced from these resources. As you recall, Carla made a significant investment in her division, whereas the other division managers did not. So naturally, we would expect Board Games division profits to increase by more than the other divisions.

Mandy:
I've always focused on the bottom line for each division. What performance measures do you propose we use?

Larry:
We have several options. Return on investment (ROI), residual income (RI), and economic value added (EVA) are three commonly used measures. Perhaps we can discuss this further next month once I've had a chance to pull some information together.

Mandy:
Excellent idea. I look forward to getting your ideas on this issue next month.

Mandy and Larry are looking for ways to evaluate the performance of the company's three division managers. Since each division is responsible for more than just the cost of production, as was the case in Chapter 4 "How Do Managers Evaluate Performance Using Cost Variance Analysis?", top management must evaluate how productively each division manager is using assets to produce profits. The focus of this chapter is on how to evaluate the performance of division managers within a decentralized organization.

5.1 Using Decentralized Organizations to Control Operations

Learning Objectives

1. Define the term decentralized organization and explain advantages and disadvantages of decentralizing.

Question: Many types of organizations decentralize operations to better manage each segment of the organization. What does it mean to decentralize operations?

Answer: The term used to describe this type of organizational structure is *decentralized organizations*. Decentralized organizations delegate decision-making and operational responsibilities to the managers of each segment of the organization. (Segments are often called divisions or subunits.) For example, universities are often segmented by discipline with one manager, or dean, responsible for each discipline (physical education, social sciences, business, etc.). Retail companies are often segmented by region, with one manager responsible for each region. Service companies are often segmented by service category, with one manager responsible for each category (e.g., an accounting firm divided into audit and tax). Decentralization is not limited to a particular type of organization, and most organizations that have grown in size and complexity decentralize to some extent.

Reasons to Decentralize

Question: Why do organizations decentralize operations?

Answer: Organizations often decentralize out of necessity as they expand. The responsibility of one manager, or group of managers, to run the entire organization can become overwhelming as the number of products offered increases.

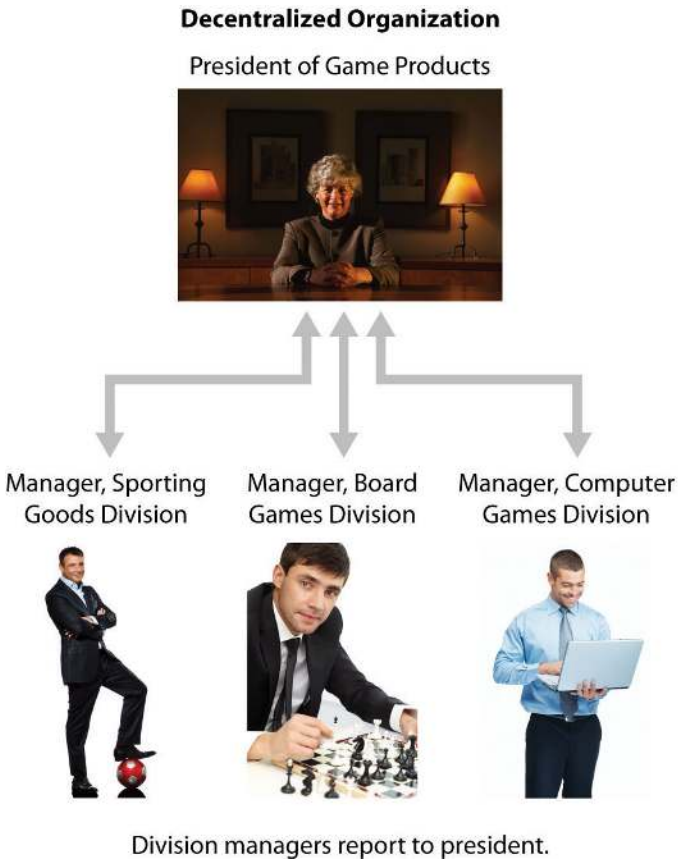
For example, Game Products, Inc., began by selling two board games to several retail stores in the northeast United States. The company did not need to decentralize at that point because it offered only two products and the geographic region in which it sold those products was limited.

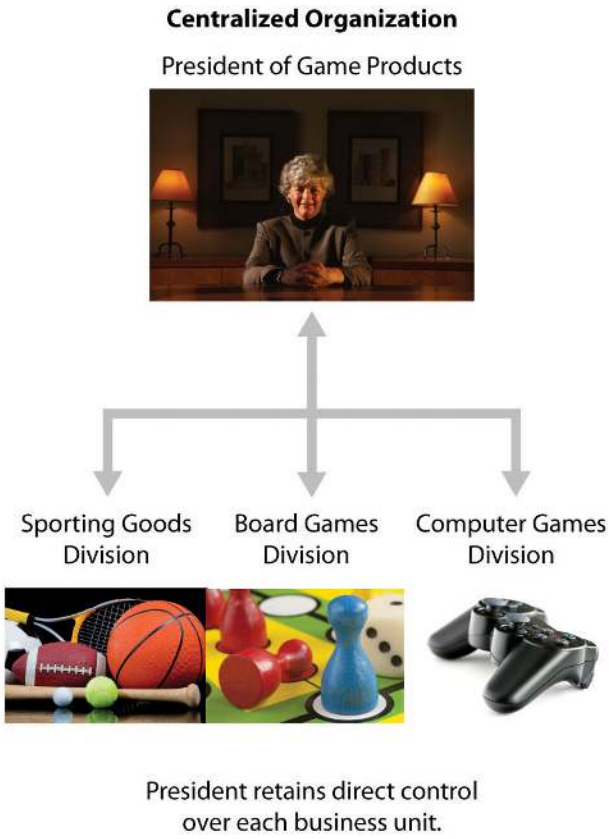
A few years later, Game Products expanded sales to Canada and the southeast Unites States, while also venturing into the computer games industry by purchasing a small maker of computer games. Although operations were not decentralized at this time—all decisions were still made at headquarters—top management was beginning to feel the strain of trying to manage two segments of the company. The decision-making process was cumbersome and slow, and the company began to miss market opportunities that would have increased sales and profits.

Two years later, Game Products decided to enter the sporting goods market, and top management and the board of directors agreed that decentralization was critical to the future success of the company. As a result, they assigned a manager to run each division. This change allowed top management to concentrate on high-level issues. such as long-range strategic planning, and it placed the decision making in the hands of managers who were intimately familiar with the operations of their individual divisions.

Although Game Products ultimately decided to decentralize operations, there are advantages and disadvantages to decentralizing. Figure 5.1 “Decentralized Versus Centralized Organizations” illustrates how operations would look at Game Products, Inc., if operations were decentralized or if they remained centralized.

Figure 5.1 Decentralized Versus Centralized Organizations





Advantages of Decentralizing Operations

Question: What are the advantages of decentralizing operations for companies like Game Products, Inc.?

Answer: Organizations like Game Products tend to decentralize as their operations grow and become more complex. The advantages of decentralizing are as follows:

- **Increased Expertise.** Rather than having one manager, or a group of managers, trying to make decisions for a wide range of products, decentralized organizations delegate decision-making authority to local managers who have expertise in specific products.
- **Quicker Decisions.** By having increased expertise and decision-making authority, local managers are able to make decisions quickly without having to wait for the approval of the organization's top management.
- **Refocus of Top Management Responsibilities.** With local managers focusing on issues important to the specific segment, top management is able to delegate the day-to-day decision-making responsibilities and focus on broader companywide issues, such as long-range strategic planning.
- **Motivation of Local Managers.** Managers who are given more responsibility, and the control necessary to manage their responsibility, tend to be more motivated than those who simply follow the orders issued by top management. In addition, a decentralized structure provides a means to train local managers for promotion to the next level of management.

Disadvantages of Decentralizing Operations

Question: What are the disadvantages of decentralizing operations for organizations, such as Game Products?

Answer: The results of decentralizing operations are not always positive. Three disadvantages of decentralizing are as follows:

- **Duplication of Services.** Organizations that decentralize often duplicate administrative services, such as accounting and computer support. That is, each segment may have its own accounting department and computer support department when these services might be provided more efficiently through one companywide department.

- **Conflict of Interest.** Managers who are evaluated solely with respect to their divisions have no incentive to make a decision that benefits the organization as a whole at the expense of the manager's division. For example, a local manager may decide to purchase raw materials from an outside supplier even though another division within the company can produce the same materials at a lower cost. (To make matters worse, the other division's manager may refuse to sell the materials at a reduced price because she is evaluated based on her division's profits!) The appendix to this chapter discusses this issue in greater detail.
- **Loss of Control.** Perhaps one of the most difficult decisions facing small, fast-growing organizations is whether to continue to expand and decentralize or to limit growth and remain highly centralized. Decentralization will lead to a loss of control at top management levels, which can have negative consequences for the organization's reputation if local managers struggle to maintain the level of quality that customers expect. Decentralized organizations are only as good as the local managers who are given decision-making authority.

Business in Action 5.1

Disadvantage of Decentralizing an Accounting Firm

Arthur Andersen was a large, decentralized accounting firm with offices located throughout the world. One or more partners operated each office independently. In 2002, **Arthur Andersen** had 85,000 employees worldwide. The firm was indicted in March 2002, and later found guilty, for obstructing justice by shredding tons of documents related to its audit work for **Enron Corporation**. As a result, **Arthur Andersen** agreed to cease its accounting practice in the United States in August 2002. By 2005, only 200 employees remained at **Arthur Andersen** to wrap up the dissolution of the firm.

Although the entire firm was indicted and found guilty of obstruction of justice, the decision to shred documents was made at the Houston office, where the bulk of the shredding took place. This serves as an extreme example of the disadvantage of decentralizing an organization. Decisions left to the division managers ("partners" in this case) can have a negative effect on the entire organization.

Note that the U.S. Supreme Court overturned the guilty verdict of the U.S. District Court in June 2005, but the damage was done and the firm did not survive.

Source: Charles Lane, "Justices Overturn Andersen Conviction," *Washington Post*, June 1, 2005, http://www.washingtonpost.com.

Key Takeaways

- Decentralized organizations delegate decision-making and operational responsibilities to the managers of each segment, or division, of the organization. Advantages of decentralized organizations include increased expertise at each division, quicker decisions, better use of time at top management levels, and increased motivation of division managers. Disadvantages include duplication of services, such as accounting and computer support; potential increase in conflicts between division manager goals and companywide goals; and loss of control at the top management level.

Check Yourself

Landscaping Services, Inc., founded and operated by Ed Barnes, has seen revenues double each year for the past three years. Although Ed has hired several laborers to ease the workload, he is still working seven days a week, 10 hours a day. Ed would like to hire a manager to assist in managing landscaping projects and has asked for your advice.

1. What concerns might you have about Ed's plan to decentralize operations?
2. How might decentralizing operations benefit Landscaping Services, Inc.?

Solution

1. There are several potential disadvantages to decentralizing. Two examples follow:
    1. For a relatively small company, such as Landscaping Services, Inc., the biggest concern is losing control over quality. Presumably Ed is successful because he provides excellent service. He must instill the importance of maintaining quality to the new manager.
    2. Ed must establish a compensation system that encourages the new manager to make decisions in the best interest of the organization. For example, if the new manager encounters an opportunity to pick up a new customer, there must be an

incentive to pursue this opportunity. If the new manager is simply given a monthly salary, there is no incentive to increase the workload! One approach is to offer part ownership in the company and therefore rights to a percentage of the company's profits.

2. There are several potential advantages to decentralizing. A few examples follow:
   - Ed can hire a manager with expertise in an area outside of Ed's expertise, which can lead to additional business and a higher level of quality.
   - Clients will no longer have to wait for Ed to arrive before a decision is made on how to proceed with the work.
   - Ed can put more time into obtaining new customers.

5.2 Maintaining Control over Decentralized Organizations

Learning Objectives

1. Define three types of responsibility centers.

Question: To evaluate performance, organizations often divide operations into segments. Segments responsible for revenues, costs, and investments in assets are called responsibility centers *. Responsibility centers can be based on such attributes as sales regions, product lines, or services offered. Why do organizations establish responsibility centers?*

Answer: The purpose of establishing responsibility centers within organizations is to hold managers responsible for only the assets, revenues, and costs they can control. For example, a factory manager typically has control over production costs, but not sales. This manager's responsibility center would only include production costs. A retail store manager typically has control over sales prices and costs. This manager's responsibility center would only include revenues and costs. The level of control a manager has over a segment's assets, revenues, and costs will help determine the type of responsibility center used for each manager.

Figure 5.2 "Three Types of Responsibility Centers" illustrates the three types of responsibility centers commonly used to evaluate segments: cost centers, profit centers, and investment centers. Each type is described in the following sections.

Figure 5.2 Three Types of Responsibility Centers

Cost Center

The human resources department is an example of a cost center.

Profit Center

An individual fast-food restaurant in a large chain is an example of a profit center.

Investment Center

A theme park is an example of an investment center.

Cost Center

Question: What is a cost center, and what measures are used to evaluate this type of responsibility center?

Answer: A cost center is an organizational segment that is responsible for costs, but not revenue or investments in assets. Service departments, such as accounting, marketing, computer support, and human resources, are cost centers. Managers of these departments are evaluated based on providing a certain level of services for the company at a reasonable cost.

Production departments within a manufacturing firm are also treated as cost centers. Production managers are evaluated based on meeting cost budgets for producing a certain level of goods. Chapter 4 “How Do Managers Evaluate Performance Using Cost Variance Analysis?” describes the use of cost variance analysis to evaluate cost centers within a manufacturing firm.

Profit Center

Question: What is a profit center, and what measures are used to evaluate this type of responsibility center?

Answer: A profit center is an organizational segment that is responsible for costs and revenues (and therefore, profit), but not investments in assets. Retail stores for companies, such as **Macy’s** or **Target**, are treated as profit centers. Individual fast food restaurants for **McDonald’s** or **Kentucky Fried Chicken** are also examples of profit centers. Managers of profit centers are responsible for revenues, costs, and resulting profits. (Some individual retail stores and fast food restaurants may be considered investment centers if the store manager is also responsible for large investment decisions, such as enlarging the building and purchasing more equipment to accommodate additional customers. Profit center determination must be made on a case-by-case basis, and it depends on the level of responsibility assigned to the store manager.)

Methods of performance evaluation for profit centers vary. Some organizations compare actual profit to budgeted profit. Others compare one profit center to another. Also, some organizations use segmented income statement ratios, such as gross margin or operating profit, to compare current profit center performance to prior periods and to other profit centers. Chapter 7 “How Do Managers Use Financial and Nonfinancial Performance Measures?” explains how companies can use financial ratios to evaluate profit center performance.

Investment Center

Question: What is an investment center, and what measures are used to evaluate this type of responsibility center?

Answer: An investment center is an organizational segment that is responsible for costs, revenues, and investments in assets. Investment center managers have control over asset investment decisions. In many cases, investment centers are treated as stand-alone businesses. Examples of investment centers include the Chevrolet division of **General Motors** and the printer division of **Hewlett Packard**.

Several measures can be used to evaluate the performance of investment center managers, including *segmented net income*, *ROI*, *RI*, and *economic value added (EVA)*. The remainder of this chapter will focus on these measures using Game Products, Inc., as the example company. Before turning to these topics, however, look at “Business in Action 5.2” which indicates the challenges that accountants and managers at **Hewlett-Packard** face when preparing the company’s annual report.

Business in Action 5.2

Segment Reporting at **Hewlett-Packard Company**

Hewlett-Packard Company provides financial information for seven segments in its annual report. Examples of segments and related revenues (in millions) include Notebooks ($22,928), Printing Supplies ($12,921), and Desktops ($12,046). These segments are likely treated as investment centers where segment managers are responsible for costs, revenues, and investments in assets.

Source: Hewlett-Packard Company, “2019 Annual Report,” .https://investor.hp.com/financials/annual-reports-and-proxies/default.aspx

Key Takeaways

- Responsibility centers are categorized depending on the level of control over revenues, costs, or investments. A segment responsible only for costs is called a cost center. A segment responsible for costs and revenues is called a profit center. A segment responsible for costs, revenues, and investment in assets is called an investment center. Performance measures used to evaluate managers depend on the type of responsibility center being managed.

Check Yourself

For each of the organizational segments listed, determine whether it is a cost center, profit center, or investment center. Explain your answer.

1. Individual retail store at **Home Depot**
2. Accounting department at **Ford Motor Company**
3. Saturn division of **General Motors**
4. Human resources department at **IBM**
5. Production department at **Sony**
6. Jet engine division of **General Electric**
7. Computer support department at **Nike**

Solution to Review Problem 11.2

1. Profit center. The manager is responsible for costs and revenues, but not investments in assets. (A case might be made that if the manager has control over significant purchases of assets for the store, this would be an investment center.)
2. Cost center. The manager is responsible for costs only, not revenues or investments in assets.
3. Investment center. The manager is responsible for costs, revenues, and investment decisions.
4. Cost center. The manager is responsible for costs only, not revenues or investments in assets.
5. Cost center. The manager is responsible for costs only, not revenues or investments in assets.
6. Investment center. The manager is responsible for costs, revenues, and investment decisions.
7. Cost center. The manager is responsible for costs only, not revenues or investments in assets.

5.3 Comparing Segmented Income for Investment Centers

Learning Objectives

1. Calculate and interpret segmented net income to evaluate performance.

Question: Now that we know an investment center is an organizational segment responsible for costs, revenues, and investments in assets, where do we start in trying to evaluate the performance of investment centers?

Answer: The starting point for evaluating investment centers is typically with reviewing segmented income for each investment center (or division). Segmented income is segment revenues minus segment expenses. Top management is interested in the level of profit that each division generates, and segmented income gives them this information.

Revisiting Game Products, Inc.

Question: In the dialogue at the beginning of the chapter, Mandy Dwyer, president and CEO, said she would like to increase the annual bonus for Carla Klesko, manager of the Board Games division, based on the division's level of profit relative to the other divisions. How does the Board Games division profits compare with the other divisions?

Answer: Profit for the Board Games division is higher than either of the other two, as shown in Figure 5.3 "Segmented Income Statements (Game Products, Inc.)".

Figure 5.3 Segmented Income Statements (Game Products, Inc.)

Game Products, Inc.
Segmented Income Statements
for the Current Fiscal Year Ended December 31
(dollar amounts are in thousands)

	Sporting Goods Division	Board Games Division	Computer Games Division
Sales	$ 20,000	$ 34,000	$ 29,000
Cost of goods sold	6,000	11,000	10,000
Gross margin	$ 14,000	$ 23,000	$ 19,000
Allocated overhead (from corporate)	1,205	2,048	1,747
Selling and administrative expenses	9,500	16,000	15,000
Operating income	$ 3,295	$ 4,925	$ 2,253
Income tax expense (30% rate)	989	1,486	676
Net income	$ 2,306	$ 3,466	$ 1,577
Profit margin ratio	11.53%	10.19%	5.44%

Although this income statement looks much like a financial accounting income statement prepared for outside users, it is for internal use and therefore, need not comply with U.S. Generally Accepted Accounting Principles (U.S. GAAP). In fact, organizations can define income or profit many different ways when evaluating performance. For example, some might only look at operating income (taxes are really outside of the control of the manager), others might exclude allocated overhead from operating income. Another alternative is to focus on gross margin. The point is that managerial accountants must be flexible in designing reports that best meet the needs of managers.

The president of Game Products, Inc., referred to net income when she indicated that the Board Games division performed very well for the year. Solely based on this measure, Mandy's statement is accurate as the Board Games division has net income of $3,466,000 versus $2,306,000 for the Sporting Goods division and $1,577,000 for the Computer Games division.

Limitations of Using Segmented Income to Measure Performance

Question: Although using net income for each division as a performance measure is relatively simple, there are two significant weaknesses. What are these weaknesses?

Answer: First, not all divisions are of equal size. Naturally, larger divisions should produce larger profits. It is unfair to compare net income for a smaller division with net income for a larger division for the purpose of evaluating division manager performance. With $34,000,000 in sales, the Board Games division should be expected to have higher net income than the other divisions, each of which has sales of less than $30,000,000.

One solution is to compare profit margin ratios for each division (net income ÷ sales). As shown at the bottom of Figure 5.3 "Segmented Income Statements (Game Products, Inc.)", the Sporting Goods division has the highest profit margin ratio at 11.53 percent, compared to 10.19 percent for Board Games, and 5.44 percent for Computer Games. (Chapter 7 "How Do Managers Use Financial and Nonfinancial Performance Measures?" presents several additional financial ratios used to evaluate performance.)

Because each division manager has control over revenues, costs, *and investments in assets*, each division is considered an investment center. Thus a second weakness in using segmented net income information to evaluate division manager performance is that net income as the sole measure of performance ignores the assets used to produce net income.

For example, suppose the Sporting Goods division only invested approximately $29,000,000 in assets to produce $2,306,000 in income, while the Board Games division invested $55,000,000 in assets to produce $3,466,000 in income. Which division had the best performance? We need a measure to evaluate how well each division performed relative to the investments made. We discuss three such measures next.

Key Takeaways

- Investment center managers are often evaluated using segment net income, which is segment revenues minus segment expenses. However, two weaknesses are that this measure does not consider the revenues required to produce segment net income, and this measure ignores the assets used to produce segment net income.

Check Yourself

Kitchen Appliances has two divisions—a Southern division and a Northern division. The following segmented financial information is for the most recent fiscal year ended December 31 (dollar amounts are in thousands).

	Southern Division	**Northern Division**
Sales	$5,000	$30,000
Cost of goods sold	1,500	13,000
Allocated overhead	286	1,714
Selling and administrative expenses	2,100	12,000

Assume the tax rate is 30 percent.

1. Prepare a segmented income statement using the format presented in Figure 5.3 “Segmented Income Statements (Game Products, Inc.)”.
2. Using net income as the measure, which division is most profitable? Explain why this conclusion might be misleading.
3. Calculate the profit margin ratio and explain why organizations often use this ratio rather than simply using net income?

Solution

1. The segmented income statements are shown as follows.

Kitchen Appliances
Segmented Income Statements
for the Current Fiscal Year Ended December 31
(dollar amounts are in thousands)

	Southern Division	Northern Division
Sales	$5,000	$30,000
Cost of goods sold	1,500	13,000
Gross margin	$3,500	$17,000
Allocated overhead (from corporate)	286	1,714
Selling and administrative expenses	2,100	12,000
Operating income	$1,114	$ 3,286
Income tax expense (30% rate)	334	986
Net income	$ 780	$ 2,300

2. The Northern division is most profitable with net income of $2,300,000 versus net income of $780,000 in the Southern division. Using net income to evaluate which division is most profitable can be misleading because it does not consider the amount of assets needed to produce income. For example, the Northern division may have invested considerably less in assets to produce net income of $780,000.

   Another reason this may be misleading is no consideration is given to the dollar amount of sales required to produce the net income for each division. Clearly the Northern division has significantly higher sales ($30,000,000 versus $5,000,000 for the Southern division) and therefore should have significantly higher net income.

3. The profit margin ratio for the Southern division is 15.60 percent (= $780,000 net income ÷ $5,000,000 sales), and the profit margin ratio for the Northern division is 7.67 percent (= $2,300,000 net income ÷ $30,000,000). This shows that each dollar in sales at the Southern division generates more net income (15.60 cents) than at the Northern division (7.67 cents).

   Organizations prefer to use the profit margin ratio when comparing segments because it serves as an equalizer in comparing divisions with significantly different levels of sales revenue.

5.4 Using Return on Investment (ROI) to Evaluate Performance

Learning Objectives

1. Calculate and interpret return on investment (ROI) to evaluate performance.

Question: Perhaps the most common measure of performance for managers responsible for investment centers is return on investment (ROI). What is ROI, and how is it used to evaluate investment centers?

Answer: ROI is defined as *operating income* divided by *average operating assets*:

Key Equation

Return on investment=Operating income / Average operating assets

Note that different organizations use different measures to calculate ROI. Our goal in this discussion is to introduce one common approach, but keep in mind that organizations often make adjustments to this formula to better suit their needs.

The advantage of ROI as a performance measure is that it includes the use of assets. For example, assume 2 divisions have $10,000 in operating income. Both divisions appear to have performed equally well based on operating income. However, further review shows that Division 1 invested $200,000 in average operating assets to produce this income while Division 2 invested $400,000. Clearly, the division that invested half the amount in assets to produce the same amount of income had the best performance of the two. Comparing the ROI for each division proves this:

ROI for Division 1=$10,000 / $200,000=5% ROI for Division 2=$10,000 / $400,000=2.5%

Let's take a closer look at the components of the ROI calculation, *operating income* and *average operating assets*.

Operating Income and Average Operating Assets

Question: What is operating income, and how does it differ from net income?

Answer: Operating income is the income produced by the division from its daily activities. It *excludes* items used in the calculation of net income, such as income tax expense, interest income, interest expense, and any unusual gains or losses. The focus is on how well the division performed relative to its core business operations, which does not include one-time gains or losses from the sale of property, plant, and equipment for example.

Question: What are average operating assets, and how is this amount calculated?

Answer: Average operating assets are the assets that the division has in place to run the daily operations of the business, and this value is calculated by adding beginning period balances and ending period balances and dividing by two. Examples of operating assets include cash, accounts receivable, prepaid assets, buildings, and equipment. As long as the division uses the assets to produce operating income, they are included in the operating assets category. Examples of nonoperating assets—assets not included in this calculation—include land held for investment purposes and office buildings leased to other companies.

An average of operating assets is taken over the period being evaluated for two reasons. First, operating assets are often purchased and sold during an accounting period, and simply taking the ending balance might produce distorted, if not inaccurate, results. Second, operating income represents information for a period of time (income statements always present information for a *period of time*), while operating assets are presented at a point in time (balance sheets always present information for a *point in time*). If both of these items are to be included in one ratio (ROI), it is best to use average balance information for balance sheet items. In fact, if the information is readily available, it would be best to take an average of daily operating asset balances for the period being evaluated.

Computing ROI at Game Products, Inc.

Question: Using ROI as the measure, how do the divisions at Game Products, Inc., compare with each other?

Answer: Figure 5.3 "Segmented Income Statements (Game Products, Inc.)" shows segmented income statement information for each of Game Products' three divisions. The *operating income* line of this income statement provides information needed for the numerator of the ROI calculation. Figure 5.4 "Segmented Balance Sheets (Game Products, Inc.)" presents the segmented balance sheets for each division needed to calculate *average operating assets*.

Figure 5.4 Segmented Balance Sheets (Game Products, Inc.)

Game Products, Inc.
Segmented Balance Sheets
December 31
(dollar amounts are in thousands)

	Sporting Goods Division		Board Games Division		Computer Games Division	
	Ending Balance	Beginning Balance	Ending Balance	Beginning Balance	Ending Balance	Beginning Balance
Assets						
Cash	$ 3,700	$ 3,500	$ 6,400	$ 5,200	$ 4,400	$ 4,200
Accounts receivable	3,200	3,000	8,000	6,600	5,000	4,700
Inventory	3,000	2,900	7,400	6,300	3,900	3,800
Total current assets	$ 9,900	$ 9,400	$21,800	$18,100	$13,300	$12,700
Property, plant and equipment (net)	20,600	18,800	39,000	32,000	21,200	19,600
Total assets	$30,500	$28,200	$60,800	$50,100	$34,500	$32,300
Liabilities and owners' equity						
Accounts payable	$ 2,400	$ 2,200	$ 3,700	$ 3,100	$ 2,600	$ 2,400
Other current liabilities	1,000	1,200	1,400	800	1,100	900
Total current liabilities	$ 3,400	$ 3,400	$ 5,100	$ 3,900	$ 3,700	$ 3,300
Long-term liabilities	0	0	0	0	0	0
Total liabilities	3,400	3,400	5,100	3,900	3,700	3,300
Total owners' equity	27,100	28,800	55,700	46,200	30,800	29,000
Total liabilities and owners' equity	$30,500	$28,200	$60,800	$50,100	$34,500	$32,300

Let's see how each division ranks using ROI. Assume all assets at Game Products, Inc., are operating assets. We use the information in Figure 5.3 "Segmented Income Statements (Game Products, Inc.)" and Figure 5.4 "Segmented Balance Sheets (Game Products, Inc.)" to calculate the ROI for each division in Figure 5.5 "ROI Calculations (Game Products, Inc.)".

Figure 5.5 ROI Calculations (Game Products, Inc.)

Game Products, Inc.
Return on Investment
for the Current Fiscal Year Ended December 31
(dollar amounts are in thousands)

	Sporting Goods Division	Board Games Division	Computer Games Division
Operating income*	$ 3,295	$ 4,952	$ 2,253
Average operating assets**	÷ $29,350	÷ $55,450	÷ $33,400
Return on investment^	11.23%	8.93%	6.75%

*Operating income amount is from segmented income statements presented in Figure 5.3 “Segmented Income Statements (Game Products, Inc.)”.

**Average operating assets are calculated using the balance sheet information in Figure 5.4 “Segmented Balance Sheets (Game Products, Inc.)”. Since all assets at Game Products, Inc., are operating assets, total asset amounts are used in this calculation. The calculation of average operating assets for each division is (Beginning balance of total assets + Ending balance of total assets) ÷ 2. Average operating assets for the Sporting Goods division is $29,350 (= [$30,500 + $28,200] ÷ 2).

^ROI = Operating income ÷ Average operating assets. For Sporting Goods division, 11.23 percent = $3,295 ÷ $29,350.

The ROI measures presented in Figure 5.5 “ROI Calculations (Game Products, Inc.)” show that although the Board Games division has the highest operating income, its ROI ranks in the middle of the three divisions. The Sporting Goods division has the highest ROI at 11.23 percent, Board Games is second at 8.93 percent, and Computer Games is the lowest at 6.75 percent. Since managers of each division are responsible for maximizing profit based on investments they make in assets, ROI is a reasonable approach to evaluating each manager. The Sporting Goods division manager appears to be outperforming the other two managers based on this measure.

Issues with ROI as a Performance Measure

Like most financial measures of performance, ROI can be calculated in several different ways. The components of this calculation often vary from one organization to the next. These variations are discussed next.

Operating Income Calculation—A Closer Look

Question: For the purposes of the Game Products, Inc., example, we use the same definition of operating income that is used for financial reporting purposes in accordance with U.S. GAAP. However, organizations often create their own unique calculation of operating income for internal evaluation purposes. How might the internal calculation of operating income vary from U.S. GAAP?

Answer: There are several variations that organizations use when calculating operating income. Two of the more common variations are discussed next.

Excluding Allocated Overhead

The segmented income statements for Game Products, Inc., are presented again in Figure 5.6 “Segmented Income Statements (Game Products, Inc.)” (these are the same segmented income statements as in Figure 5.3 “Segmented Income Statements (Game Products, Inc.)”). Notice the expense line item labeled *allocated overhead (from corporate)*. Although we include this expense in calculating operating income, many organizations do not, particularly if division managers have no control over allocated overhead. Excluding allocated overhead has the effect of increasing ROI for each division manager and holds each division manager responsible only for expense amounts that are controllable.

Figure 5.6 Segmented Income Statements (Game Products, Inc.)

Game Products, Inc.
Segmented Income Statements
for the Current Fiscal Year Ended December 31
(dollar amounts are in thousands.)

	Sporting Goods Division	Board Games Division	Computer Games Division
Sales	$20,000	$34,000	$29,000
Cost of goods sold	6,000	11,000	10,000
Gross margin	$14,000	$23,000	$19,000
Allocated overhead (from corporate)	1,205	2,048	1,747
Selling and administrative expenses	9,500	16,000	15,000
Operating income	$ 3,295	$ 4,925	$ 2,253
Income tax expense (30% rate)	989	1,486	676
Net income	$ 2,306	$ 3,466	$ 1,577

Some companies do not include allocated overhead to calculate ROI.

Some companies include income tax expense to calculate ROI.

Game Products uses operating income to calculate ROI.

Including Income Tax Expense

Review Figure 5.6 "Segmented Income Statements (Game Products, Inc.)" and notice the line item labeled *income tax expense*. Although we do not include income tax expense in the operating income calculation, some organizations prefer to include this item. Including after-tax expense reduces ROI for each division manager (assuming each division is profitable).

The point here is that the needs of management determine how to define operating income. We will use the U.S. GAAP definition, presented as operating income in Figure 5.6 "Segmented Income Statements (Game Products, Inc.)", throughout this chapter unless indicated otherwise.

Average Operating Assets Calculation—A Closer Look

Question: For Game Products, Inc., we assume all assets are operating assets. That is, all assets are used in the daily operations of the business. As discussed earlier, assets that are not used in the daily operations of the business, such as land held for investment or buildings sublet to other companies, are not included in this calculation. The average is found by taking the beginning balance plus ending balance and dividing by two. The issue in this calculation focuses on long-term assets that are depreciated over time. What options exist in valuing long-term assets for the purpose of calculating ROI?

Answer: There are two common approaches to valuing long-term assets when calculating ROI. Each approach is discussed next.

Using Net Book Value to Calculate ROI

In the Game Products, Inc., example, we use the net book value of long-term assets to calculate operating assets. That is, accumulated depreciation is subtracted from the original cost on the segmented balance sheet in accordance with U.S. GAAP. The balance sheet presented in Figure 5.4 "Segmented Balance Sheets (Game Products, Inc.)" shows this in the line item labeled *property, plant, and equipment, net*. The advantage of using net book value is that the information is easily obtained from the financial records.

The problem with this approach is division managers with older assets that have been substantially depreciated have an advantage over division managers with newer assets that have not been significantly depreciated. Older assets have a lower net book value (cost – accumulated depreciation) than newer assets, which reduces average operating assets in the denominator and increases ROI.

For example, assume two divisions have identical operating income for the year and identical assets. However, Division 1 has been in operation for many more years than Division 2 and thus has far more accumulated depreciation on long-term assets. This results in a lower net book value on long-term assets for Division 1 as shown in the following:

	Division 1 (older)	Division 2 (newer)
Property, plant and equipment	$1,000,000	$1,000,000
Less accumulated depreciation	800,000	100,000
Net book value	$ 200,000	$ 900,000

The net book value approach to calulating ROI includes net book value of long-term assets in the denominator (shown here).

Assuming all other assets are identical, and both divisions have identical operating income, Division 1 will have a higher ROI simply because long-term assets are older and have more accumulated depreciation, thereby reducing average operating assets in the denominator. (Reducing the denominator increases the ratio.)

An additional weakness in using net book value to calculate average operating assets is the disincentive it creates for division managers to replace old and inefficient long-term assets, such as equipment and machinery. Although new equipment purchases may be needed to improve efficiency and to remain competitive, the short-term impact is to reduce ROI. (Older equipment will have a lower net book value than identical newer equipment. Thus replacing old equipment will decrease ROI.)

If division managers are evaluated based on ROI, using net book value tends to discourage investments in long-term assets, often at the expense of the organization's long-term profitability.

Using Gross Book Value to Calculate ROI

An alternative approach in calculating ROI is to use gross book value in the average operating assets calculation. Gross book value simply refers to the original cost of long-term assets and ignores accumulated depreciation.

In our example of two divisions with identical assets and identical operating income, the same original cost amount is used in calculating average operating assets. Division 2 is not penalized in the denominator for having newer assets and less accumulated depreciation.

	Division 1 (older)	Division 2 (newer)
Property, plant and equipment	$1,000,000	$1,000,000
Less accumulated depreciation	800,000	100,000
Net book value	$ 200,000	$ 900,000

The gross book value approach to calculating ROI uses the original cost of long-term assets in the denominator (shown here).

Although both net book value and gross book value are used in practice, we will use net book value throughout this chapter unless indicated otherwise. “Key Equation: Variations of ROI Calculation” summarizes the issues surrounding the calculation of ROI.

Key Equation

Variations of ROI Calculation

Return on investment=Operating income* / Average operating assets**

*The U.S. GAAP definition of operating income is used for the numerator. However, organizations often calculate operating income differently. Some exclude allocated overhead while others may include income tax expense to get after-tax operating income.

**Average operating assets includes only those assets used in the daily operations of the business. Long-term assets are valued at net book value. However, valuation of long-term assets varies from one organization to the next. Some use *gross* book value rather than *net* book value.

Check Yourself

This is a continuation of the earlier check yourself for Kitchen Appliances. Recall that Kitchen Appliances has two divisions broken out by region—a Southern division and a Northern division. The following segmented income statement is for the most recent fiscal year ended December 31 (you were asked to prepare this income statement earlier).

Kitchen Appliances
Segmented Income Statements
for the Current Fiscal Year Ended December 31
(dollar amounts are in thousands)

	Southern Division	Northern Division
Sales	$ 5,000	$ 30,000
Cost of goods sold	1,500	13,000
Gross margin	$ 3,500	$ 17,000
Allocated overhead (from corporate)	286	1,714
Selling and administrative expenses	2,100	12,000
Operating income	$ 1,114	$ 3,286
Income tax expense (30% rate)	334	986
Net income	$ 780	$ 2,300

Segmented balance sheets for Kitchen Appliances appear as follows.

Kitchen Appliances
Segmented Balance Statements
December 31
(dollar amounts are in thousands)

	Southern Division		Northern Division	
Assets	Ending Balance	Beginning Balance	Ending Balance	Beginning Balance
Cash	$ 1,100	$ 1,050	$ 4,400	$ 3,800
Accounts receivable	800	850	3,100	3,150
Inventory	2,000	2,100	7,500	7,650
Total current assets	$ 3,900	$ 4,000	$ 14,600	$ 14,600
Property, plant and equipment (net)	5,500	5,800	26,000	28,000
Land (held for sale)	1,000	1,000	2,500	2,500
Total assets	$ 10,400	$ 10,800	$ 43,100	$ 45,100
Liabilities and owners' equity				
Accounts payable	$ 1,200	$ 1,150	$ 3,700	$ 3,300
Other current liabilities	300	350	1,250	1,200
Total current liabilities	$ 1,500	$ 1,500	$ 4,950	$ 4,500
Long-term liabilities	0	0	0	0
Total liabilities	$ 1,500	$ 1,500	$ 4,950	$ 4,500
Total owners' equity	8,900	9,300	38,150	40,600
Total liabilities and owners' equity	$ 10,400	$ 10,800	$ 43,100	$ 45,100

1. Calculate *average operating assets* for each division. (Hint: land held for sale is *not* an operating asset.)
2. Calculate *ROI* for each division.
3. What does the ROI tell you about each division at Kitchen Appliances?

Solution

(All dollar amounts are in thousands.)

1. Average operating assets are calculated in the following. Note that land held for sale is not an operating asset and thus must be deducted from total assets to find operating assets.

	Southern Division		Northern Division	
	Ending Balance	Beginning Balance	Ending Balance	Beginning Balance
Total assets	$10,400	$10,800	$43,100	$45,100
Less land held for sale	(1,000)	(1,000)	(2,500)	(2,500)
Total operating assets	$ 9,400	$ 9,800	$40,600	$42,600
Average operating assets	$9,600*		$41,600**	

*$9,600 = ($9,400 ending balance + $9,800 beginning balance) ÷ 2.

**$41,600 = ($40,600 ending balance + $42,600 beginning balance) ÷ 2.

2. ROI is calculated as follows:

Kitchen Appliances
Return on Investment
for the Current Fiscal Year Ended December 31
(dollar amounts are in thousands)

	Southern Division	Northern Division
Operating income*	$1,114	$3,286
Average operating assets**	÷ $9,600	÷ $41,600
Return on investment^	11.60%	7.90%

*Operating income is provided in the segmented income statement.

**Average operating assets is calculated in requirement 1.

^ROI = Operating income ÷ Average operating assets. For Southern division, 11.60 percent = $1,114 ÷ $9,600. For Northern Division it is $3,286 / $41,600 = 7.9%.

3. The Southern division of Kitchen Appliances has the highest ROI at 11.60 percent. The Northern division's ROI is 7.90 percent. This measure indicates the Southern division is making more profitable use of its assets than the Northern division.

Further Analysis of ROI

Question: How does breaking ROI down into two separate measures help division managers improve their division's ROI?

Answer: Many companies break ROI down into two ratios; *operating profit margin* and *asset turnover*. Each of these measures can be used to evaluate strengths and weaknesses of ROI within each division.

Key Equation

Operating profit margin=Operating income / Sales

Key Equation

Asset turnover=Sales / Average operating assets

Operating profit margin: It provides information about how much operating profit is being produced for each dollar of sales. Asset turnover is the ratio of sales to average operating assets. It provides information about how much revenue each dollar invested in average operating assets produces.

These two ratios can be multiplied by each other to find the ROI as follows:

Key Equation

ROI=Operating profit margin×Asset turnover = Return on Investment=Operating income / Average operating assets=Operating income / Sales×Sales / Average operating assets

Breaking out ROI into these two ratios provides information that helps division managers identify areas for improvement. ROI can be improved by increasing the operating profit margin, which focuses solely on income statement information. ROI can also be

improved by increasing asset turnover, which focuses on the division's use of operating assets to produce sales.

Question: How are these ratios used to evaluate the three divisions at Game Products, Inc.?

Answer: Operating profit margin, asset turnover, and ROI calculations for Game Products, Inc., are shown in Figure 5.7 "Operating Profit Margin, Asset Turnover, and ROI for Game Products, Inc.". Notice the resulting ROI for each division is the same as the ROI shown in Figure 5.5 "ROI Calculations (Game Products, Inc.)" except for slight differences attributed to rounding.

Figure 5.7 Operating Profit Margin, Asset Turnover, and ROI for Game Products, Inc.

		Sporting Goods Division	Board Games Division	Computer Games Division
Operating profit margin	= Operating income* ÷ Sales*	$ 3,295 ÷ $20,000 **16.48%**	$ 4,952 ÷ $34,000 **14.56%**	$ 2,253 ÷ $29,000 **7.77%**
Asset turnover	= Sales* ÷ Average operating assets**	$20,000 ÷ $29,350 **0.68**	$34,000 ÷ $55,450 **0.61**	$29,000 ÷ $33,400 **0.87**
ROI	= Operating profit margin × Asset turnover	16.48% × 0.68 **11.21%**	14.56% × 0.61 **8.88%**	7.77% × 0.87 **6.76%**

*From Figure 5.3 "Segmented Income Statements (Game Products, Inc.)".

**From Figure 5.5 "ROI Calculations (Game Products, Inc.)".

Figure 5.7 "Operating Profit Margin, Asset Turnover, and ROI for Game Products, Inc." shows that Sporting Goods has the highest operating profit margin at 16.48 percent compared to Board Games (14.56 percent) and Computer Games (7.77 percent). However, Computer Games has the highest asset turnover at 0.87 compared to Sporting Goods (0.68) and Board Games (0.61).

This information helps each division manager identify strengths and weaknesses. For example, the Computer Games division has excellent asset turnover relative to other divisions, but has a very low profit margin. The manager of this division must look for ways to improve the profit margin for its products (e.g., increase prices, reduce operating expenses, or both).

Another example is the Sporting Goods division, which has an excellent profit margin, but relatively low asset turnover. The manager of this division must look at ways to improve the utilization of assets to increase turnover.

Key Takeaway

- ROI is defined as operating income divided by average operating assets as shown in the following equation:

  Return on investment=Operating income / Average operating assets

  This measure provides an assessment of how effectively each division is using operating assets to produce operating income. ROI can also be broken into two separate ratios, operating profit margin and asset turnover, which are multiplied together to get ROI as follows:

  Operating profit margin×Assetturnover = Return on Investment=Operating income / Average operating assets=Operating income / Sales×Sales / Average operating assets

  Many variations of the ROI calculation are used in practice depending on the nature of the organization.

Check Yourself

Use the information from earlier check yourselves for Kitchen Appliances to complete the following requirements.

1. Calculate the operating profit margin, asset turnover, and ROI.
2. Which division has the highest ROI? Explain how the two ratios—operating profit margin and asset turnover—influenced the ROI for each division.

Solution

(All dollar amounts are in thousands.)

		Southern Division	Northern Division
Operating profit margin	= Operating income* ÷ Sales*	$1,114 ÷ $5,000 **22.28%**	$ 3,286 ÷ $30,000 **10.95%**
Asset turnover	= Sales* ÷ Average operating assets**	$5,000 ÷ $9,600 **0.52**	$30,000 ÷ $41,600 **0.72**
ROI	= Operating profit margin × Asset turnover	22.28% × 0.52 **11.59%^**	10.95% × 0.72 **7.88%^**

1.

   *From earlier data.

   **From earlier solutions, part 1.

   ^Due to rounding, ROI percent is slightly different than when computed earlier

2. The Southern division has the highest ROI (11.59 percent versus 7.88 percent at the Northern division), largely attributed to the high operating profit margin (22.28 percent versus 10.95 percent at the Northern division). However, the Southern division has the lowest asset turnover at 0.52 compared to 0.72 at the Northern division. The manager of the Northern division must look for ways to improve the profit margin for its products (e.g., increasing prices and/or reducing operating expenses). Conversely, the manager of the Southern division must look at ways to improve the utilization of assets to increase turnover.

5.5 Using Residual Income (RI) to Evaluate Performance

Learning Objectives

1. Calculate and interpret residual income (RI) to evaluate performance.

Question: Although ROI is commonly used as a divisional performance measure, some division managers dislike this measure. Why do some division managers prefer not to use ROI as a performance measure?

Answer: Some managers dislike ROI because it can lead to decisions that benefit the division but hurt the organization as a whole. Division managers have an incentive to turn down investments that *exceed* the company's minimum required rate of return but are *below* the division's current ROI, mainly because ROI trends are often used to evaluate managers. For example, assume the manager of a division is evaluated based on ROI, and the division currently has an ROI of 20 percent:

ROI before new investment=Operating income / Average operating assets=$20,000 / $100,000=20%

The company's minimum required rate of return is 10 percent, and the division manager is presented with an investment opportunity expected to yield an ROI of 15 percent. This investment totals $70,000 and annual operating profit will be $10,500 (15

percent ROI = $10,500 ÷ $70,000). Although this investment is well above the company's minimum required rate of return, the division manager will likely not make the investment since the division's overall ROI will decline from 20 percent to 17.9 percent:

ROI after new investment= ($20,000 + $10,500) / ($100,000 + $70,000)=$30,500 / $170,000=17.9%

If evaluated solely based on ROI, the division manager would prefer to invest only in projects that increase the division's ROI above 20 percent. In fact, the division manager has an incentive to shed all investments yielding less than 20 percent, even if the investments are producing a return above the company's minimum requirement of 10 percent. An alternative measure to ROI, called *residual income (RI)*, helps to mitigate this apparent conflict.

Calculating Residual Income

Question: What is RI (residual income), and how does it help to prevent the conflict associated with ROI?

Answer: RI is the dollar amount of division operating profit in excess of the division's cost of acquiring capital to purchase operating assets. The calculation is as follows:

Key Takeaways

Residual income = Operating income−(Percent cost of capital × Average operating assets)

Rather than using a ratio to evaluate performance, RI uses a dollar amount. As long as an investment yields operating profit higher than the division's cost of acquiring capital, managers evaluated with RI have an incentive to accept the investment. The manager's goal is to increase RI from one period to the next.

Notice that *operating income* and *average operating assets* used here to calculate RI are the same measures used in the ROI calculation presented earlier. The one new item, percent cost of capital, is the company's percentage cost to obtain investment funds (often called capital). For example, a company that raises funds by issuing bonds would use the interest rate associated with the bonds in establishing its percent cost of capital. We will always provide the percent cost of capital in this chapter, leaving detailed discussions of its calculation to more advanced courses. Note that several sources provide cost of capital information by industry. One source is the Leonard N. Stern School of Business at New York University (http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/wacc.htm).

Let's take another look at the division that rejected an investment yielding an ROI higher than the company's minimum required rate of return of 10 percent but lower than the division's current ROI of 20 percent. Assume the company's percent cost of capital is the same as its minimum required rate of return of 10 percent. Three RI calculations are provided as follows, (1) RI *before* the new investment, (2) RI *from* the new investment, and (3) RI *after* the new investment. (Note that some organizations make adjustments to the cost of capital to determine the minimum required rate of return. Throughout this chapter, assume *percent cost of capital* is the same as *minimum required rate of return* unless stated otherwise.)

Residual income before new investment=$20,000 − (10% × $100,000)=$20,000−$10,000=$10,000
Residual income from new investment=$10,500 − (10% × $70,000)=$10,500 − $7,000= $3,500
Residual income after new investment=$30,500 − (10% × $170,000)=$30,500 − $17,000=$13,500

Since the manager's goal is to continually increase RI, the proposed investment would be accepted resulting in an increase of $3,500 in RI (= $13,500 − $10,000). As shown in this example, using RI as a performance measure is an effective way to minimize the conflict between company goals and division goals that arise using ROI. Rather than maximizing ROI, division managers focus on increasing RI. Managers are more likely to accept investment proposals that have a return greater than the company's minimum required rate of return, regardless of the impact on the division's ROI.

Limitation of RI

Question: Although RI resolves some of the problems of using ROI as a performance measure, it does not provide an efficient means for comparing divisions. What is the problem with using RI to compare divisions?

Answer: Similar to the problem encountered with using segmented net income to compare divisions, RI is stated in dollars (or some other currency) rather than as a ratio. One division may have high RI simply because it has a larger asset base, which

produces higher revenues. Thus division managers should be evaluated based on how effectively they increase RI from one period to the next, perhaps in percentage growth, and *not* on how their RI compares to other divisions.

Most organizations that use RI also use ROI. Using both measures has the benefit of comparing one division to another by using ROI and minimizes the conflict between company goals and division goals by using RI.

Computing RI at Game Products, Inc.

Question: Let's revisit Game Products, Inc., and calculate RI for each of the three divisions. How did the three divisions perform using RI as the measure?

Answer: Figure 5.8 "RI Calculations (Game Products, Inc.)" shows the RI calculation for each division at Game Products, Inc., assuming a cost of capital of 8 percent. Notice that Sporting Goods and Board Games have positive RI, which indicates both divisions are producing operating income above and beyond the minimum required rate of return. Since the Computer Games division has negative RI, this division is *not* producing enough operating income to achieve the minimum required rate of return.

Having positive RI is reasonable for Sporting Goods and Board Games since both divisions have an ROI above the 8 percent minimum required rate of return (as shown back in Figure 5.7 "Operating Profit Margin, Asset Turnover, and ROI for Game Products, Inc."). It is also reasonable that Computer Games has *negative* RI since the division's ROI is less than 8 percent.

Figure 5.8 RI Calculations (Game Products, Inc.)

$$\text{Residual Income} = \text{Operating Income} - \left(\text{Percent Cost of Capital} \times \text{Average Operating Assets}\right)$$

Sporting Goods Division (dollar amounts are in thousands):

Residual income = $3,295* – (8% x $29,350**)
= $3,295 – $2,348
= $947

Board Games Division (dollar amounts are in thousands):

Residual income = $4,952* – (8% x $55,450**)
= $4,952 – $4,436
= $516

Computer Games Division (dollar amounts are in thousands):

Residual income = $2,253* – (8% x $33,400**)
= $2,253 – $2,672
= ($419)

*From Figure 5.3 "Segmented Income Statements (Game Products, Inc.)".

**From Figure 5.5 "ROI Calculations (Game Products, Inc.)".

Key Takeaways

- RI is the dollar amount of division operating profit in excess of the division's cost of acquiring capital to purchase its operating assets. The calculation is as follows:

  Residual income=Operating income−(Percent cost of capital × Average operating assets)

Operating income and average operating assets used to calculate ROI are also used here to calculate RI. The percent cost of capital is new and represents the company's percentage cost to obtain investment funds. The goal is for each division manager to increase RI over time.

Check Yourself

This is a continuation of the Kitchen Appliances example presented earlier. Financial information for Kitchen Appliances is provided again as follows. Assume the cost of capital rate is 6 percent.

Kitchen Appliances
Segmented Income Statements
for the Current Fiscal Year Ended December 31
(dollar amounts are in thousands)

	Southern Division	Northern Division
Sales	$ 5,000	$30,000
Cost of goods sold	1,500	13,000
Gross margin	$ 3,500	$17,000
Allocated overhead (from corporate)	286	1,714
Selling and administrative expenses	2,100	12,000
Operating income	$ 1,114	$ 3,286
Income tax expense (30% rate)	334	986
Net income	$ 780	$ 2,300

Kitchen Appliances
Segmented Balance Sheets
December 31
(dollar amounts are in thousands)

	Southern Division		Northern Division	
Assets	Ending Balance	Beginning Balance	Ending Balance	Beginning Balance
Cash	$ 1,100	$ 1,050	$ 4,000	$ 3,800
Accounts receivable	800	850	3,100	3,150
Inventory	2,000	2,100	7,500	7,650
Total current assets	$ 3,900	$ 4,000	$14,600	$14,600
Property, plant and equipment (net)	5,500	5,800	26,000	28,000
Land (held for sale)	1,000	1,000	2,500	2,500
Total assets	$10,400	$10,800	$43,100	$45,100
Liabilities and owners' equity				
Accounts payable	$ 1,200	$ 1,150	$ 3,700	$ 3,300
Other current liabilities	300	350	1,250	1,200
Total current liabilities	$ 1,500	$ 1,500	$ 4,950	$ 4,500
Long-term liabilities	0	0	0	0
Total liabilities	$ 1,500	$ 1,500	$ 4,950	$ 4,500
Total owners' equity	8,900	9,300	38,150	40,600
Total liabilities and owners' equity	$10,400	$10,800	$43,100	$45,100

1. Calculate *RI* for each division.
2. How should this information be used to evaluate each division manager?

Solution

1. All dollar amounts are in thousands.

$$\text{Residual Income} = \text{Operating Income} - \left(\text{Percent Cost of Capital} \times \text{Average Operating Assets}\right)$$

Southern Division (dollar amounts are in thousands):

$$\begin{aligned}\text{Residual income} &= \$1{,}114^{*} - (6\% \times \$9{,}600^{**}) \\ &= \$1{,}114 - \$576 \\ &= \underline{\underline{\$538}}\end{aligned}$$

Northern Division (dollar amounts are in thousands):

$$\begin{aligned}\text{Residual income} &= \$3{,}286^{*} - (6\% \times \$41{,}600^{**}) \\ &= \$3{,}286 - \$2{,}496 \\ &= \underline{\underline{\$790}}\end{aligned}$$

*From Earlier data.

**From earlier solutions, part 1.

2. Although the Northern division has higher RI ($790,000) than the Southern division ($538,000), it is not enough to simply conclude that the Northern division manager is performing better than the Southern division manager. The goal for each manager is to continually increase RI over time. Thus Kitchen Appliances should compare RI for each division to prior periods and reward division managers for significant increases from one period to the next.

5.6 Using Economic Value Added (EVA) to Evaluate Performance

Learning Objectives

1. Calculate and interpret economic value added (EVA) to evaluate performance.

Question: Another measure of performance similar to residual income (RI) is called economic value added. What is economic value added, and how is it used to evaluate divisions?

Answer: Economic value added (EVA)Similar to RI, and it is defined as Economic value added = Net operating profit after taxes^{adjusted} – (Percent cost of capital × Average operating assets^{adjusted}) was created and trademarked by **Stern Stewart & Company**, a management consulting firm, and is defined as follows (additional information can be found at **Stern Stewart & Company's** Web site: http://www.sternstewart.com).

Key Equation

Economic value added=Net operating profit after taxes adjusted−(Percent cost of capital × Average operating assets adjusted)

Although the calculation is similar to RI, adjustments are made to the financial information to better reflect the economic results of the division. **Stern Stewart & Company** created EVA to provide financial information without the "anomalies" that result from following U.S. GAAP. One example of an anomaly is the expensing of research and development (R&D) costs even though R&D breakthroughs often benefit companies in future years.

There are two distinct differences in calculating EVA compared to RI. First, operating profit is calculated net of income taxes. Finding operating income *after taxes* simply requires deducting income taxes from operating income. Second, adjustments are made to operating income and average operating assets. Although more than 150 possible adjustments can be made, most firms limit adjustments to 15 or less.

Three examples of adjustments to be considered when using EVA are related to research and development (R&D), advertising, and noninterest bearing current liabilities.

- **Research and development.** U.S. GAAP requires that R&D costs be expensed as incurred. However, R&D work typically benefits the company in future periods. EVA capitalizes R&D costs (that is, records these costs as a long-term asset) and amortizes these costs over the estimated useful life of R&D activities.
- **Advertising.** U.S. GAAP also requires that advertising costs be expensed as incurred. Since marketing efforts typically benefit the company in future periods, EVA capitalizes these costs and amortizes them over a period of time.
- **Noninterest bearing current liabilities.** EVA requires deducting noninterest bearing current liabilities from average operating assets. This is because current liabilities that do not require an interest payment are a free source of capital. For example, a company purchasing large amounts of inventory (an asset) on account has a free source of capital, which is presented as a noninterest bearing current liability on the balance sheet.

These three items are provided as examples of adjustments proposed by EVA advocates. However, the adjustments made depend on the organization since EVA calculations are modified to fit the needs of the organization.

Computing EVA for Game Products, Inc.

Question: How is EVA calculated for the divisions at Game Products, Inc.?

Answer: Figure 5.9 “Income Statement and Balance Sheet Information (Game Products, Inc.)” provides the segmented income statements and segmented balance sheet information for each division. These amounts were used earlier in the chapter to calculate segmented net income, ROI, and RI. Notice that research and development costs are now shown as a separate line item on the income statement, and average balances are shown on the balance sheet rather than beginning and ending balances. (Average balances are simply beginning balances plus ending balances divided by two.)

To simplify our analysis, we make only two adjustments—one for research and development and one for noninterest bearing current liabilities. The management believes research and development activities benefit future periods and would like to capitalize R&D costs and amortize these costs over several years. In addition, all current liabilities are noninterest bearing liabilities and as such will be deducted from average operating assets.

The impact of these two adjustments that must be made to the financial information presented in Figure 5.9 “Income Statement and Balance Sheet Information (Game Products, Inc.)”, described as follows, is shown in Figure 5.10 “EVA Calculations (Game Products, Inc.)”.

- **Adjustment 1.** On the balance sheet, capitalized R&D costs will increase average operating assets by the unamortized amount of $400,000 for Sporting Goods, $1,200,000 for Board Games, and $2,400,000 for Computer Games. On the income statement, R&D expense for the year shown in Figure 5.9 “Income Statement and Balance Sheet Information (Game Products, Inc.)” is added back to operating income; R&D amortization expense for one year will be deducted as an expense. R&D amortization expense for the year is $100,000 for Sporting Goods, $300,000 for Board Games, and $600,000 for Computer Games. (Note for the purposes of this chapter, amortization expense amounts will be given. Detailed calculations are left to more advanced cost accounting textbooks.)

  Since net operating profit after taxes (NOPAT) is used in the EVA calculation, we must remember to calculate NOPAT after making the R&D adjustments. Also, assume this is the first year calculating EVA. Thus Game Products has decided *not* to make any adjustments related to previous years’ R&D expenditures.

- **Adjustment 2.** All current liabilities are noninterest bearing and thus are deducted from average operating assets. (Recall that all assets are considered operating assets at Game Products, Inc.)

Figure 5.9 Income Statement and Balance Sheet Information (Game Products, Inc.)

Game Products, Inc.
Segmented Income Statements
for the Current Fiscal Year Ended December 31
(dollar amounts are in thousands)

	Sporting Goods Division	Board Games Division	Computer Games Division
Sales	$20,000	$34,000	$29,000
Cost of goods sold	6,000	11,000	10,000
Gross margin	$14,000	$23,000	$19,000
Allocated overhead (from corporate)	1,205	2,048	1,747
Research and development expenses	500	1,500	3,000
Selling and administrative expenses	9,000	14,500	12,000
Operating income	$ 3,295	$ 4,925	$ 2,253
Income tax expense (30% rate)	989	1,486	676
Net income	$ 2,306	$ 3,466	$ 1,577

Game Products, Inc.
Segmented Balance Sheets Average Balances
December 31
(dollar amounts are in thousands)

	Sporting Goods Division	Board Games Division	Computer Games Division
	Average	Average	Average
Assets	Balance	Balance	Balance
Cash	$ 3,600	$ 5,800	$ 4,300
Accounts receivable	3,100	7,300	4,850
Inventory	2,950	6,850	3,850
Total current assets	$ 9,650	$19,950	$13,000
Property, plant and equipment (net)	19,700	35,500	20,400
Total assets	$29,350	$55,450	$33,400
Liabilities and owners' equity			
Accounts payable	$ 2,300	$ 3,400	$ 2,500
Other current liabilities	1,100	1,100	1,000
Total current liabilities	3,400	4,500	3,500
Long-term liabilities	0	0	0
Total liabilities	$ 3,400	$ 4,500	$ 3,500
Total owners' equity	25,950	50,950	29,900
Total liabilities and owners' equity	$29,350	$55,450	$33,400

Figure 5.10 “EVA Calculations (Game Products, Inc.)” shows the adjustments, and the resulting EVA calculation for each division. Assume the company’s cost of capital rate is 8 percent. This is the same rate that was used for calculating RI.

Figure 5.10 EVA Calculations (Game Products, Inc.)

Game Products, Inc.
(dollar amounts are in thousands.)

Used for residual income and ROI

	Sporting Goods Division	Board Games Division	Computer Games Division
EVA adjustments to operating income			
Operating income*	$ 3,295	$ 4,952	$ 2,253
Adjustment 1: Add back R&D expenses*	500	1,500	3,000
Adjustment 1: Deduct R&D amortization (amount is given)	(100)	(300)	(600)
Adjusted operating income before tax	$ 3,695	$ 6,152	$ 4,653
Income tax expenses (30% rate)	(1,109)	(1,846)	(1,396)
Net operating profit after tax (adjusted)	$ 2,586	$ 4,306	$ 3,257
EVA adjustments to average operating assets			
Average operating assets*	$29,350	$55,450	$33,400
Adjustment 1: Add unamortized R&D (amount is given)	400	1,200	2,400
Adjustment 1: Deduct non-interest bearing current liabilities	(3,400)	(4,500)	(3,500)
Average operating assets (adjusted)	$26,350	$52,150	$32,300

Used for EVA

EVA Calculations

$$\text{Economic Value Added} = \text{Net Operating Profit After Taxes}^{adjusted} - \left(\text{Percent Cost of Capital} \times \text{Average Operating Assets}^{adjusted}\right)$$

Sporting Goods EVA = $2,586 – (8% × $26,350)
= $2,586 – $2,108
= $478

Board Games EVA = $4,306 – (8% × $52,150)
= $4,306 – $4,172
= $134

Computer Games EVA = $3,257 – (8% × $32,300)
= $3,257 – $2,584
= $673

*From Figure 5.9 “Income Statement and Balance Sheet Information (Game Products, Inc.)”.

Question: How did each of the three divisions perform using EVA as the measure?

Answer: As shown at the bottom of Figure 5.10 “EVA Calculations (Game Products, Inc.)”, all three divisions have positive EVA amounts, which indicates all three have NOPAT (adjusted) in excess of each division’s cost of investment funds (adjusted).

Recall from the example in Figure 5.8 “RI Calculations (Game Products, Inc.)” that Computer Games was the only division with negative RI. This negative amount turns to a positive amount using EVA mainly because research and development costs are capitalized and amortized over future years rather than expensed as incurred. Because the Computer Games division had significant

research and development costs, and these costs were backed out and recorded as an asset using EVA, NOPAT (adjusted) increased significantly. This caused the EVA amount for Computer Games to become positive.

Weaknesses with EVA

Question: While EVA is no doubt a popular method for evaluating investment centers, and companies as a whole, there are weaknesses in its approach. What are these weaknesses?

Answer: As stated earlier, EVA is similar to RI except adjustments are made to operating income and average operating assets to offset accounting anomalies created by U.S. GAAP. Critics of EVA argue that U.S. GAAP was established for a variety of reasons, one of which was to provide a set of reasonable and objective accounting rules to be followed when recording economic events. Modifying U.S. GAAP to calculate EVA strays from the objectivity provided by U.S. GAAP.

For example, U.S. GAAP requires R&D and advertising costs to be expensed in the period incurred because it is very difficult and subjective to estimate the future benefit these activities may provide. EVA adjustments described earlier for R&D and advertising costs depart from U.S. GAAP. EVA recommends that these costs be capitalized and amortized over the useful life of the activity. This leads to different interpretations of what the useful life should be. Managers now have an incentive to stretch useful lives out as far as possible to minimize amortization expense taken each period.

As with any performance measure, EVA has advantages and disadvantages. The key is to develop a measure that promotes behavior desired by top management and to provide consistency in evaluating managers.

Key Takeaways

Key Takeaway

- EVA is simply an extension of RI. Adjustments are made to operating income and average operating assets. EVA is calculated as follows:

  Economic value added=Net operating profit after taxes adjusted−(Percent cost of capital × Average operating assets adjusted)

Check Yourself

This is a continuation of the Kitchen Appliances example used in previous review problems. Top management of Kitchen Appliances has decided to use EVA as a performance measure for its division managers. The cost of capital rate is 6 percent.

Assume management will make three adjustments to calculate EVA as follows:

- **Adjustment 1.** Marketing costs will be capitalized and amortized over several years. On the balance sheet, average operating assets will increase by the unamortized amount of $70,000 for the Southern division and $2,800,000 for the Northern division. On the income statement, marketing expense for the year will be added back to operating income; marketing amortization expense for one year will be deducted. Assume marketing amortization expense for the year is $30,000 for the Southern division and $1,200,000 for the Northern division. No adjustments will be made for previous years' marketing expenditures.
- **Adjustment 2.** Land held for sale is not an operating asset and thus is deducted from average operating assets.
- **Adjustment 3.** All current liabilities are noninterest bearing and thus are deducted from average operating assets.

Segmented income statements and balance sheet average amounts are presented next.

Kitchen Appliances
Segmented Income Statements
For the Current Fiscal Year Ended December 31
(dollar amounts are in thousands)

	Southern Division	Northern Division
Sales	$ 5,000	$ 30,000
Cost of goods sold	1,500	13,000
Gross margin	$ 3,500	$ 17,000
Allocated overhead (from corporate)	286	1,714
Marketing expenses	100	4,000
Administrative expenses	2,000	8,000
Operating income	$ 1,114	$ 3,286
Income tax expense (30% rate)	334	986
Net income	$ 780	$ 2,300

Kitchen Appliances
Segmented Balance Sheets Average Balances
December 31
(dollar amounts are in thousands)

	Southern Division	Northern Division
Assets	Average Balance	Average Balance
Cash	$ 1,075	$ 3,900
Accounts receivable	825	3,125
Inventory	2,050	7,575
Total current assets	$ 3,950	$ 14,600
Property, plant and equipment (net)	5,650	27,000
Land (held for sale)	1,000	2,500
Total assets	$ 10,600	$ 44,100
Liabilities and owners' equity		
Accounts payable	$ 1,175	$ 3,500
Other current liabilities	325	1,225
Total current liabilities	$ 1,500	$ 4,725
Long-term liabilities	0	0
Total liabilities	$ 1,500	$ 4,725
Total owners' equity	9,100	39,375
Total liabilities and owners' equity	$ 10,600	$ 44,100

1. Calculate EVA for each division.
2. What does the EVA show for each division?

Solution

1. The EVA calculation is as follows:

Kitchen Appliances
(dollar amounts are in thousands.)

Used for residual income and ROI

	Southern Division	Northern Division
EVA adjustment to operating income		
Operating income (from income statement)	$ 1,114	$ 3,286
Adjustment 1: Add back R&D expenses (from income statement)	100	4,000
Adjustment 1: Deduct R&D amortization (given)	(30)	(1,200)
Income tax expenses (30% rate)	$ 1,184	$ 6,086
Net operating profit after tax (adjusted)	(355)	(1,826)
	$ 829	$ 4,260
EVA adjustment to average operating assets		
Average operating assets (from balance sheet)	9,600	41,600
Adjustment 1: Add unamortized R&D (amount is given)	70	2,800
Adjustment 2: Deduct land held for sale	(1,000)	(3,500)
Adjustment 3: Deduct non-interest bearing current liabilities	(1,500)	(4,725)
Average operating assets (adjusted)	$ 52,150	$ 39,675

Used for EVA

EVA Calculations

$$\text{Economic Value Added} = \text{Net Operating Profit After Taxes}^{adjusted} - \left(\text{Percent Cost of Capital} \times \text{Average Operating Asset}^{adjusted}\right)$$

Southern Division EVA = $829 – (6% × $8,170)
= $829 – $490
= $339

Northern Division EVA = $4,260 – (6% × $39,675)
= $4,260 – $2,381
= $1,893

2. Both divisions have positive EVA amounts, indicating both have NOPAT (adjusted) above and beyond the cost of investment funds (adjusted). It is interesting to note that when compared to RI amounts calculated earlier, EVA results in a significantly higher amount for the Northern division. This can be attributed to the large amount of marketing expenditures at the Northern division that were expensed using RI, but capitalized and amortized using EVA. Deferring significant amounts of marketing expenses to future years has the impact of increasing NOPAT in the year of the expenditure, thereby increasing EVA.

11.7 Wrap-Up of Game Products, Inc.

Question: At the meeting described at the beginning of the chapter between Mandy Dwyer (president and CEO) and Larry Meske (CFO), Mandy wanted to revise the compensation plan for the manager of the Board Games division to increase her bonus because

profits had increased significantly compared to prior years. Larry suggested using measures other than segmented net income to evaluate each division and asked for time to gather additional information. What information did Larry gather, and how does this additional information help Mandy evaluate each division?

Answer: Larry assembled the information using the five methods of evaluating investment centers presented in this chapter: (1) segmented net income, (2) profit margin ratio, (3) return on investment (ROI), (4) residual income (RI), and (5) economic value added (EVA). These five measures have been calculated for each division of Game Products, Inc., and are summarized in Figure 5.11 "Five Performance Measures at Game Products, Inc.".

Figure 5.11 Five Performance Measures at Game Products, Inc.

Game Products, Inc.
Performance Evaluation Measures
for the Current Fiscal Year Ended December 31
(dollar amounts are in thousands.)

	Sporting Goods Division	Board Games Division	Computer Games Division
1. Segmented net income	$2,306.00	$3,466.00	$1,577.00
2. Profit margin ratio	11.53%	10.19%	5.44%
3. Return on investment	11.23%	8.93%	6.75%
4. Residual income	$ 947.00	$ 516.00	$ (419.00)
5. Economic value added	$ 478.00	$ 134.00	$ 673.00

Figure 5.12 "Comparison of Income Performance Measures for Each Division at Game Products, Inc." shows a comparison of the three divisions for segmented income, RI, and economic value added. Figure 5.13 "Comparison of Profit Margin Ratio and Return Investment for Each Division at Game Products, Inc." shows a comparison of the three divisions for the profit margin ratio and ROI.

Figure 5.12 Comparison of Income Performance Measures for Each Division at Game Products, Inc.

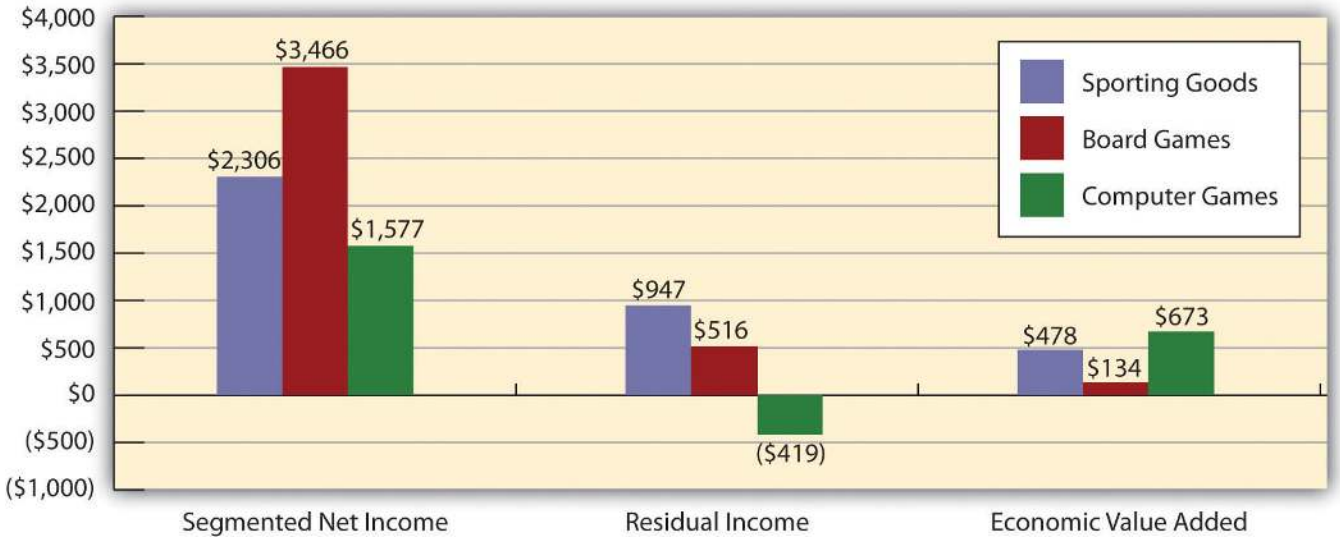
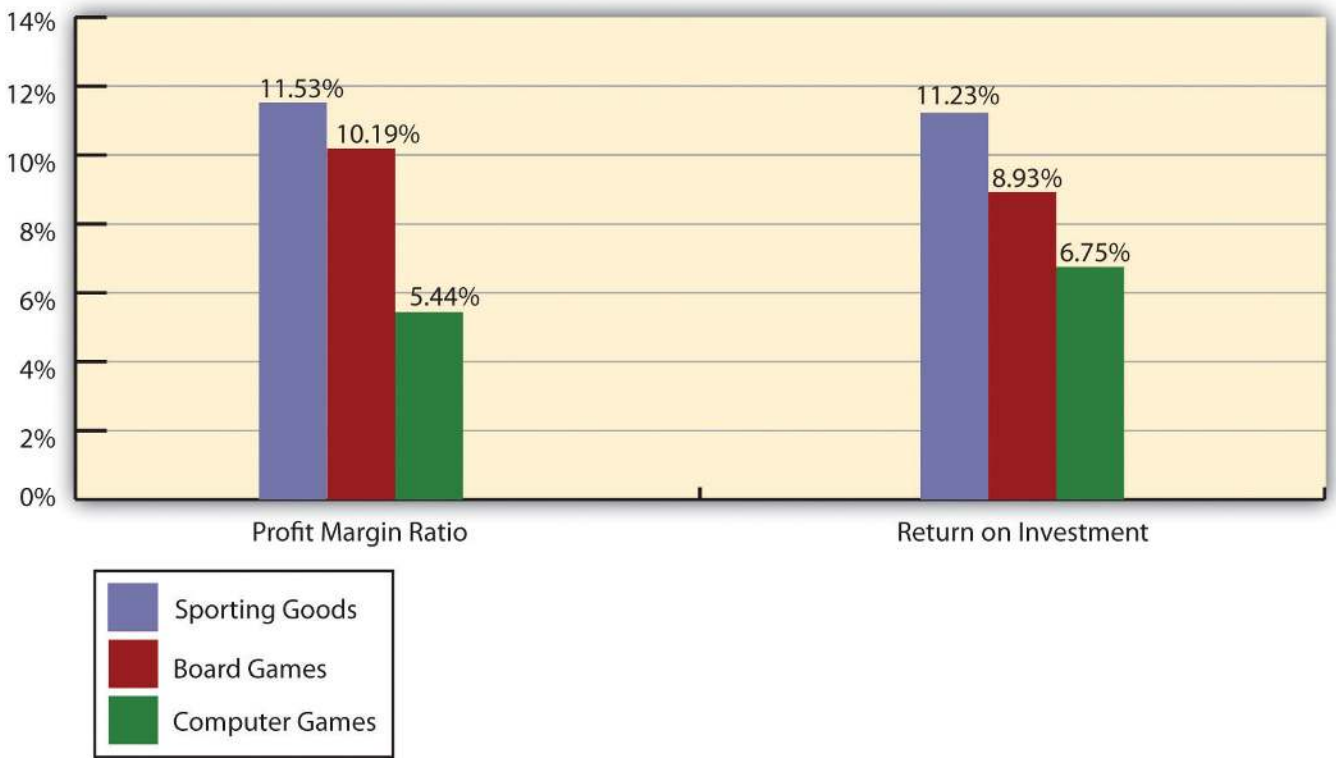


Figure 5.13 Comparison of Profit Margin Ratio and Return Investment for Each Division at Game Products, Inc.



When Mandy and Larry meet again a month later, Larry has the difficult task of explaining the information to Mandy and recommending a course of action.

Mandy (president and CEO):
Larry, let's begin where we left off at our last meeting. What do you have for me with regard to performance evaluation measures we might use for our division managers?

Larry (CFO):
Here is a summary of five measures I think can be useful if used correctly (see Figure 5.11 "Five Performance Measures at Game Products, Inc."). As you suggested, Mandy, the starting point is segmented net income, which is shown on line one. The Board Games division has the highest net income and looks to be a strong performer in this regard.

Mandy:
What is the ratio shown on line two?

Larry:
This is the profit margin ratio. It is a much better measure to evaluate the profitability of each division relative to sales. This measure shows the Sporting Goods division produced the highest profit for each dollar in sales with a ratio of 11.53 percent. Board Games is second at 10.19 percent and Computer Games is last at 5.44 percent.

Mandy:
I see. What about the use of assets? Each division is responsible for investments in assets and we would like to know how effective each division is in producing income with these assets. Is this where ROI comes in?

Larry:
Yes. As shown on line three, the Sporting Goods division is making the best use of its operating assets with an ROI of 11.23 percent. Board Games is second at 8.93 percent, and Computer Games is last at 6.75 percent.

Mandy:
So you're telling me Sporting Goods is doing better than the other two divisions, even though Board Games has the highest net income?

Larry:
Yes, Sporting Goods is the most effective at using assets to produce profit.

Mandy:
What are the last two measures you show here?

Larry:
Both of these last two measures also consider asset use in the calculation. As shown on line four, Sporting Goods had the best performance by producing $947,000 in RI compared to $516,000 at Board Games and $(419,000) at Computer Games.

Mandy:
Computer Games has negative RI?

Larry:
Yes. However, you will notice that EVA shown on line five presents a different picture.

Mandy:
Why?

Larry:
Computer Games has high research and development costs each year—it's the nature of the industry. U.S. GAAP requires these costs to be expensed when incurred. EVA suggests recording R&D costs as an asset and amortizing the costs over the useful life of R&D activities. Since Computer Games has much higher R&D costs than the other divisions, the numbers changed dramatically relative to the other divisions. Also, after-tax income is used rather than operating income, and average assets are adjusted as well.

Mandy:
Seems as if there is an awful lot of subjectivity in using EVA.

Larry:
Yes, there is. If we choose to use EVA as one of our measures, management must meet to discuss and agree upon the adjustments to be made.

Mandy:
Larry, thanks for your analysis. I'm beginning to understand the importance of including asset use in our performance measures. Where do we go from here?

Larry:
I like the first three measures—net income, profit margin ratio, and ROI. They are widely used in industry, and managers tend to understand the nature of these measures. The last two measures are also useful and should not be overlooked. My recommendation is to meet with the division managers to develop a comprehensive incentive compensation plan. The key is to develop a plan that motivates our managers to achieve company goals.

Mandy:
I like the idea! Let's meet next week.

End-of-Chapter Exercises

Questions

1. What is meant by the term *decentralized organization*?
2. What are the advantages and disadvantages of decentralizing operations?
3. How did decentralization at **Arthur Andersen** contribute to the company's downfall?
4. Describe the three types of responsibility centers presented in the chapter.

5. Describe at least three measures used to evaluate performance of investment center division managers.
6. What are the two weaknesses of using segmented net income to evaluate managers of investment centers? What performance measures would you use to overcome these weaknesses?
7. What is the primary advantage of using ROI rather than segmented net income or profit margin ratio to evaluate investment center managers?
8. Describe *operating profit margin* and *asset turnover*, and explain how each of these ratios can be used to help division managers improve ROI.
9. Describe the potential conflict that can occur between division manager goals and overall company goals when evaluating divisions using ROI.
10. Describe residual income (RI), and explain how RI can resolve the conflict between division manager goals and company goals often created by using ROI.
11. Explain the difference between RI and economic value added.
12. Refer to the Game Products, Inc., performance measures presented in Figure 5.11 “Five Performance Measures at Game Products, Inc.”. Identify which measures you would recommend to the CEO of Game Products, and explain the reasoning behind your recommendation.

Brief Exercises

16. **Evaluating Division Managers at Game Products, Inc.** Refer to the dialogue at Game Products, Inc., presented at the beginning of the chapter. Why does the president want to give Carla Klesko, the Board Games division manager, a bonus? Does the CFO agree that Carla deserves a larger bonus than the other division managers? What performance measures would the CFO like to consider before awarding Carla a larger bonus?

17. **Decentralizing Operations.** Burton Electronics produces radios, computers, and navigation systems. Although all high level decisions are made at company headquarters by top management, rapid expansion and increasingly specialized products have caused the company to consider decentralizing into three divisions. Each division manager would be responsible for costs, revenues, and investments in assets.

    Required:

    1. How should the company classify each division, as a cost center, profit center, or investment center? Explain.
    2. What are the potential advantages of decentralizing?
    3. What are the potential disadvantages of decentralizing?

18. **Responsibility Centers.** Aviation Products, Inc., operates primarily in the United States and has several segments:

    1. Accounting and finance: responsible for recording financial information and preparing financial reports.
    2. Human resources: responsible for hiring employees and maintaining personnel records.
    3. Retail stores: responsible for sales prices and all costs within each store.
    4. Advertising: responsible for promotional materials.
    5. Production: responsible for manufacturing company products.
    6. International operations: acts as an independent segment responsible for all facets of the business outside of the United States.

    Required:

    For each of the preceding segments, identify whether it is a cost center, profit center, or investment center. Explain your answer.

19. **Segmented Net Income.** Franklin Bikes has two divisions—Road Bikes and Mountain Bikes. Using the segmented income statements presented in the following, determine the profit margin ratio for each division.

Franklin Bikes
Segmented Income Statements
for the Current Fiscal Year Ended December 31
(dollar amounts are in thousands)

	Road Bikes Division	Mountain Bikes Division
Sales	$1,500,000	$500,000
Cost of goods sold	800,000	215,000
Gross margin	$ 700,000	$285,000
Allocated overhead	150,000	115,000
Selling and administrative expenses	100,000	75,000
Operating income	$ 450,000	$ 95,000
Income tax expense (30% rate)	135,000	28,500
Net income	$ 315,000	$ 66,500

20. **Return on Investment (ROI).** The segmented income statements presented as follows are for the two divisions of Franklin Bikes. (This is the same company as the previous exercise. This exercise can be assigned independently.) Assume the Road Bikes division had average operating assets totaling $4,500,000 for the year, and the Mountain Bikes division had average operating assets of $800,000. Calculate ROI for each division.

Franklin Bikes
Segmented Income Statements
for the Current Fiscal Year Ended December 31
(dollar amounts are in thousands)

	Road Bikes Division	Mountain Bikes Division
Sales	$ 1,500,000	$ 500,000
Cost of goods sold	800,000	215,000
Gross margin	$ 700,000	$ 285,000
Allocated overhead	150,000	115,000
Selling and administrative expenses	100,000	75,000
Operating income	$ 450,000	$ 95,000
Income tax expense (30% rate)	135,000	28,500
Net income	$ 315,000	$ 66,500

21. **Residual Income (RI).** The segmented income statements presented as follows are for the two divisions of Franklin Bikes. (This is the same company as the previous exercises. This exercise can be assigned independently.) Assume the Road Bikes

division had average operating assets totaling $4,500,000 for the year, and the Mountain Bikes division had average operating assets of $800,000. The company's cost of capital rate is 8 percent. Calculate RI for each division.

Franklin Bikes
Segmented Income Statements
for the Current Fiscal Year Ended December 31
(dollar amounts are in thousands)

	Road Bikes Division	Mountain Bikes Division
Sales	$ 1,500,000	$ 500,000
Cost of goods sold	800,000	215,000
Gross margin	$ 700,000	$ 285,000
Allocated overhead	150,000	115,000
Selling and administrative expenses	100,000	75,000
Operating income	$ 450,000	$ 95,000
Income tax expense (30% rate)	135,000	28,500
Net income	$ 315,000	$ 66,500

22. **Economic Value Added (EVA).** Computer Tech Company has two divisions—Hardware and Software. Adjustments have already been made to *net operating profit after taxes (NOPAT)* and *average operating assets* for the purposes of calculating EVA for each division. This adjusted information is shown as follows. Assume the company's cost of capital is 12 percent. Calculate EVA for each division.

	Hardware Division	Software Division
NOPAT—adjusted	$ 810,000	$ 980,000
Average operating assets—adjusted	3,500,000	3,200,000

Exercises:

23. Segmented Net Income. Pool Accessories, Inc., has two divisions—Furniture and Supplies. The following segmented financial information is for the most recent fiscal year ended December 31.

	Furniture Division	Supplies Division
Sales	$3,000,000	$1,000,000
Cost of goods sold	1,600,000	430,000
Allocated overhead	375,000	125,000
Selling and administrative expenses	250,000	200,000

Assume the tax *rate* is 30 percent.

Required:

1. Prepare a segmented income statement using the format presented in Figure 5.3 “Segmented Income Statements (Game Products, Inc.)”. Include the profit margin ratio for each division at the bottom of the segmented income statement.
2. Using net income as the measure, which division is most profitable? Explain why this conclusion might be misleading.

What does the profit margin ratio tell us about each division? Why do organizations often use profit margin ratio to evaluate division performance rather than simply using net income?

24. ROI. Pool Accessories, Inc., has two divisions—Furniture and Supplies. (This is the same company as the previous exercise. This exercise can be assigned independently.) Segmented income statement information for the most recent fiscal year ended December 31 is shown as follows. Assume the Furniture division had average operating assets totaling $6,500,000 for the year, and the Supplies division had average operating assets of $1,750,000.

Pool Accessories, Inc.
Segmented Income Statements
for the Current Fiscal Year Ended December 31
(dollar amounts are in thousands)

	Furniture Division	Supplies Division
Sales	$ 3,000,000	$ 1,000,000
Cost of goods sold	1,600,000	430,000
Gross margin	$ 1,400,000	$ 570,000
Allocated overhead	375,000	125,000
Selling and administrative expenses	250,000	200,000
Operating income	$ 775,000	$ 245,000
Income tax expense (30% rate)	232,500	73,500
Net income	$ 542,500	$ 171,500

Required:

1. Calculate ROI for each division.
2. What does ROI tell us about each division? Indicate why this measure is useful in evaluating investment centers.

25. ROI Using Operating Profit Margin and Asset Turnover. Pool Accessories, Inc., has two divisions—Furniture and Supplies. (This is the same company as the previous exercises. This exercise can be assigned independently.) Segmented income statement information for the most recent fiscal year ended December 31 is shown as follows. Assume the Furniture division had average operating assets totaling $6,500,000 for the year, and the Supplies division had average operating assets of $1,750,000.

Pool Accessories, Inc.
Segmented Income Statements
for the Current Fiscal Year Ended December 31
(dollar amounts are in thousands)

	Furniture Division	Supplies Division
Sales	$ 3,000,000	$ 1,000,000
Cost of goods sold	1,600,000	430,000
Gross margin	$ 1,400,000	$ 570,000
Allocated overhead	375,000	125,000
Selling and administrative expenses	250,000	200,000
Operating income	$ 775,000	$ 245,000
Income tax expense (30% rate)	232,500	73,500
Net income	$ 542,500	$ 171,500

Required:

1. For each division, calculate operating profit margin, asset turnover, and resulting ROI.
2. Which division has the highest ROI? For the division that has the lowest ROI, what can be done to improve this ratio?

26. RI. Pool Accessories, Inc., has two divisions—Furniture and Supplies. (This is the same company as the previous exercises. This exercise can be assigned independently.) Segmented income statement information for the most recent fiscal year ended December 31 is shown as follows. Assume the Furniture division had average operating assets totaling $6,500,000 for the year, and the Supplies division had average operating assets of $1,750,000. Assume the cost of capital rate is 10 percent.

Pool Accessories, Inc.
Segmented Income Statements
for the Current Fiscal Year Ended December 31
(dollar amounts are in thousands)

	Furniture Division	Supplies Division
Sales	$ 3,000,000	$ 1,000,000
Cost of goods sold	1,600,000	430,000
Gross margin	$ 1,400,000	$ 570,000
Allocated overhead	375,000	125,000
Selling and administrative expenses	250,000	200,000
Operating income	$ 775,000	$ 245,000
Income tax expense (30% rate)	232,500	73,500
Net income	$ 542,500	$ 171,500

Required:

1. Calculate RI for each division.
2. What does RI tell us about each division?

27. Solving Unknowns for ROI. The following information is for two divisions at Kayak Company.

	Lake Division	Ocean Division
Sales	?	$900,000
Operating income	?	$108,000
Operating profit margin	8.0 percent	?
Average operating assets	$150,000	$600,000
Asset turnover	1.7	?
ROI	?	?

Required:

Find the missing information for each division.

28. EVA. Links Company produces golf clubs and other sporting goods accessories. The following information is for each division at Links for the most recent fiscal year.

	Golf Division	Sporting Goods Division
Income statement:		
Sales	$ 5,000,000	$ 12,000,000
Cost of goods sold	2,400,000	5,000,000
Gross margin	$ 2,600,000	$ 7,000,000
Allocated overhead (from corporate)	1,470,588	3,529,412
R&D expenses	500,000	800,000
Administrative expenses	250,000	550,000
Operating income	$ 379,412	$ 2,120,588
Income tax expense (30% rate)	113,824	636,176
Net income	$ 265,588	$ 1,484,412
Balance sheet information:		
Average operating assets	$ 3,400,000	$ 14,500,000
Non-interest bearing current liabilities	770,000	2,100,000
Percent cost of capital	11%	11%

To calculate EVA, the management requires adjustments for R&D and noninterest bearing current liabilities as outlined in the following.

Research and development will be capitalized and amortized over several years resulting in an increase to average operating assets of $400,000 for the Golf division and $650,000 for the Sporting Goods division. On the income statement, R&D expense for the year will be added back to operating income; then R&D amortization expense for one year will be deducted. The current year amortization expense will total $100,000 for the Golf division and $150,000 for the Sporting Goods division.

Noninterest bearing liabilities will be deducted from average operating assets.

Required:

Calculate EVA for each division and comment on your results.

Problems

29. Segmented Net Income, ROI, and RI. Custom Auto Company has two divisions—East and West. The following segmented financial information is for the most recent fiscal year:

	East Division	West Division
Sales	$2,000,000	$4,000,000
Cost of goods sold	800,000	2,040,000
Allocated overhead	600,000	1,200,000
Selling and administrative expenses	360,000	380,000

The East division had average operating assets totaling $1,800,000 for the year, and the West division had average operating assets of $2,600,000. Assume the cost of capital rate is 8 percent, and the company's tax rate is 30 percent. Division managers are

responsible for sales, costs, and investments in assets.

Required:

1. What type of responsibility center is each division at Custom Auto Company? Explain.
2. Prepare a segmented income statement using the format presented in Figure 5.3 "Segmented Income Statements (Game Products, Inc.)". Include the profit margin ratio for each division at the bottom of the segmented income statement.
3. Calculate ROI for each division.
4. Calculate RI for each division.
5. Summarize the answers to parts *a*, *b*, and *c* using the format presented in Figure 5.11 "Five Performance Measures at Game Products, Inc.". What does this information tell us about each division?

30. Investment Decisions Using ROI and RI. (Note: the previous problem must be completed before working this problem.) Assume each division of Custom Auto Company is considering separate investment opportunities expected to yield a return of 10 percent, well above the company's minimum required rate of return of 8 percent. Each investment opportunity will require $1,000,000 in average operating assets and yield operating income of $100,000.

Required:

1. Using the information presented in the previous problem, and the new investment proposal information presented previously, calculate each division's overall *ROI* assuming the new investment is accepted.
2. Compare your results in part *a* to each division's ROI prior to the new investment (calculated in the previous problem). Which division(s) will likely accept the proposal and which will likely reject the proposal using ROI as the measure? Explain.
3. Using the information presented in the previous problem, and the new investment proposal information presented previously, calculate each division's overall *RI* assuming the new investment is accepted.
4. Compare your results in part *c* to each division's RI prior to the new investment (calculated in the previous problem). Which division(s) will likely accept the proposal and which will likely reject the proposal using RI as the measure? Explain.

Assume the goal is to maximize company profit. Which measure do you think is best in deciding whether to accept a new investment proposal, ROI or RI? Explain.

31. Segmented Net Income, ROI, and RI; Making Investment Decisions. Quality Cycles, Inc., has two divisions—Cruisers and Racers. The following segmented financial information is for the most recent fiscal year:

	Cruisers Division	Racers Division
Sales	$6,000,000	$10,000,000
Cost of goods sold	2,500,000	4,000,000
Allocated overhead	375,000	625,000
Selling and administrative expenses	2,100,000	3,950,000

The Cruisers division had average operating assets totaling $5,700,000 for the year, and the Racers division had average operating assets of $9,600,000. Assume the cost of capital rate is 10 percent, and the company's tax rate is 30 percent.

Required:

1. Prepare a segmented income statement using the format presented in Figure 5.3 "Segmented Income Statements (Game Products, Inc.)". Include the profit margin ratio for each division at the bottom of the segmented income statement.
2. Calculate ROI for each division.
3. Calculate RI for each division.
4. Summarize the answers to parts *a*, *b*, and *c* using the format presented in Figure 5.11 "Five Performance Measures at Game Products, Inc.". What does this information tell us about each division?

5. Assume each division of Quality Cycles, Inc., is considering separate investment opportunities expected to yield a return of 16 percent, well above the company's minimum required rate of return of 10 percent. Each investment opportunity will require $4,000,000 in average operating assets and yield operating income of $640,000.
    1. Using the information presented at the beginning of this problem, and the new investment proposal information presented previously, calculate each division's overall ROI assuming the new investment is accepted.
    2. Compare your results in requirement **e.1** to each division's ROI prior to the new investment (calculated in requirement **b**). Which division(s) will likely accept the proposal and which will likely reject the proposal using ROI as the measure? Explain.
    3. Using the information presented at the beginning of this problem, and the new investment proposal information presented previously, calculate each division's overall RI assuming the new investment is accepted.
    4. Compare your results in requirement **e.3** to each division's RI prior to the new investment (calculated in requirement *c*). Which division(s) will likely accept the proposal and which will likely reject the proposal using RI as the measure? Explain.

Assume the goal is to maximize company profit. Which measure do you think is best in deciding whether to accept a new investment proposal, ROI or RI? Explain.

32. Operating Profit Margin, Asset Turnover, and ROI. Financial information for Computer Systems, Inc., for the most recent fiscal year appears as follows. All dollar amounts are in thousands.

Computer Systems, Inc.
Segmented Income Statements
for the Current Fiscal Year
(dollar amounts are in thousands)

	Server Division	PC Division
Sales	$10,000	$30,000
Cost of goods sold	3,200	11,000
Gross margin	$ 6,800	$19,000
Allocated overhead (from corporate)	1,500	4,500
Selling and administrative expenses	4,000	11,000
Operating income	$ 1,300	$ 3,500
Income tax expense (30% rate)	390	1,050
Net income	$ 910	$ 2,450

Computer Systems, Inc.
Segmented Balance Sheets Average Balances
at End of Most Recent Fiscal Year
(dollar amounts are in thousands)

	Server Division		PC Division	
Assets	Ending Balance	Beginning Balance	Ending Balance	Beginning Balance
Cash	$ 950	$ 1,020	$ 3,200	$ 2,900
Accounts receivable	700	750	1,850	1,600
Inventory	$ 1,700	$ 1,650	$ 2,800	$ 2,500
Total current assets	3,350	3,420	7,850	7,000
Property, plant and equipment (net)	4,000	3,850	17,500	16,600
Land (held for sale)	2,000	2,000	3,150	3,150
Total assets	$ 9,350	$ 9,270	$28,500	$26,750
Liabilities and owners' equity				
Accounts payable	1,200	1,150	3,400	3,100
Other current liabilities	360	290	1,350	1,100
Total current liabilities	$ 1,560	$ 1,440	$ 4,750	$ 4,200
Long-term liabilities	0	0	0	0
Total liabilities	$ 1,560	$ 1,440	$ 4,750	$ 4,200
Total owners' equity	7,790	7,830	23,750	22,550
Total liabilities and owners' equity	$ 9,350	$ 9,270	$28,500	$26,750

Required:

1. Calculate average operating assets for each division. (Hint: land held for sale is *not* an operating asset.)
2. Calculate operating profit margin, asset turnover, and ROI for each division.
3. What does this information tell us about each division?

33. Operating Profit Margin, Asset Turnover, ROI, and RI. Financial information for Web Design, LLP, for the most recent fiscal year appears as follows. All dollar amounts are in thousands.

Web Design, LLP
Segmented Income Statements
for the Current Fiscal Year
(dollar amounts are in thousands)

	Design Division	Maintenance Division
Sales	$ 6,000	$ 9,000
Cost of goods sold	2,300	2,700
Gross margin	$ 3,700	$ 6,300
Allocated overhead (from corporate)	1,200	1,800
Selling and administrative expenses	1,850	3,350
Operating income	$ 650	$ 1,150
Income tax expense (30% rate)	195	345
Net income	$ 455	$ 805

Web Design, LLP
Segmented Balance Sheets
at End of Most Recent Fiscal Year
(dollar amounts are in thousands)

	Design Division		Maintenance Division	
Assets	Ending Balance	Beginning Balance	Ending Balance	Beginning Balance
Cash	$ 400	$ 390	$ 1,100	$ 1,150
Accounts receivable	300	310	600	620
Inventory	800	730	950	900
Total current assets	$ 1,500	$ 1,430	$ 2,650	$ 2,670
Property, plant and equipment (net)	2,000	1,800	6,100	6,020
Investment in Global, Inc.			1,500	1,500
Land (held for sale)	2,100	2,100	0	0
Total assets	$ 5,600	$ 5,330	$10,250	$10,190
Liabilities and owners' equity				
Accounts payable	590	610	1,150	950
Other current liabilities	160	145	420	300
Total current liabilities	$ 750	$ 755	$ 1,570	$ 1,280
Long-term liabilities	0	0	0	0
Total liabilities	$ 750	$ 755	$ 1,570	$ 1,280
Total owners' equity	4,850	4,575	8,680	8,910
Total liabilities and owners' equity	$ 5,600	$ 5,330	$10,250	$10,190

Required:

1. Calculate average operating assets for each division. (Hint: *land held for sale* and *investments in Global, Inc.*, are *not* operating assets.)
2. Calculate operating profit margin, asset turnover, and ROI for each division.
3. Calculate RI for each division assuming a cost of capital rate of 12 percent.
4. What does the information from requirements **b** and **c** tell us about each division?

34. EVA. Conner, Inc., produces brass and woodwind music instruments. The following information is for each division at Conner for the most recent fiscal year.

	Brass Division	Woodwind Division
Income statement:		
Sales	$1,500,000	$2,250,000
Cost of goods sold	1,000,000	1,600,000
Gross margin	$ 500,000	$ 650,000
Allocated overhead (from corporate)	120,000	180,000
R&D expenses	60,000	110,000
Marketing expenses	40,000	50,000
Administrative expenses	85,000	130,000
Operating income	$ 195,000	$ 180,000
Income tax expense (30% rate)	58,500	54,000
Net income	$ 136,500	$ 126,000
Balance sheet information:		
Average operating assets	$1,850,000	$2,400,000
Non-interest bearing current liabilities	450,000	530,000
Percent cost of capital	10%	10%

To calculate EVA, management requires adjustments for R&D expenses, marketing expenses, and noninterest bearing current liabilities as outlined in the following.

Research and development will be capitalized and amortized over several years resulting in an increase to average operating assets of $40,000 for the Brass division and $80,000 for the Woodwind division. On the income statement, R&D expenses for the year will be added back to operating income; R&D amortization expense for one year will be deducted. The current year amortization expense will total $20,000 for the Brass division and $30,000 for the Woodwind division.

Marketing will be capitalized and amortized over several years resulting in an increase to average operating assets of $30,000 for the Brass division and $38,000 for the Woodwind division. On the income statement, marketing expenses for the year will be added back to operating income; marketing amortization expense for one year will be deducted. The current year amortization expense will total $10,000 for the Brass division and $12,000 for the Woodwind division.

Noninterest bearing current liabilities will be deducted from average operating assets.

Required:

1. Calculate EVA for each division. What do the results show us for each division?
2. Why does EVA typically require adjustments to operating income and average operating assets?

One Step Further: Skill-Building Cases

35. Group Activity—Decentralizing Operations. Each of the following scenarios is being considered at two separate companies.

1. Walker Wood Products manufactures custom garage doors and custom furniture. The company recently experienced significant growth and top management would like to separate the company into two divisions—Garage and Furniture.
2. Iron Manufacturing produces iron fencing for residential and commercial properties. The company recently experienced significant growth and top management would like to separate the company into two divisions—Residential and Commercial.

Required:

Form groups of two to four students. Each group is to perform the following requirements for the scenario assigned:

1. Identify the potential *advantages* and *disadvantages* of decentralizing into two divisions and allowing the manager of each division to have complete control over operations.
2. Discuss the findings of your group with the class.

36. Internet Project—Economic Value Added. Stern Stewart & Company is a global consulting firm that pioneered the development of the EVA concept. Go to the **Stern Stewart & Company** Web site at http://www.sternstewart.com. Review the information provided at this Web site and write a one-page report summarizing the information you found to be most interesting. Also submit a printed copy of the information from the Web site with your report.

37. Creating a Segmented Income Statement Using Excel. Pool Accessories, Inc., has two divisions—Furniture and Supplies. The following segmented financial information is for the most recent fiscal year ended December 31.

	Furniture Division	**Supplies Division**
Sales	$3,000,000	$1,000,000
Cost of goods sold	1,600,000	430,000
Allocated overhead	375,000	125,000
Selling and administrative expenses	250,000	200,000

Assume the tax rate is 30 percent.

Required:

1. Prepare an Excel spreadsheet similar to Figure 5.3 “Segmented Income Statements (Game Products, Inc.)” showing Pool Accessories’ segmented income statement and profit margin ratio for each division.

Comprehensive Case

38. Ethics and ROI. Computer chip makers incur significant costs for research and development. Some research and development projects result in technologies used in new computer chips. Other research and development projects do *not* result in a useable technology. Because of the unpredictable nature of R&D activities, U.S. GAAP require that R&D costs be expensed in the period incurred.

Integrated Circuits, Inc. (ICI), produces computer chips and invests heavily in R&D. The firm has been struggling in recent years, and as a result, the board of directors hired a new top management group with the clear purpose of improving profitability. The board proposed a compensation package providing top managers with an annual bonus if the company’s operating income this coming year (year 2) increases 10 percent compared to year 1 and ROI remains above the 11 percent level achieved in year 1.

The new top management group is willing to accept this proposal, but only if costs related to *successful* R&D activities are capitalized and amortized over five years for internal reporting purposes. Their argument is most R&D activities benefit future years, and U.S. GAAP unfairly requires all R&D costs to be expensed in the period incurred, regardless of whether the activities are successful. This treatment by U.S. GAAP provides a disincentive for managers to invest in R&D projects that are vital to the company’s future survival. The board of directors agrees with this assertion and grants the new management group their request to capitalize costs for successful R&D activities over five years.

One year has passed with the new management group in place, and their financial results are presented as follows (for year two), along with last year's information (year one). The entire $10,000,000 spent on R&D in year 2 was for unsuccessful projects since management decided to go a different direction with the company's technology at the end of year 2. Nevertheless, top management capitalized the entire $10,000,000 and amortized these costs over 5 years as reflected in the year 2 financial results. (Note: of this amount, $2,000,000 is included in *depreciation and amortization expense* for year 2, and $8,000,000 is included in *average operating assets* for year 2.)

	Year 2	Year 1
Income statement:		
Sales	$54,000,000	$45,000,000
Cost of goods sold	29,950,000	22,500,000
Gross margin	$24,050,000	$22,500,000
R&D expenses	0	8,750,000
Depreciation and amortization expenses	$ 8,900,000	$ 6,500,000
Other selling and administrative expenses	990,000	936,000
Operating income	$14,160,000	$ 6,314,000
Balance sheet information:		
Average operating assets	$74,900,000	$57,400,000

Required:

1. Based on the financial data presented, calculate ROI for each year and the percent change in operating income from year 1 to year 2. Does the new management group qualify for the bonus?
2. Prepare revised financial information in the same format as presented previously assuming *none* of the $10,000,000 in year 2 R&D costs are capitalized and amortized. (Hint: Amounts for year 1 will remain the same. Income statement and balance sheet amounts for year 2 will change.) Calculate the revised ROI for year two, and the revised percent change in operating income from year one to year two. Based on your results, would the new management group qualify for the bonus?
3. Is the new management group's treatment of R&D costs for year 2 ethical?
4. How should the board of directors respond to the new management group's assertion that $10,000,000 in R&D costs should be capitalized in year 2?

39. Performance Evaluation Methods. Casey Fashions, Inc., sells clothing throughout North America. The company's compensation committee, made up of five members from the board of directors, is meeting to discuss the CEO's contract, which expires next month. The committee is currently reviewing financial information for the three most recent fiscal years: year 3 (most recent), year 2, and year 1 (shown as follows).

The income statement indicates sales increased 30 percent from year 1 to year 2 and 35 percent from year 2 to year 3. Net income increased 14 percent from year 1 to year 2, and 18 percent from year 2 to year 3. One member on the committee, Chris Carson, would like to offer the CEO a multiyear extension with a significant bump in salary and thousands of shares of stock options. When questioned why, Chris pointed to the positive results reflected on the income statement.

Another committee member, Mary Nichols, agrees with Chris that income statement trends look great, but she would like to review other measures of performance as well. Mary has asked you to come up with two measures of performance that go beyond simply looking at the income statement.

Casey Fashions, Inc.
Income Statement
(dollar amounts are in thousands)

	Year 3	Year 2	Year 1
Sales	$ 96,525	$ 71,500	$ 55,000
Cost of goods sold	28,958	21,450	16,500
Gross margin	$ 67,567	$ 50,050	$ 38,500
Selling and administrative expenses	60,200	43,800	33,000
Operating income	$ 7,367	$ 6,250	$ 5,500
Income tax expense (30% rate)	2,210	1,875	1,650
Net income	$ 5,157	$ 4,375	$ 3,850

Casey Fashions, Inc.
Balance Sheet Average Balance
(dollar amounts are in thousands)

	Year 3	Year 2	Year 1
Assets	Average Balance	Average Balance	Average Balance
Cash	$ 10,752	$ 6,720	$ 4,200
Accounts receivable	11,776	7,360	4,600
Inventory	13,312	8,320	5,200
Total current assets	$ 35,840	$ 22,400	$ 14,000
Property, plant and equipment (net)	38,400	24,000	15,000
Land (held for sale)	3,500	3,500	3,500
Total assets	$ 77,740	$ 49,900	$ 32,500
Liabilities and owners' equity			
Accounts payable	9,216	5,760	3,600
Other current liabilities	5,632	3,520	2,200
Total current liabilities	$ 14,848	$ 9,280	$ 5,800
Long-term liabilities	0	0	0
Total liabilities	$ 14,848	$ 9,280	$ 5,800
Total owners' equity	62,892	40,620	26,700
Total liabilities and owners' equity	$ 77,740	$ 49,900	$ 32,500

Required:

1. Calculate ROI for each of the three years. Note that balance sheet amounts presented for each year are already average balances (i.e., no need to calculate average balances). Assume land held for sale is *not* an operating asset.
2. Calculate RI for each of the 3 years assuming the company's cost of capital rate is 12 percent.
3. Prepare a written report to the compensation committee summarizing and explaining your findings in part **a** and **b**.

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Chapter 6 How Is the Statement of Cash Flows Prepared and Used?

John Huston, CEO and founder of Home Store, Inc., has reviewed the company's income statement and balance sheet for the most recent fiscal year ended December 31, 2020. Home Store has grown rapidly this past year, with sales and net income showing significant gains compared to 2019. Although John is satisfied with the increase in profitability, he notices a significant decline in cash. John decides to pursue this with Linda Nash (CFO) and Steve Bauer (treasurer) in their weekly meeting:

John:
I just received the income statement and balance sheet for 2020. Profits look great, but our cash position seems to have deteriorated. We had $130,000 in cash to start the year and ended with only $32,000. I noticed cash was declining throughout the year when I reviewed our monthly financial statements, but I'm concerned about how far our cash balance has dropped.

Steve:
You're right, John. We encountered cash flow problems several times throughout the year in spite of increased sales and profits. On several occasions, I had to delay payments to creditors because of cash flow issues.

John:
Seems to me we shouldn't have this problem. Where is our cash going?

Linda:
Good question. Let me round up our cash flow information for the year. I'll have something for you by next week.

John:
Great! I'd like to start next week's meeting by discussing how much cash we generated in 2020 from our daily operations. I realize net income is shown on an accrual basis, but I'd like to know how much net income was received in the form of cash.

Linda:
No problem. I'll have it for you next week.

Home Store, Inc., has cash flow problems that are common to many fast growing companies. Although the income statement and balance sheet provide important information concerning financial performance and financial condition, neither statement provides information regarding cash activity for a period of time. The focus of this chapter is on preparing a statement that provides cash flow information. This statement is appropriately called the *statement of cash flows*.

6.1 Purpose of the Statement of Cash Flows

Learning Objectives

1. Define the purpose of the statement of cash flows.

Question: Most organizations prepare four financial statements for external reporting purposes: income statement, balance sheet, statement of owners' equity, and statement of cash flows. Financial accounting courses cover the first three statements in detail and often provide an overview of the statement of cash flows. This chapter will focus on preparing the statement of cash flows and on using the resulting cash flow information for analytical purposes. What information is provided in the statement of cash flows?

Answer: The statement of cash flows provides cash receipt and cash payment information and reconciles the change in cash for a period of time. Cash receipts and cash payments are summarized and categorized as operating, investing, or financing activities. Simply put, the statement of cash flows indicates where cash came from and where cash went for a period of time.

Assume you keep track of your individual cash transactions for an entire year in a check register (e.g., checks written and paycheck deposits) and suppose you have hundreds of transactions for the year. Rather than showing every single transaction in a formal

report, the statement of cash flows summarizes these transactions. For example, all cash receipts from paychecks are added together and shown as one line item, all cash payments for rent are added together and shown as one line item, all cash payments for food are added together and shown as one line item, and so on. The goal is to start with the beginning of the year cash balance, add all cash receipts for the year, subtract all cash payments for the year, and find the resulting end-of-year cash balance. Although the formal statement of cash flows is not quite this simple, the concept is the same.

Question: Why did the Financial Accounting Standards Board (FASB) create the statement of cash flows in 1987?

Answer: The statement of cash flows was created due to a lack of cash flow information on the income statement, balance sheet, and statement of owners' equity. The income statement shows revenues and expenses using the accrual basis of accounting, but it does not indicate how much cash was received for revenues or paid for expenses. The balance sheet shows assets, liabilities, and owners' equity at a point in time, but it does not show how much cash was received or paid for these items. The only cash information provided on these statements is the change in cash from the end of last period to the end of the current period derived from the cash line item on the balance sheet (often called *cash and cash equivalents*).

Owners, creditors, and managers wanted more cash flow information. They often asked such questions as: Why did cash go down? How much cash was received related to net income? How much cash was paid for the purchase of equipment? How much cash was received from issuing bonds? As a result of the demand for more cash flow information, the FASB formally created the statement of cash flows in 1987 (Statement of Financial Accounting Standard No. 95, which can be found at http://www.fasb.org). Most companies are now required to prepare the statement of cash flows along with the other three statements. We begin the process of explaining how to prepare this statement in the next section.

Business in Action 6.1

Cash Flows at **Southwest Airlines**

Southwest Airlines was in the enviable position of generating $2.3 billion in net income for the year ended December 31, 2019. However, cash on the balance sheet only increased $700 million for the same period. Why did total cash go up by such a small amount compared to the net income? The statement of cash flows provides the information necessary to answer this question. **Southwest** generated nearly $4 billion from operating activities including net income. **Southwest** spent $303 million on property and equipment (planes, parts, etc.) and $3 billion to pay off long-term debt and buy back treasury stock.

Source: **Southwest Airlines**, "2019 Annual Report," http://www.southwest.com.

Key Takeaway

- The statement of cash flows provides cash receipt and cash payment information and reconciles the change in cash for a period of time. The primary purpose of the statement is to show what caused the change in cash from the beginning of the period to the end of the period.

Check Yourself

1. Describe the purpose of the statement of cash flows.
2. Why did the FASB create the statement of cash flows?

Solution

1. The purpose of the statement of cash flows is to provide a summary of cash receipt and cash payment information for a period of time and to reconcile the difference between beginning and ending cash balances shown on the balance sheet. The statement of cash flows clarifies how cash was generated and how cash was used for a period of time.
2. The FASB created the statement of cash flows because owners, creditors, managers, and other stakeholders wanted more information regarding cash receipts and cash expenditures. Although the balance sheet shows cash balances at the end of each period, no further information is provided on the balance sheet, income statement, or statement of owners' equity regarding cash flow activities. The statement of cash flows takes care of this problem.

6.2 Three Types of Cash Flow Activities

Learning Objectives

1. Describe the three categories of cash flows.

Question: What are the three types of cash flows presented on the statement of cash flows?

Answer: Cash flows are classified as operating, investing, or financing activities on the statement of cash flows, depending on the nature of the transaction. Each of these three classifications is defined as follows.

- Operating activities include cash activities related to net income. For example, cash generated from the sale of goods (revenue) and cash paid for merchandise (expense) are operating activities because revenues and expenses are included in net income.
- Investing activities include cash activities related to noncurrent assets. Noncurrent assets include (1) long-term investments; (2) property, plant, and equipment; and (3) the principal amount of loans made to other entities. For example, cash generated from the sale of land and cash paid for an investment in another company are included in this category. (Note that interest received from loans is included in operating activities.)
- Financing activities include cash activities related to noncurrent liabilities and owners' equity. Noncurrent liabilities and owners' equity items include (1) the principal amount of long-term debt, (2) stock sales and repurchases, and (3) dividend payments. (Note that interest paid on long-term debt is included in operating activities.)

Figure 6.1 "Examples of Cash Flows from Operating, Investing, and Financing Activities" shows examples of cash flow activities that generate cash or require cash outflows within a period.

Figure 6.1 Examples of Cash Flow Activity by Category

Operating Activities
(activities related to net income)

Cash receipts from the following:
- Sales of goods or services
- Interest received from loans
- Dividends received from investments

Cash payments for the following:
- Merchandise purchased from suppliers
- Materials used to manufacture products
- Employee payroll
- Interest paid to lenders
- Income taxes
- Other operating expenses

Investing Activities
(activities related to noncurrent assets)

Cash receipts from the following:
- Sale of long-term investments (e.g., bonds and stocks of other companies)*
- Sale of property, plant, and equipment
- Collection of principal for loans made to other entities*

Cash payments for the following:
- Purchase of long-term investments (e.g., bonds and stocks of other companies)
- Purchase of property, plant, and equipment
- Loans made to other entities

Financing Activities
(activities related to noncurrent liabilities and owners' equity)

Cash receipts from the following:
- Issuance of notes (e.g., a loan with a bank)
- Issuance of bonds
- Issuance of common stock

Cash payments for the following:
- Principal amount of loans*
- Principal amount of bonds*
- Repurchase of common stock (treasury stock)

Cash dividends

**Receipts* of cash for dividends from investments and for interest on loans made to other entities are included in operating activities since both items relate to net income. Likewise, *payments* of cash for interest on loans with a bank or on bonds issued are also included in operating activities because these items also relate to net income.

Question: Which section of the statement of cash flows is regarded by most financial experts to be most important?

Answer: The operating activities section of the statement of cash flows is generally regarded as the most important section since it provides cash flow information related to the daily operations of the business. This section answers the question, "how much cash did we generate from the daily activities of our core business?" Owners, creditors, and managers are most interested in cash flow generated from daily activities rather than from a one-time issuance of stock or a one-time sale of land. The operating activities section allows stakeholders to assess the ongoing viability of the company. We discuss how to use cash flow information to evaluate organizations later in the chapter.

Business in Action 6.2

Cash Activity at **Home Depot** and **Lowe's**

The Home Depot. Inc., and **Lowe's Companies, Inc.,** are large home improvement retail companies with stores throughout North America. A review of the statements of cash flows for both companies reveals the following cash activity. Positive amounts are cash inflows, and negative amounts are cash outflows.

	Home Depot	Lowes
Operating	13,723	4,296
Investing	(2,653)	(1,369)
Financing	(10,834)	(2,734)
Net Change in Cash	236	193

Amounts are in millions.

This information shows both companies generated significant amounts of cash from daily *operating* activities; $13.7 billion for **The Home Depot** and $4.3 billion for **Lowe's**. It is interesting to note both companies spent significant amounts of cash to acquire property and equipment and long-term investments as reflected in the negative *investing* activities amounts. For both companies, a significant amount of cash outflows from *financing* activities were for the repurchase of common stock. Apparently, both companies chose to return cash to owners by repurchasing stock. So while the amounts for Home Depot are significantly higher than for Lowes the pattern is remarkably similar and the resulting change in cash is very close to the same.

Source: The Home Depot Inc., "2019 Annual Report," http://www.homedepot.com; Lowe's Companies Inc., "2019 Annual Report," http://www.lowes.com.

Key Takeaways

- The three categories of cash flows are operating activities, investing activities, and financing activities. Operating activities include cash activities related to net income. Investing activities include cash activities related to noncurrent assets. Financing activities include cash activities related to noncurrent liabilities and owners' equity.

Check Yourself

Identify whether each of the following items would appear in the operating, investing, or financing activities section of the statement of cash flows. Explain your answer for each item.

1. Cash payments for purchases of merchandise
2. Cash receipts from sale of common stock
3. Cash payments for equipment
4. Cash receipts from sales of goods

5. Cash dividends paid to shareholders
6. Cash payments to employees
7. Cash payments to lenders for interest on loans
8. Cash receipts from collection of principal for loans made to other entities
9. Cash receipts from issuance of bonds
10. Cash receipts from collection of interest on loans made to other entities

Solution

1. It would appear as **operating activity** because merchandise activity impacts net income as an expense (merchandise costs ultimately flow through cost of goods sold on the income statement).
2. It would appear as **financing activity** because sale of common stock impacts owners' equity.
3. It would appear as **investing activity** because purchase of equipment impacts noncurrent assets.
4. It would appear as **operating activity** because sales activity impacts net income as revenue.
5. It would appear as **financing activity** because dividend payments impact owners' equity.
6. It would appear as **operating activity** because employee payroll activity impacts net income as an expense.
7. It would appear as **operating activity** because interest payments impact net income as an expense.
8. It would appear as **investing activity** because principal collections impact noncurrent assets.
9. It would appear as **financing activity** because bond issuance activity impacts noncurrent liabilities.
10. It would appear as **operating activity** because interest received impacts net income as revenue.

6.3 Four Key Steps to Preparing the Statement of Cash Flows

Learning Objectives

1. Describe the four steps used to prepare the statement of cash flows.

Question: Recall from your financial accounting course that the accrual basis of accounting recognizes revenue when earned and expenses when incurred, regardless of when cash is exchanged. Conversely, the cash basis of accounting recognizes revenue when cash is received and expenses when cash is paid, regardless of when goods or services are exchanged. The income statement, balance sheet, and statement of owners' equity are all created using the accrual basis of accounting. However, the statement of cash flows is based on cash flows only, and thus adjustments must be made to convert accrual basis information to a cash basis. What information is necessary to make these adjustments?

Answer: Several pieces of information are required to make these adjustments in preparing the statement of cash flows:

- **Balance sheets** for the end of last year and end of the current year are needed to calculate the amount of change in each balance sheet account. These changes in balance sheet accounts are needed to prepare certain parts of the statement of cash flows.
- **Income statement** information for the current year is needed as the starting point for converting net income from an accrual basis to a cash basis, which is shown in the operating activities section of the statement of cash flows.
- **Other information** is needed to complete the statement of cash flows, such as cash dividends paid and the original cost of long-term investments sold.

Question: With this information in hand, four steps are required to prepare the statement of cash flows. What are these four steps?

Answer: The four steps required to prepare the statement of cash flows are described as follows:

Step 1. Prepare the *operating activities* **section by converting net income from an accrual basis to a cash basis.**

This step can be done using one of two methods—the *direct* method or the *indirect* method. Because more than 98 percent of companies surveyed use the indirect method we will use the indirect method throughout this chapter.

The indirect method begins with net income from the income statement and makes several adjustments related to changes in current assets, current liabilities, and other items to arrive at *cash provided by operating activities* (or *used by operating activities* if

the result is a cash outflow). *Cash provided by operating activities* represents net income on a cash basis. It tells the reader how much cash was received from the daily operations of the business.

Step 2. Prepare the *investing activities* **section by presenting cash activity for noncurrent assets.**

This step focuses on the effect changes in noncurrent assets have on cash. Noncurrent asset balances found on the balance sheet, coupled with other information (e.g., cash proceeds from sale of equipment) are used to perform this step.

Step 3. Prepare the *financing activities* **section by presenting cash activity for noncurrent liabilities and owners' equity.**

This step focuses on the effect changes in noncurrent liabilities and owners' equity have on cash. Noncurrent liabilities and owners' equity balances found on the balance sheet, coupled with other information (e.g., cash dividends paid) are used to perform this step.

Step 4. Reconcile the change in cash.

Each section of the statement of cash flows described in steps 1, 2, and 3, will show the total cash provided by (increase) or used by (decrease) the activity. Step 4 simply confirms that the net of these changes equates to the change in cash on the balance sheet.

For example, assume the balance sheet shows cash totaled $100 at the end of last year and $140 at the end of the current year. Thus cash increased $40 over the course of the current year. Step 4 reconciles this change with the changes shown in the three sections of the statement of cash flows. Suppose operating activities *provided* cash of $170, investing activities *used* cash of $160, and financing activities *provided* cash of $30. These 3 amounts netted together reconcile to the $40 increase in cash shown on the balance sheet (= $170 − $160 + $30).

Key Takeaways

- The four steps required to prepare the statement of cash flows are described as follows:

  Step 1. Prepare the operating activities section by converting net income from an accrual basis to a cash basis.

  Step 2. Prepare the investing activities section by presenting cash activities for noncurrent assets.

  Step 3. Prepare the financing activities section by presenting cash activities for noncurrent liabilities and owners' equity.

  Step 4. Reconcile the change in cash from the beginning of the period to the end of the period.

Check Yourself

Describe the four steps necessary to prepare the statement of cash flows.

Solution

The four steps required to prepare the statement of cash flows are as follows:

Step 1. Prepare the *operating activities* **section by converting net income from an accrual basis to a cash basis.**

This step starts with net income on an accrual basis (from the income statement) and makes adjustments related to changes in current assets, current liabilities, and other items to find net income on a cash basis. The resulting cash basis net income is called *cash provided by operating activities*.

Step 2. Prepare the *investing activities* **section by presenting cash activity for noncurrent assets.**

This step focuses on the effect changes in noncurrent assets have on cash.

Step 3. Prepare the *financing activities* **section by presenting cash activity for noncurrent liabilities and owners' equity.**

This step focuses on the effect changes in noncurrent liabilities and owners' equity have on cash.

Step 4. Reconcile the change in cash.

Each section of the statement of cash flows described in steps 1, 2, and 3 will show the total cash provided by or used by each activity. Step 4 confirms that the net of these changes equates to the change in cash derived from the balance sheet.

6.4 Using the Indirect Method to Prepare the Statement of Cash Flows

Learning Objectives

1. Prepare a statement of cash flows using the indirect method.

Question: Now that you are familiar with the four key steps, let's take a look at the statement of cash flows for Home Store, Inc. Where do we start in preparing Home Store, Inc.'s statement of cash flows?

Answer: As stated earlier, the information needed to prepare the statement of cash flows includes the balance sheet, income statement, and other selected data. This information is presented in Figure 6.2 "Balance Sheet and Income Statement for Home Store, Inc.". Other pertinent data for 2020 are as follows:

- Sold equipment with a book value of $11,000 (= $21,000 cost − $10,000 accumulated depreciation) for $5,000 cash
- Purchased equipment for $67,000 cash
- Long-term investments were purchased for $12,000 cash. There were no sales of long-term investments
- Bonds were paid with a principal amount of $18,000
- Issued common stock for $4,000 cash
- Declared and paid $32,000 in cash dividends

With these data and the information provided in Figure 6.2 "Balance Sheet and Income Statement for Home Store, Inc.", we can start preparing the statement of cash flows. It is important to note that all positive amounts shown in the statement of cash flows denote an *increase* in cash, and all negative amounts denote a *decrease* in cash.

Figure 6.2 Balance Sheet and Income Statement for Home Store, Inc.

Home Store, Inc.
Balance Sheet
December 31, 2020 and December 31, 2019

	2020	2019	Changes in Assets, Liabilities, and Equity from 2019 to 2020 Increase (decrease)
Assets			
Current assets			
Cash	$ 32,000	$ 130,000	$ (98,000)
Accounts receivable	85,000	25,000	60,000
Merchandise inventory	126,000	60,000	66,000
Prepaid expenses	18,000	20,000	(2,000)
Noncurrent assets			
Property, plant, and equipment	956,000	910,000	46,000
Accumulated depreciation	(299,000)	(285,000)	(14,000)
Long-term investments	70,000	58,000	12,000
Total assets	$ 988,000	$ 918,000	
Liabilities and owners' equity			
Current liabilities			
Accounts payable	$ 16,000	$ 15,000	$ 1,000
Income tax payable	39,000	48,000	(9,000)
Noncurrent liabilities			
Bonds payable	87,000	105,000	(18,000)
Owners' equity			
Common stock	414,000	410,000	4,000
Retained earnings	432,000	340,000	92,000
Total liabilities and owners' equity	$ 988,000	$ 918,000	

The end goal of the statement of cash flows is to explain this change in cash.

This contra-asset account increased from 2019 to 2020 thereby decreasing assets.

Home Store, Inc.
Income Statement
For the Year Ended December 31, 2020

Sales	$ 900,000
Cost of goods sold	546,000
Gross margin	$ 354,000
Selling and administrative expenses	120,000
Depreciation expense	24,000
Operating income	$ 210,000
Interest expense	15,000
Loss on sale of equipment	6,000
Income before taxes	$ 189,000
Income tax expense	65,000
Net income	$ 124,000

Step 1: Prepare the Operating Activities Section

Question: We will be using the indirect *method to prepare the operating activities section. The starting point using the indirect method is net income. Home Store, Inc., had net income of $124,000 in 2020. This amount comes from the income statement, which was prepared using the accrual basis of accounting. How do we convert this amount to a cash basis?*

Answer: Several adjustments are necessary to convert this amount to a cash basis and to provide an amount related only to daily operating activities of the business. If the resulting adjusted amount is a cash inflow, it is called *cash provided by operating activities*; if it is a cash outflow, it is called *cash used by operating activities*.

Three general types of adjustments are necessary to convert net income to *cash provided by operating activities*. These three types of adjustments are shown in Figure 6.3 “Operating Activities Format and Adjustments”, which also displays the format used for the operating activities section of the statement of cash flows. Examine this figure carefully.

Figure 6.3 Operating Activities Format and Adjustments

Cash flows from operating activities	
Net income (from income statement)	$ XXX,XXX
Adjustments (to convert net income to cash provided by operating activities)	
1. Add back expenses that do not impact cash such as depreciation and amortization expense	XXX,XXX
2. Add back losses and deduct gains related to investing activities	XXX,XXX
3. Add and subtract changes in current assets (except cash) and current liabilities using the adjustment rules	XXX,XXX
Cash provided by (used by) operating activities	$ XXX,XXX

Adjustment One: Adding Back Noncash Expenses

Question: What is the first type of adjustment necessary to convert net income to a cash basis?

Answer: The first adjustment to net income involves adding back expenses that do not affect cash (often called noncash expenses). For example, the accrual basis of accounting deducts depreciation expense in calculating net income, even though depreciation expense does not involve cash. (Recall the financial accounting entry to record depreciation expense: debit depreciation expense and credit accumulated depreciation. Notice cash is not involved.) Thus to convert net income to a cash basis, depreciation expense is added back to net income. In effect, we are reversing depreciation expense because it is not an expense using the cash basis of accounting. The end result is as though depreciation expense was never deducted as an expense.

Next, we show how the first adjustment to net income appears in the operating activities section of the statement of cash flows for Home Store, Inc. (net income and depreciation expense come from the income statement shown in Figure 6.2 “Balance Sheet and Income Statement for Home Store, Inc.”):

Cash flows from operating activities	
Net income	$ 124,000
Adjustments (to convert net income to cash provided by operating activities)	
1. Add back depreciation expense	24,000
2. Add back losses and deduct gains related to investing activities	XXX,XXX
3. Add and subtract changes in current assets (except cash) and current liabilities using the adjustment rules	XXX,XXX
Cash provided by (used by) operating activities	$XXX,XXX

The income statement for Home Store, Inc., shows $24,000 in depreciation expense for the year. As shown previously, this amount is added back to the net income of $124,000.

Adjustment Two: Adding Back Losses and Deducting Gains Related to Investing Activities

Question: What is the second type of adjustment necessary to convert net income to a cash basis?

Answer: The second adjustment to net income involves adding back losses and deducting gains related to investing activities. For example, Home Store, Inc., realized a $6,000 loss on the sale of equipment. This loss is shown on the income statement as a deduction in calculating net income (see Figure 6.2 “Balance Sheet and Income Statement for Home Store, Inc.”). However, this

loss is *not* related to the daily operations of the business. That is, Home Store, Inc., is not in the business of buying and selling equipment daily. Remember, we are trying to find the cash provided by *operating activities* in this section of the statement of cash flows.

Since equipment is a *noncurrent* asset, cash activity related to the disposal of equipment should be included in the investment activities section of the statement of cash flows. Thus the $6,000 loss shown as a deduction on the income statement is added back to net income, and it will be included later in the investing activities section as part of the proceeds from the sale of equipment. In effect, we are reversing the $6,000 loss because it is *not* an operating expense.

Here's how the second adjustment to net income appears in the operating activities section of the statement of cash flows for Home Store, Inc.:

Cash flows from operating activities	
Net income	$ 124,000
Adjustments (to convert net income to cash provided by operating activities)	
1. Add back depreciation expense	24,000
2. Add back loss on sale of equipment	6,000
3. Add and subtract changes in current assets (except cash) and current liabilities using the adjustment rules	XXX,XXX
Cash provided by (used by) operating activities	$ XXX,XXX

Adjustment Three: Adding and Subtracting Changes in Current Assets and Current Liabilities

Question: What is the third type of adjustment necessary to convert net income to a cash basis?

Answer: The third type of adjustment to net income involves analyzing the changes in all current assets (except cash) and current liabilities from the beginning of the period to the end of the period. Technically it is changes in operating assets and liabilities but most of the time current assets and liabilities will be operating assets and liabilities unless a note tells you differently. These changes are already shown in the far right column of the balance sheet portion of Figure 6.2 "Balance Sheet and Income Statement for Home Store, Inc.". Two important rules must be followed to determine how the change is reflected as an adjustment to net income. Study these two rules carefully:

1. **Current assets.** Increases in current assets are *deducted* from net income; decreases in current assets are *added* to net income. (There is an *inverse relationship* between the change in a current asset account and how it is shown as an adjustment.)
2. **Current liabilities.** Increases in current liabilities are *added* to net income; decreases in current liabilities are *deducted* from net income. (There is a *direct relationship* between the change in a current liability account and how it is shown as an adjustment.)

Now let's work through each current asset and current liability line item shown in the balance sheet (Figure 6.2 "Balance Sheet and Income Statement for Home Store, Inc.") and use these rules to determine how each item fits into the operating activities section as an adjustment to net income.

The first current asset line item, cash, shows the change in cash from the beginning of the year to the end of year. Cash decreased by $98,000. The goal of the statement of cash flows is to show what caused this $98,000 decrease. This amount will appear in step 4 when we reconcile the beginning cash balance to the ending cash balance. The next line item is accounts receivable.

Accounts receivable (current asset) increased by $60,000. The current asset rule states that increases in current assets are deducted from net income. Thus $60,000 is deducted from net income in the operating activities section of the statement of cash flows. Here's why.

Assume all Home Store's sales shown on the income statement are credit sales (each sale required a debit to accounts receivable and a credit to sales). The beginning accounts receivable balance of $25,000 is increased by $900,000 for credit sales made during the year, resulting in $925,000 in total receivables to be collected. Since $85,000 in accounts receivable remains at the end of the

year, $840,000 in cash was collected (= $925,000 − $85,000). On a cash basis, Home Store, Inc., should show $840,000 in revenue rather than $900,000. Thus net income must be reduced by $60,000 (= $900,000 revenue using accrual basis − $840,000 revenue using cash basis). The accounts receivable T-account shown in the following provides further clarification.

Accounts Receivable

Beginning balance	25,000		
Sales on account	**900,000**	**Cash receipt**	**840,000**
Ending balance	85,000		

This is the revenue on the income statement using the accrual basis.

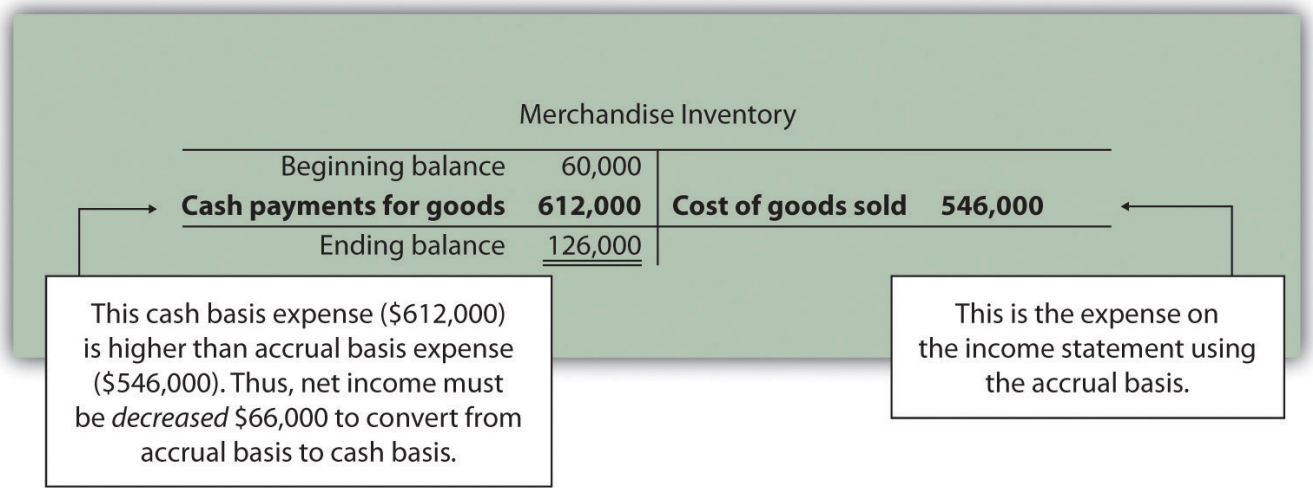
This cash basis revenue ($840,000) is lower than accrual basis revenue ($900,000). Thus net income must be *decreased* $60,000 to convert from accrual basis to cash basis.

Here's how the accounts receivable adjustment to net income appears in the operating activities section of the statement of cash flows for Home Store, Inc.:

Cash flows from operating activities	
Net income	$ 124,000
Adjustments (to convert net income to cash provided by operating activities)	
1. Add back depreciation expense	24,000
2. Add back loss on sale of equipment	6,000
3. Increase in accounts receivable	(60,000)
Cash provided by (used by) operating activities	$XXX,XXX

We will continue analyzing each current asset and current liability item in the balance sheet shown in Figure 6.2 "Balance Sheet and Income Statement for Home Store, Inc." and present the resulting adjustments and completed operating activities section at the end of our analysis in Figure 6.4 "Operating Activities Section of Statement of Cash Flows (Home Store, Inc.)".

Merchandise inventory (current asset) increased by $66,000. Because the current asset rule states that increases in current assets are deducted from net income, $66,000 is deducted from net income in the operating activities section of the statement of cash flows. To explain why, let's assume Home Store, Inc., pays cash for all purchases of merchandise inventory. If the merchandise inventory account increases over time, more goods are purchased than are sold. Because merchandise inventory at Home Store, Inc., increased $66,000 and cost of goods sold totaled $546,000, the company must have purchased inventory with a cost of $612,000 during the period (= $66,000 + $546,000). Thus more cash was paid for merchandise ($612,000) than was reflected on the income statement as cost of goods sold ($546,000). If expenses are higher using a cash basis, the adjustment must decrease net income. Therefore $66,000 is deducted from net income in the operating activities section of the statement of cash flows. This information is summarized in the merchandise inventory T-account in the following.



Prepaid expenses (current asset) decreased by $2,000. Because the current asset rule states that decreases in current assets are added to net income, $2,000 is *added* to net income in the operating activities section of the statement of cash flows. This is because cash paid for these expenses was lower than the expenses recognized on the income statement using the accrual basis. Since expenses are $2,000 lower using the cash basis, net income must be increased by $2,000.

Key Point

Important Operating/Current Asset Rule

When preparing the operating activities section of the statement of cash flows, *increases in current/operating assets are deducted from net income; decreases in current/operating assets are added to net income*.

Question: Now that we know how to handle the change in current/operating assets when preparing the operating activities section of the statement of cash flows, what do we do with current/operating liabilities?

Answer: The current liability rule is a bit different than the current asset rule as described next.

Accounts payable (current liability) increased by $1,000. Because the current liability rule states that increases in current liabilities are added to net income, $1,000 is *added* to net income in the operating activities section of the statement of cash flows. An increase in accounts payable signifies that Home Store, Inc., recorded more as an expense on the income statement (accrual basis) than the company paid in cash (cash basis). Since expenses are lower using the cash basis, net income must be *increased* by $1,000.

Income tax payable (current liability) decreased by $9,000. Because the current liability rule states that decreases in current liabilities are deducted from net income, $9,000 is *deducted* from net income in the operating activities section of the statement of cash flows. A decrease in income tax payable signifies that Home Store, Inc., paid more for income taxes (cash basis) than the company recorded as an expense on the income statement (accrual basis). Since expenses are higher using the cash basis, net income must be *decreased* by $9,000.

Key Point

Important Current/Operating Liability Rule

When preparing the operating activities section of the statement of cash flows, *increases in current/operating liabilities are added to net income; decreases in current/operating liabilities are deducted from net income*.

Question: What does the operating activities section of the statement of cash flows look like for Home Store, Inc.?

Answer: Figure 6.4 “Operating Activities Section of Statement of Cash Flows (Home Store, Inc.)” shows the completed operating activities section of the statement of cash flows for Home Store. Inc. The most important line is at the bottom, which shows cash of $22,000 was generated during the year from daily operations of the business. Notice this amount is significantly lower than the net income amount of $124,000 reported on the income statement. Study Figure 6.4 “Operating Activities Section of Statement of Cash Flows (Home Store, Inc.)” carefully noting the three types of adjustments made to net income.

Figure 6.4 Operating Activities Section of Statement of Cash Flows (Home Store, Inc.)

Cash flows from operating activities	
Net income	$ 124,000
Adjustments (to convert net income to cash provided by operating activities)	
1. Add back depreciation expense	24,000
2. Add back loss on sale of equipment	6,000
3. Increase in accounts receivable	(60,000)
3. Increase in merchandise inventory	(66,000)
3. Decrease in prepaid expenses	2,000
3. Increase in accounts payable	1,000
3. Decrease in income tax payable	(9,000)
Cash provided by operating activities	$ 22,000

The company received $22,000 in cash for the year related to daily operations of the business.

For current assets, the adjustment is in the *opposite* direction of the change in the account. For current liabilities, the adjustment is in the *same* direction as the change in the account.

Check Yourself

This check yourself will use the data presented as follows for Phantom Books. Each review problem corresponds to the four steps required to prepare a statement of cash flows.

Phantom Books is a retail store that sells new and used books. Phantom’s most recent balance sheet, income statement, and other important information for 2020 are presented in the following.

Phantom Books
Balance Sheet
December 31, 2020 and December 31, 2019

	2020	2019	Change in Assets, Liabilities, and Equity from 2019 to 2020 Increase (decrease)
Assets			
Current assets			
Cash	$ 45,000	$ 24,000	$ 21,000
Accounts receivable	15,000	21,000	(6,000)
Merchandise inventory	73,000	60,000	13,000
Prepaid expenses	12,000	16,000	(4,000)
Noncurrent assets			
Property, plant, and equipment	357,000	360,000	(3,000)
Accumulated depreciation	(122,000)	(115,000)	(7,000)
Long-term investments	30,000	16,000	14,000
Total assets	$ 410,000	$ 382,000	
Liabilities and owners' equity			
Current liabilities			
Accounts payable	$ 7,000	$ 8,000	(1,000)
Income tax payable	5,000	3,000	2,000
Noncurrent liabilities			
Notes payable	25,000	20,000	5,000
Owners' equity			
Common stock	87,000	103,000	(16,000)
Retained earnings	286,000	248,000	38,000
Total liabilities and owners' equity	$ 410,000	$ 382,000	

Phantom Books
Income Statement
for the Year Ended December 31, 2020

Sales	$750,000
Cost of goods sold	546,000
Gross margin	$204,000
Selling and administrative expenses	79,000
Depreciation expense	29,000
Operating income	$ 96,000
Interest expense	(11,000)
Gain on sale of equipment	4,000
Loss on sale of long-term investments	(8,000)
Income before taxes	$ 81,000
Income tax expense	30,000
Net income	$ 51,000

Additional data for 2020 include the following:

- Sold equipment with a book value of $8,000 (= $30,000 cost − $22,000 accumulated depreciation) for $12,000 cash
- Purchased equipment for $27,000 cash
- Sold long-term investments with an original cost of $11,000 for $3,000 cash
- Purchased long-term investments for $25,000 cash
- Signed a note with the bank for $5,000 cash. No principal amounts were paid during the year
- Repurchased common stock (treasury stock) for $16,000 cash. No new common stock was issued
- Declared and paid $13,000 in cash dividends

1. Prepare the *operating activities* section of the statement of cash flows for Phantom Books using the indirect method. Follow the format presented in Figure 6.4 “Operating Activities Section of Statement of Cash Flows (Home Store, Inc.)”.
2. How much cash did Phantom Books generate from operating activities for the year?

Solution

1. Start with net income from the income statement; make the appropriate adjustments for (1) noncash expenses, such as depreciation and amortization; (2) gains and losses related to investing activities; and (3) changes in current assets other than cash and current liabilities. The operating activities section of the statement of cash flows for Phantom Books appears as follows.

Cash flows from operating activities	
Net income	$ 51,000
Adjustments (to convert net income to cash provided by operating activities)	
1. Add back depreciation expense	29,000
2. Deduct gain on sale of equipment	(4,000)
2. Add back loss on sale of long-term investments	8,000
3. Decrease in accounts receivable	6,000
3. Increase in merchandise inventory	(13,000)
3. Decrease in prepaid expenses	4,000
3. Decrease in accounts payable	(1,000)
3. Increase in income tax payable	2,000
Cash provided by operating activities	$ 82,000

For current assets, the adjustment is in the *opposite* direction of the change in the account. For current liabilities, the adjustment is in the *same* direction as the change in the account.

2. Cash totaling $82,000 was generated from the company's operating activities during the year.

Before moving on to step 2, note that investing and financing activities sections always use the same format whether the operating activities section is presented using the direct method or indirect method.

Step 2: Prepare the Investing Activities Section

Question: Now that we have completed the operating activities section for Home Store, Inc., the next step is to prepare the investing activities section. What information is used for this section, and how is it prepared?

Answer: The investing activities section of the statement of cash flows focuses on cash activities related to noncurrent assets. Review the noncurrent asset section of Home Store, Inc.'s balance sheet presented in Figure 6.2 "Balance Sheet and Income Statement for Home Store, Inc.". Three noncurrent asset line items must be analyzed to determine how to present cash flow information in the investing activities section.

Property, plant, and equipment increased by $46,000. The additional information provided for 2020 indicates two types of transactions caused this increase. First, the company purchased equipment for $67,000 cash. Home Store, Inc., made the following journal entry for this transaction:

Dr. property, plant, and equipment	67,000	
Cr. cash		67,000

Second, the company sold equipment for $5,000 cash (often called a *disposal* of equipment). This equipment was on the books at an original cost of $21,000 with accumulated depreciation of $10,000. Home Store, Inc., made the following journal entry for this transaction:

Dr. cash	5,000	
Dr. accumulated depreciation	10,000	
Dr. loss on sale of equipment	6,000	
Cr. property, plant, and equipment		21,000

Notice the two entries to property, plant, and equipment shown previously. The net effect of these 2 entries is an increase of $46,000 (= $67,000 − $21,000). This is summarized in the following T-account:

Property, Plant, and Equipment

Beginning balance	910,000		
Purchases	**67,000**	**Disposals (original cost)**	**21,000**
Ending balance	956,000		

Represents cash paid for equipment during the year.

Represents the original cost of equipment sold during the year.

Question: How is this property, plant, and equipment information used in the investing activities section of the statement of cash flows for Home Store, Inc.?

Answer: First, the purchase of equipment for $67,000 cash is shown as a *decrease* in cash. Second, the sale of equipment for $5,000 is shown as an *increase* in cash. It is not enough to simply show a cash outflow of $62,000 in the investing activities section of the statement of cash flows (= $67,000 − $5,000). Instead, Home Store, Inc., must show the components of this cash outflow as separate line items in the statement of cash flows as required by U.S. GAAP. The formal presentation of this information in the investing activities section is shown later in Figure 6.5 “Investing Activities Section of Statement of Cash Flows (Home Store, Inc.)”.

Accumulated depreciation decreased noncurrent assets by $14,000. This contra asset account is not typical of the other asset accounts shown on Home Store, Inc.’s balance sheet since contra asset accounts have the effect of reducing assets. Thus as this accumulated depreciation account increases, it further reduces overall assets. Terminology can get confusing, so here is a simple way to look at it. The higher the account goes; the more it reduces assets. This is why the change column shows this account as decreasing assets.

Two items caused the change in the accumulated depreciation account. First, the sale of equipment during the year caused the company to take $10,000 in accumulated depreciation off the books. Second, $24,000 in depreciation expense was recorded during the year (with a corresponding entry to accumulated depreciation). This information is summarized in the following T-account:

Accumulated Depreciation			
		Beginning balance	285,000
Disposal	**10,000**	**Depreciation expense**	**24,000**
		Ending balance	299,000

Accumulated depreciation taken off the books for equipment sold during the year.

Depreciation expense recorded for the year.

Question: How is accumulated depreciation information used in the statement of cash flows for Home Store, Inc.?

Answer: This information is already reflected in two places (the work has already been done!). First, depreciation expense is a noncash expense and is added back to net income in the operating activities section of the statement of cash flows (see Figure 6.4 "Operating Activities Section of Statement of Cash Flows (Home Store, Inc.)"). Second, $10,000 of accumulated depreciation related to disposals is included as part of the $5,000 proceeds from the sale of equipment in the investing activities section of the statement of cash flows (see Figure 6.5 "Investing Activities Section of Statement of Cash Flows (Home Store, Inc.)"). Here are the components of the equipment sale that support the $5,000 in cash proceeds shown in the investing activities section:

Book value of equipment sold	$11,000	(= $21,000 cost – $10,000 accumulated depreciation)
Loss on sale of equipment	(6,000)	
Cash proceeds from sale of equipment	$ 5,000	

Long-term investments increased by $12,000. The additional information provided for 2020 indicates there were no sales of long-term investments during the year. The increase of $12,000 is solely from purchasing long-term investments with cash. Thus the purchase of long-term investments for $12,000 is shown as a *decrease* in cash in the investing activities section.

Figure 6.5 "Investing Activities Section of Statement of Cash Flows (Home Store, Inc.)" shows the three investing activities described previously: (1) a $67,000 decrease in cash from the purchase of equipment, (2) a $5,000 increase in cash from the sale of equipment, and (3) a $12,000 decrease in cash from the purchase of long-term investments. Examine Figure 6.5 "Investing Activities Section of Statement of Cash Flows (Home Store, Inc.)" carefully noting the impact these three items have on cash and the resulting *cash used by investing activities* of $74,000.

Figure 6.5 Investing Activities Section of Statement of Cash Flows (Home Store, Inc.)

Cash flows from investing activities	
Purchase of equipment	$ (67,000)
Proceeds from sale of equipment	5,000
Purchase of long-term investments	(12,000)
Cash used by investing activities	$ (74,000)

The company used $74,000 in cash for investing activities.

Check Yourself

Using the information presented earlier for Phantom Books:

1. Prepare the *investing activities* section of the statement of cash flows for Phantom Books. Follow the format presented in Figure 6.5 “Investing Activities Section of Statement of Cash Flows (Home Store, Inc.)”.
2. How much cash did Phantom Books use for investing activities during the year?

Solution

1. Start by analyzing changes in noncurrent assets on the balance sheet. Then prepare the investing activities section of the statement of cash flows. The cash flows related to each noncurrent asset account are underlined as follows.

   Property, plant, and equipment decreased by $3,000. Additional data provided indicate 2 items caused this change: (1) equipment was purchased for $27,000 cash, causing a $27,000 increase in the account; and (2) equipment with an original cost of $30,000 was sold for $12,000 cash, causing a $30,000 decrease in the account. The net effect of these 2 items on the property, plant, and equipment account is a decrease of $3,000 (= $27,000 purchase − $30,000 original cost of equipment sold). The impact these items have on cash is reflected in the investing activities section of the statement of cash flows by showing a *$27,000 cash outflow* for the purchase of equipment and a *$12,000 cash inflow* from the sale of equipment.

   Accumulated depreciation decreased assets by $7,000. Two items caused this change: (1) the sale of equipment caused the company to take $22,000 in accumulated depreciation off the books—this was the accumulated depreciation on the books for the equipment sold, and (2) $29,000 in depreciation expense was recorded during the year, with a corresponding entry to accumulated depreciation. Neither of these entries to accumulated depreciation impacts the investing activities section. However, $29,000 in depreciation expense is a noncash expense and is added back to net income in the operating activities section.

   Long-term investments increased by $14,000. Additional data provided indicate 2 items caused this change: (1) long-term investments with an original cost of $11,000 were sold for $3,000 cash, and (2) long-term investments were purchased for $25,000 cash. The net effect of these 2 items on the long-term investments account is an increase of $14,000 (= $25,000 purchase − $11,000 original cost of investments sold). The impact these items have on cash is reflected in the investing activities section of the statement of cash flows by showing a *$25,000 cash outflow* for the purchase of investments, and a *$3,000 cash inflow* from the sale of investments.

   The investing activities section of the statement of cash flows for Phantom Books is shown as follows:

Cash flows from investing activities	
Purchase of equipment	$ (27,000)
Proceeds from sale of equipment	12,000
Purchase of long-term investments	(25,000)
Proceeds from sale of long-term investments	3,000
Cash used by investing activities	$ (37,000)

The company used $37,000 in cash for investing activities.

2. Cash totaling $37,000 was used for investing activities during the year.

Step 3: Prepare the Financing Activities Section

Question: Now that we have completed the operating and investing activities sections for Home Store, Inc., the next step is to prepare the financing activities section. What information is used for this section, and how is it prepared?

Answer: The financing activities section of the statement of cash flows focuses on cash activities related to noncurrent liabilities and owners' equity (i.e., cash activities related to long-term company financing). Review the noncurrent liability and owners' equity sections of Home Store, Inc.'s balance sheet presented in Figure 6.2 "Balance Sheet and Income Statement for Home Store, Inc.". One noncurrent liability item (bonds payable) and two owners' equity items (common stock and retained earnings) must be analyzed to determine how to present cash flow information in the financing activities section. The formal presentation of this information in the financing activities section is shown later in Figure 6.6 "Financing Activities Section of Statement of Cash Flows (Home Store, Inc.)".

Bonds payable decreased by $18,000. The additional information provided for 2020 indicates Home Store, Inc., paid off bonds during the year with a principal amount of $18,000. This is reflected in the financing activities section of the statement of cash flows as an $18,000 *decrease* in cash.

Common stock increased by $4,000. The additional information provided for 2020 indicates the company issued common stock for $4,000 cash. This is reflected in the financing activities section of the statement of cash flows as $4,000 *increase* in cash.

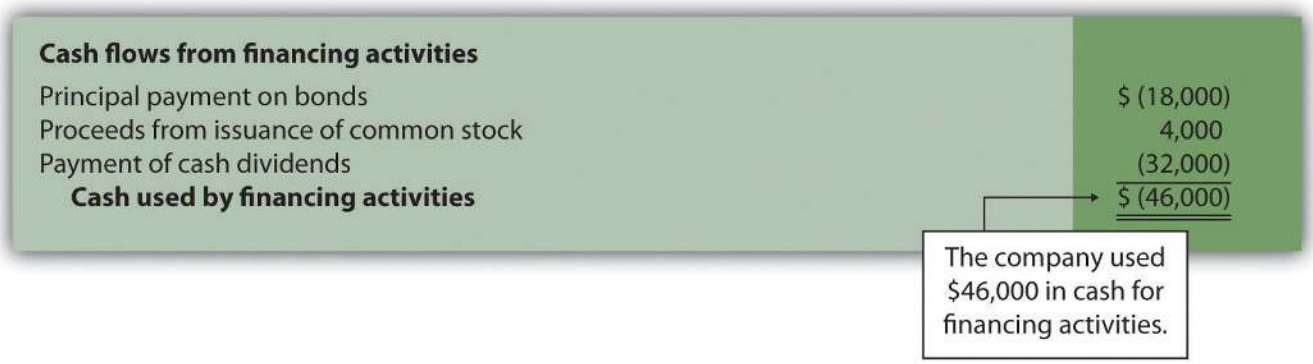
Retained earnings increased by $92,000. Two items caused this increase: (1) net income of $124,000 increased retained earnings, and (2) cash dividends paid totaling $32,000 decreased retained earnings. The net effect of these two entries is an increase of $92,000 (= $124,000 net income − $32,000 cash dividends).

Question: How is this information used in the statement of cash flows?

Answer: Net income is already included at the top of the operating activities section as shown in Figure 6.4 "Operating Activities Section of Statement of Cash Flows (Home Store, Inc.)". Cash dividends are included in the financing activities section as a $32,000 *decrease* in cash.

Figure 6.6 "Financing Activities Section of Statement of Cash Flows (Home Store, Inc.)" shows the three financing activities described previously: (1) an $18,000 decrease in cash from paying off the principal amount of bonds, (2) a $4,000 increase in cash from the issuance of common stock, and (3) a $32,000 decrease in cash from the payment of cash dividends. Examine Figure 6.6 "Financing Activities Section of Statement of Cash Flows (Home Store, Inc.)" carefully noting the impact these three items have on cash and the resulting *cash used by financing activities* of $46,000.

Figure 6.6 Financing Activities Section of Statement of Cash Flows (Home Store, Inc.)



Significant Noncash Investing and Financing Activities

Question: Some organizations have noncash activities involving the exchange of one noncurrent or owners' equity balance sheet item for another (e.g., the issuance of common stock for a building; or the issuance of common stock in exchange for bonds held by creditors). Do these types of transactions appear in the statement of cash flows?

Answer: These exchanges do not involve cash and thus do not appear directly on the statement of cash flows. However, if the amount is significant, this type of exchange must be disclosed as a separate note below the statement of cash flows or in the notes to the financial statements.

Check Yourself

Using the information presented for Phantom Books do the following:

1. Prepare the *financing activities* section of the statement of cash flows for Phantom Books. Follow the format presented in Figure 6.6 “Financing Activities Section of Statement of Cash Flows (Home Store, Inc.)”.
2. How much cash did Phantom Books use for financing activities during the year?

Solution

1. Start by analyzing changes in noncurrent liabilities and owners’ equity on the balance sheet. Then prepare the financing activities section of the statement of cash flows. The cash flows related to each noncurrent liability and owners’ equity account are underlined as follows.

   Note payable increased by $5,000. Additional data provided indicate the company signed a note with the bank and received $5,000 cash. This is reflected in the financing activities section as a *$5,000 cash inflow*.

   Common stock decreased by $16,000. Additional data provided indicate the company repurchased common stock for $16,000 cash. This is reflected in the financing activities section as a *$16,000 cash outflow*. This purchase of company stock would be shown as Treasury Stock which would reduce stock holders equity.

   Retained earnings increased by $38,000. Two items caused this increase: (1) net income of $51,000 increased retained earnings and (2) cash dividends paid totaling $13,000 (provided as additional data) decreased retained earnings. The net effect of these 2 items is an increase of $38,000 (= $51,000 net income − $13,000 cash dividends). Net income is already included at the top of the operating activities section. Cash dividends are included in the financing activities section as a *$13,000 cash outflow*.

   The financing activities section of the statement of cash flows for Phantom Books is shown as follows:

Cash flows from financing activities	
Proceeds from note payable	$ 5,000
Repurchase of common stock	(16,000)
Payment of cash dividends	(13,000)
Cash used by financing activities	$ (24,000)

The company used $24,000 in cash for financing activities.

2. Cash totaling $24,000 was used for financing activities during the year.

Step 4: Reconcile the Change in Cash

Question: We’re almost done with Home Store, Inc.’s statement of cash flows. What is the fourth and final step needed to complete the statement of cash flows?

Answer: The final step is to show that the change in cash on the statement of cash flows agrees with the change in cash on the balance sheet. As shown at the bottom of the completed statement of cash flows for Home Store, Inc., in Figure 6.7 “Statement of Cash Flows (Home Store, Inc.)”, the net decrease in cash of $98,000 shown on this statement (= $22,000 increase from operating activities − $74,000 decrease from investing activities − $46,000 decrease from financing activities) agrees with the change in cash shown on the balance sheet (= $32,000 ending cash balance − $130,000 beginning balance).

Figure 6.7 Statement of Cash Flows (Home Store, Inc.)

Home Store, Inc.
Statement of Cash Flows
for the Year Ended December 31, 2020

Cash flows from operating activities[a]			
Net income	$ 124,000		Step 1
Adjustments (to convert net income to cash provided by operating activities)			
Add back depreciation expense	24,000		
Add back loss on sale of equipment	6,000		
Increase in accounts receivable	(60,000)		
Increase in merchandise inventory	(66,000)		
Decrease in prepaid expenses	2,000		
Increase in accounts payable	1,000		
Decrease in income tax payable	(9,000)		
Cash provided by operating activities		$ 22,000	
Cash flows from investing activities[b]			
Purchase of equipment	(67,000)		Step 2
Proceeds from sale of equipment	5,000		
Purchase of long-term investments	(12,000)		
Cash used by investing activities		(74,000)	
Cash flows from financing activities[c]			
Principal payment on bonds	(18,000)		Step 3
Proceeds from issuance of common stock	4,000		
Payment of cash dividends	(32,000)		
Cash used by financing activities		(46,000)	
Net decrease in cash		$ (98,000)	Step 4
Cash at beginning of year[d]		130,000	
Cash at end of year[d]		$ 32,000	

[a] From Figure 6.4 “Operating Activities Section of Statement of Cash Flows (Home Store, Inc.)”.

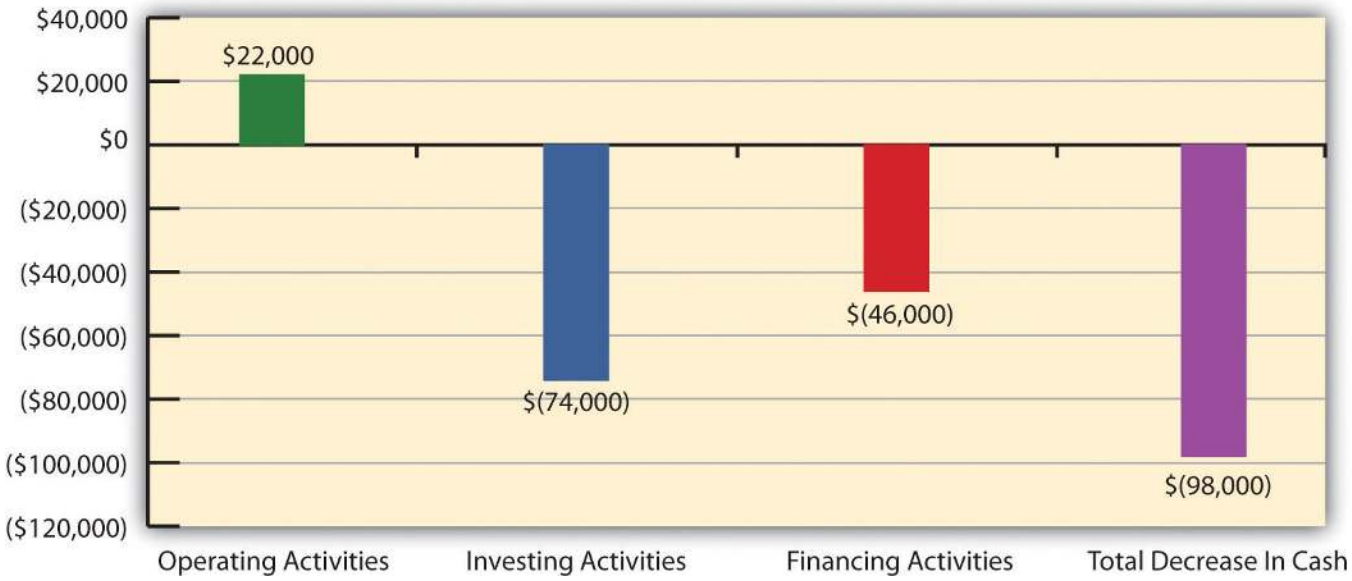
[b] From Figure 6.5 “Investing Activities Section of Statement of Cash Flows (Home Store, Inc.)”.

[c] From Figure 6.6 “Financing Activities Section of Statement of Cash Flows (Home Store, Inc.)”.

[d] From Figure 6.2 “Balance Sheet and Income Statement for Home Store, Inc.”.

Figure 6.8 “Cash Flows at Home Store, Inc.” provides a summary of cash flows for operating activities, investing activities, and financing activities for Home Store, Inc., along with the resulting total decrease in cash of $98,000.

Figure 6.8 Cash Flows at Home Store, Inc.



Exercises

Review Problem 12.7

Using the information presented for Phantom Books, prepare a complete statement of cash flows for Phantom Books. Follow the format presented in Figure 6.7 “Statement of Cash Flows (Home Store, Inc.)”.

Phantom Books
Statement of Cash Flows
for the Year Ended December 31, 2020

Cash flows from operating activities[a]			
Net income	$ 51,000		Step 1
Adjustments (to convert net income to cash provided by operating activities)			
Add back depreciation expense	29,000		
Deduct gain on sale of equipment	(4,000)		
Add back loss on sale of long-term investment	8,000		
Decrease in accounts receivable	6,000		
Increase in merchandise inventory	(13,000)		
Decrease in prepaid expenses	4,000		
Decrease in accounts payable	(1,000)		
Increase in income tax payable	2,000		
Cash provided by operating activities		$ 82,000	
Cash flows from investing activities[b]			
Purchase of equipment	(27,000)		Step 2
Proceeds from sale of equipment	12,000		
Purchase of long-term investments	(25,000)		
Proceeds from sale of long-term investments	3,000		
Cash used by investing activities		(37,000)	
Cash flows from financing activities[c]			
Proceeds from note payable	5,000		Step 3
Repurchase of common stock	(16,000)		
Payment of cash dividends	(13,000)		
Cash used by financing activities		(24,000)	
Net increase in cash		$ 21,000	Step 4
Cash at beginning of year (from balance sheet)		24,000	
Cash at end of year (from balance sheet)		$ 45,000	

Solution

[a] From earlier check yourself

[b] From earlier check yourself

[c] From earlier check yourself

Home Store, Inc., Update

Recall the dialogue at Home Store, Inc., between John (CEO), Steve (treasurer), and Linda (CFO). John was concerned about the company's drop in cash from $130,000 at the beginning of the year to $32,000 at the end of the year. He asked Linda to investigate and wanted to know how much cash was generated from daily operations during the year. The group reconvened the following week. As you read the dialogue that follows, refer to Figure 6.7 "Statement of Cash Flows (Home Store, Inc.)"; it is the statement of cash flows that Linda prepared for the meeting.

John (CEO):
Welcome, everyone. Linda, what information do you have for us regarding the company's cash flow?

Linda (CFO):
I've completed a statement of cash flows for the year—here are copies for your review (see Figure 6.7 "Statement of Cash Flows (Home Store, Inc.)"). This statement tells us about the company's cash activities during the year and ultimately explains why cash decreased by $98,000.

John:
How much cash did we generate from ongoing operations for the year?

Linda:
That can be found in the top portion of the statement under "cash flows from operating activities." We generated $22,000 from operating activities.

Steve (Treasurer):
You're kidding! We had net income totaling $124,000 but only generated $22,000 in cash?

John:
That does seem like a huge disparity. Linda, are you sure this is correct?

Linda:
Yes! The reason cash from operating activities is so much lower than net income is that accounts receivable and merchandise inventory increased significantly from the beginning of the year to the end of the year. In fact, both accounts more than doubled.

Steve:
The cash tied up in these two areas is definitely hurting our cash flow. We really struggled to meet our cash budgets for accounts receivable collections and inventory purchases.

John:
Clearly, we've got to get a handle on receivables and inventory. But even with this huge difference between net income and cash flows from operating activities, we generated $22,000 in cash. This does not explain why cash decreased by $98,000.

Linda:
You're right, John. Operating activities produced positive cash flow in spite of these receivables and inventory issues. Let's look further down the statement. Notice we spent $67,000 on equipment and purchased $12,000 in long-term investments.

Steve:
Yes, I recall purchasing a new forklift—the old one was a safety hazard—and purchasing long-term investments at the beginning of the year when our cash balance was on the high side.

Linda:
Once we factor in the cash proceeds from the old equipment, you can see we spent $74,000 in cash for equipment and investments.

John:
Looking back, we probably should have financed the equipment rather than having paid for it all at once. What else can you tell us, Linda?

Linda:
Bonds totaling $18,000 came due during the year, as shown toward the bottom of the statement, and we paid $32,000 in dividends.

Steve:
I realize the board felt cash levels were high enough during 2019 to warrant a large dividend payment in 2020, but we need to cut way back on these dividends in the future.

Linda:
I agree. To answer your question, John, the $98,000 decrease in cash came primarily from the purchase of equipment and long-term investments and payments for bonds and cash dividends.

John:
Thank you, Linda. This provides the information we need to improve cash flow going forward.

As you can see from this dialogue, the statement of cash flows is not only a reporting requirement for most companies, it is also a useful tool for analytical and planning purposes. Next, we will discuss how to use cash flow information to assess performance and help in planning for the future.

Key Takeaways

- The statement of cash flows is prepared using the four steps described in the previous segment. In step 1, the indirect method starts with net income in the operating activities section and makes three types of adjustments to convert net income to a cash basis. The first adjustment is adding back expenses that do not affect cash, such as depreciation. The second adjustment is adding back losses and deducting gains related to investing activities. The third adjustment is adding and subtracting changes in current assets (except cash) and current liabilities using the adjustment rules. Steps 2 and 3 are done by analyzing and presenting cash activities associated with noncurrent assets (investing activities) and noncurrent liabilities and owners' equity (financing activities). Step 4 shows that the change in cash on the statement of cash flows agrees with the change in cash on the balance sheet.

12.5 Analyzing Cash Flow Information

Learning Objective

1. Analyze cash flow information.

Question: Companies and analysts tend to use income statement and balance sheet information to evaluate financial performance. In fact, financial results presented to the investing public typically focus on earnings per share as covered in financial accounting. However, analysis of cash flow information is becoming increasingly important to managers, auditors, and outside analysts. What measures are commonly used to evaluate performance related to cash flows?

Answer: Three common cash flow measures used to evaluate organizations are (1) operating cash flow ratio, (2) capital expenditure ratio, and (3) free cash flow. We will use two large home improvement retail companies, **The Home Depot, Inc.**, and **Lowe's Companies, Inc.**, to illustrate these measures.

Operating Cash Flow Ratio

Question: The operating cash flow ratio *is cash* provided by operating activities *divided by* current liabilities. *What does this ratio tell us, and how is it calculated?*

Answer: This ratio measures the company's ability to generate enough cash from daily operations over the course of a year to cover current obligations. Although similar to the commonly used current ratio, this ratio replaces current assets in the numerator with cash provided by operating activities. The operating cash flow ratio is as follows:

Key Equation

Operating cash flow ratio= Cash provided by operating activities / Current liabilities

The numerator, *cash provided by operating activities*, comes from the bottom of the operating activities section of the statement of cash flows. The denominator, *current liabilities*, comes from the liabilities section of the balance sheet. (Note that if current liabilities vary significantly from one period to the next, some analysts prefer to use average current liabilities. We will use ending current liabilities unless noted otherwise.)

As with most financial measures, the resulting ratio must be compared to similar companies in the industry to determine whether the ratio is reasonable. Some industries have a large operating cash flow relative to current liabilities (e.g., mature computer chip makers, such as **Intel Corporation**), while others do not (e.g., startup medical device companies).

The operating cash flow ratio is calculated for **Home Depot** and **Lowe's** in the following using information from each company's balance sheet and statement of cash flows.

	Cash Provided by Operating Activities	Current Liabilities	Operating Cash Flow Ratio
Lowe's	4,296	15,182	.28
Home Depot	13,723	18,375	.75

Home Depot and **Lowe's** are in the same industry but Home Depot shows a much higher operating cash flow ratio meaning that meeting current obligations out of operating cash flow will be easier for Home Depot than for Lowe's.

Capital Expenditure Ratio

Question: The capital expenditure ratio *is* cash provided by operating activities *divided by* capital expenditures. *What does this ratio tell us, and how is it calculated?*

Answer: This ratio measures the company's ability to generate enough cash from daily operations to cover capital expenditures. A ratio in excess of 1.0, for example, indicates the company was able to generate enough operating cash to cover investments in property, plant, and equipment. The capital expenditure ratio is as follows:

Key Equation

Capital expenditure ratio=Cash provided by operating activities / Capital expenditures

The numerator, *cash provided by operating activities*, comes from the bottom of the operating activities section of the statement of cash flows. The denominator, *capital expenditures*, comes from information within the investing activities section of the statement of cash flows.

The capital expenditure ratio is calculated for **Home Depot** and **Lowe's** in the following using information from each company's statement of cash flows.

	Cash Provided by Operating Activities	Capital Expenditures	Capital Expenditure Ratio
Lowe's	4,296	1,484	2.89
Home Depot	13,723	2,678	5.12

Since the capital expenditure ratio for each company is well above 1.0, both companies were able to generate enough cash from operating activities to cover investments in property, plant, and equipment (also called *fixed assets*). Home Depot's ratio is almost double that of Lowe's showing that Home Depot spends a much smaller part of its operating cash flow on new property, plant and equipment than Lowe's does.

Free Cash Flow

Question: Another measure used to evaluate organizations, called free cash flow, is simply a variation of the capital expenditure ratio described previously. What does this measure tell us, and how is it calculated?

Answer: Rather than using a ratio to determine whether the company generates enough cash from daily operations to cover capital expenditures and dividends to shareholders, free cash flow is measured in dollars. Free cash flow is *cash provided by operating activities* minus *capital expenditures* minus *dividends*. The idea is that companies must continue to invest in fixed assets to remain competitive and must pay dividends to keep shareholders happy. Free cash flow provides information regarding how much cash generated from daily operations is left over after investing in fixed assets or paying current dividends so that other investments could be made or the dividends increased. Many organizations, such as **Amazon.com**, consider this measure to be one of the most important in evaluating financial performance. The free cash flow formula is as follows:

Key Equation

Free cash flow = Cash provided by operating activities − Capital expenditures – Dividends

The *cash provided by operating activities* comes from the bottom of the operating activities section of the statement of cash flows. The *capital expenditures* amount comes from information within the investing activities section of the statement of cash flows. The *dividends* are found in the financing section of the cash flow statement.

The free cash flow amount is calculated for **Home Depot** and **Lowe's** as follows using information from each company's statement of cash flows.

	Cash Provided by Operating Activities	-Capital Expenditures – Dividends	= Free Cash Flow
Lowe's	4,296	– 1,484 – 1,618	1,194
Home Depot	13,723	– 2,678 – 5,958	5,087

Because free cash flow for each company is above zero, both companies were able to generate enough cash from operating activities to cover investments in fixed assets and pay dividends and have some left over to invest elsewhere. This conclusion is consistent with the capital expenditure ratio analysis, which uses the same information to assess the company's ability to cover fixed asset expenditures.

Formulas for the cash flow performance measures presented in this chapter are summarized in Table 6.1 "Summary of Cash Flow Performance Measures".

Table 6.1 Summary of Cash Flow Performance Measures

Operating cash flow ratio= Cash provided by operating activities / Current liabilities
Capital expenditure ratio=Cash provided by operating activities / Capital expenditures
Free cash flow=Cash provided by operating activities − Capital expenditures – Dividends

Key Takeaways

- Three measures are often used to evaluate cash flow. *The operating cash flow ratio* measures the company's ability to generate enough cash from daily operations over the course of a year to cover current obligations. The formula is as follows:

Operating cash flow ratio=Cash provided by operating activities / Current liabilities

The *capital expenditure ratio* measures the company's ability to generate enough cash from daily operations to cover capital expenditures. The formula is as follows:

Capital expenditure ratio=Cash provided by operating activities / Capital expenditures

Free cash flow measures the company's ability to generate enough cash from daily operations to cover capital expenditures and determines how much cash is remaining to invest elsewhere in the company. The formula is as follows:

Free cash flow = Cash provided by operating activities − Capital expenditures – Dividends

Check Yourself

The following financial information is for **PepsiCo Inc.** and **Coca-Cola Company** for a recent fiscal year.

Income Statement
(in millions)

	PepsiCo	Coca-Cola
Revenues	$57,838	$ 35,119
Expenses	51,500	17,115
Net income	$ 6,338	$ 11,859

Balance Sheet
(in millions)

	PepsiCo	Coca-Cola
Current assets	$17,569	$ 21,579
Noncurrent assets	50,584	51,342
Total assets	$68,153	$ 72,921
Current liabilities	15,892	18,508
Noncurrent liabilities	30,785	23,096
Owners' equity	21,476	31,317
Total liabilities and owners' equity	$68,153	$ 72,921

Statement of Cash Flows
(in millions)

	PepsiCo	Coca-Cola
Cash provided by operating activities	$ 8,448	$ 9,532
Cash used by investing activities	(7,668)	(4,405)
Cash provided (used) by financing activities	1,386	(3,465)
Net increase in cash	$ 2,166	$ 1,662
Fixed asset expenditures (included in investing activities)	$ 3,253	$ 2,215

PepsiCo paid 5,304 in dividends and **Coca-Cola** paid 6,845 in dividends. For **PepsiCo** and **Coca Cola,** calculate the following measures and comment on your results:

1. Operating cash flow ratio
2. Capital expenditure ratio (*Hint:* fixed asset expenditures are the same as capital expenditures.)
3. Free cash flow

Solution

All dollar amounts are in millions.

1. The formula for calculating the operating cash flow ratio is as follows:

   Operating Cash Flow Ratio=Cash provided by operating activities / Current liabilities
   PepsiCo operating cash flow ratio=$8,448÷$15,892=0.53
   Coca-Cola operating cash flow ratio=$9,532÷$18,508=0.52

   PepsiCo generated slightly more cash from operating activities to cover current liabilities than **Coca-Cola**.

2. The formula for calculating the capital expenditure ratio is as follows:

   Capital Expenditure Ratio=Cash provided by operating activities / Capital expenditures
   PepsiCo capital expenditure ratio=$8,448÷$3,253=2.60
   Coca-Cola capital expenditure ratio=$9,532÷$2,215=4.30

   Both companies generated more than enough cash from operating activities to cover capital expenditures.

3. The formula to calculate free cash flow is as follows:

   Free cash flow = Cash provided by operating activities − Capital expenditures – Dividends
   PepsiCo free cash flow=$8,448−$3,253 – 5,304 =$(109)
   Coca-Cola free cash flow=$9,532−$2,214 – 6,845 = $473

   While Coca Cola has cash flow left over after purchasing new property, plant and equipment, Pepsi does not and thus Pepsi would not have the flexibility to pursue other options to improve their business.

End-of-Chapter Exercises

Questions

1. Why was the statement of cash flows created by the Financial Accounting Standards Board (FASB)?
2. Describe the three classifications of cash flows, and provide examples of activities that would appear in each classification.
3. Which section of the statement of cash flows is widely regarded as the most important? Why?
4. Briefly describe the four steps required to prepare the statement of cash flows using the indirect method.
5. Describe the three adjustments necessary to convert net income to a cash basis using the indirect method. Provide an example for each adjustment.
6. Why is depreciation expense added back to net income using the indirect method of preparing the statement of cash flows?
7. Assume you are using the *indirect* method to prepare the operating activities section of the statement of cash flows. Describe the adjustment rules for current assets and current liabilities, and provide one example for each rule.
8. You have just completed the statement of cash flows for a company, and the bottom of the statement shows a net increase in cash of $250,000. Describe where this increase should be shown elsewhere in the financial statements.
9. Provide an example of a noncash investing or financing activity. Describe how these transactions are disclosed in the financial statements.
10. How is the operating cash flow ratio calculated, and what does it tell the user?
11. How is the capital expenditure ratio calculated, and what does it tell the user?
12. How is free cash flow calculated, and what does it tell the user?

Brief Exercises

17. **Evaluating Cash Flows at Home Store, Inc.** Refer to the dialogue at Home Store, Inc., presented at the beginning of the chapter and the follow-up dialogue.

Required:

1. Why was the CEO concerned about the company's cash flow?
2. Why did the CEO state, "We probably should have financed the equipment rather than having paid for it all at once"?

18. **Classifying Cash Flows.** Identify whether each of the following items would appear in the operating, investing, or financing activities section of the statement of cash flows. Briefly explain your answer for each item.

    1. Cash receipts from the sale of common stock
    2. Cash receipts from the sale of a building
    3. Cash payments for income taxes
    4. Cash receipts from issuance of bonds
    5. Cash payments for the purchase of equipment

19. **Operating Activities Section Using the Indirect Method.** The following income statement and current sections of the balance sheet are for Donzi, Inc.

Donzi, Inc.
Income Statement
for the Year Ended December 31, 2020

Sales	$650,000
Cost of goods sold	410,000
Gross margin	$240,000
Selling and administrative expenses	89,000
Depreciation expense	21,000
Operating income	$130,000
Gain on sale of equipment	1,600
Income before taxes	$131,600
Income tax expense	46,600
Net income	$ 85,000

	December 31	
	2020	**2019**
Current assets		
Cash	$ 40,000	$ 32,000
Accounts receivable	10,000	8,000
Merchandise inventory	12,500	16,000
Prepaid expenses	4,000	2,700
Current liabilities		
Accounts payable	4,500	3,700
Income tax payable	2,200	1,800

Required:

Using the indirect method, prepare the operating activities section of the statement of cash flows for Donzi, Inc., for the year ended December 31, 2020. Use the format presented in Figure 6.4 “Operating Activities Section of Statement of Cash Flows (Home Store, Inc.)”.

20. **Investing Activities Section.** The following information is from the noncurrent asset portion of Santana, Inc.’s balance sheet.

	December 31	
	2020	2019
Property, plant and equipment	$180,000	$150,000
Accumulated depreciation	(111,000)	(95,000)
Long-term investments	41,000	26,000

The following activities occurred during 2020:

- Sold equipment with a book value of $3,000 (= $13,000 cost − $10,000 accumulated depreciation) for $4,000 cash and depreciation expense for the year totaled $26,000
- Purchased property for $43,000 cash
- Purchased long-term investments for $15,000 cash

Required:

Prepare the investing activities section of the statement of cash flows for Santana, Inc., for the year ended December 31, 2020. Use the format presented in Figure 6.5 “Investing Activities Section of Statement of Cash Flows (Home Store, Inc.)”.

21. **Financing Activities Section.** The following information is from the noncurrent liabilities and owners’ equity portions of Canton Company’s balance sheet.

	December 31	
	2020	2019
Bonds payable	$ 410,000	$ 330,000
Common stock	800,000	700,000
Retained earnings	995,000	950,000

The following activities occurred during 2020:

- Issued bonds for $80,000 cash
- Issued common stock for $100,000 cash
- Earned net income totaling $60,000
- Paid cash dividends totaling $15,000

Required:

Prepare the financing activities section of the statement of cash flows for Canton Company for the year ended December 31, 2020. Use the format presented in Figure 6.6 “Financing Activities Section of Statement of Cash Flows (Home Store, Inc.)”.

22. **Cash Flow Measures.** The selected information in the following is from Diaz Company’s financial records for the most recent

fiscal year.

Current assets	$600,000
Current liabilities	$250,000
Cash provided by operating activities	$700,000
Net income	$300,000
Capital expenditures	$550,000

Required:

Calculate Diaz Company's

1. Operating cash flow ratio;
2. Capital expenditure ratio; and
3. Free cash flow.

Exercises:

23. Classifying Cash Flows. Identify whether each of the following items would appear in the operating, investing, or financing activities section of the statement of cash flows. Briefly explain your answer for each item.

1. Cash payments for the repurchase of common stock
2. Cash payments for the purchases of merchandise
3. Cash receipts from the collection of interest on loans made to other entities
4. Cash receipts from the collection of principal on loans made to other entities
5. Cash payments to shareholders for dividends
6. Cash payments for the purchase of equipment

24. Operating Activities Section Using the Indirect Method. The following income statement and current sections of the balance sheet are for Capstone, Inc.

Capstone, Inc.
Income Statement
for the Year Ended December 31, 2020

Sales	$990,000
Cost of goods sold	520,000
Gross margin	$470,000
Selling and administrative expenses	110,000
Depreciation expense	63,000
Operating income	$297,000
Loss on sale of equipment	(4,100)
Income before taxes	$292,900
Income tax expense	112,900
Net income	$180,000

	December 31	
	2020	**2019**
Current assets		
Cash	$ 62,000	$ 76,000
Accounts receivable	21,000	24,000
Merchandise inventory	45,000	33,000
Prepaid expenses	11,000	12,200
Current liabilities		
Accounts payable	53,000	60,500
Income tax payable	8,600	13,400

Required:

1. Using the indirect method, prepare the operating activities section of the statement of cash flows for Capstone, Inc., for the year ended December 31, 2020. Use the format presented in Figure 6.4 “Operating Activities Section of Statement of Cash Flows (Home Store, Inc.)”.
2. How much cash was provided by (used by) operating activities? Briefly describe what this amount tells us about the company.

    1.

25. **Investing Activities Section.** The following information is from the noncurrent asset portion of Caldera, Inc.’s balance sheet.

	December 31	
	2020	2019
Property, plant and equipment	$ 580,000	$ 440,000
Accumulated depreciation	(235,000)	(200,000)
Loans made to other entities	20,000	300,000
Long-term investments	33,000	60,000

The following activities occurred during 2020:

- Sold equipment with a book value of $46,000 (= $170,000 cost − $124,000 accumulated depreciation) for $37,000 cash and depreciation expense for the year totaled $159,000
- Purchased equipment for $310,000 cash
- No additional loans to other entities were made during the year (Hint: Solve for the principal amount on loans collected during the year.)
- Sold long-term investments with an original cost of $27,000 for $33,000 cash

Required:

1. Prepare the investing activities section of the statement of cash flows for Caldera, Inc., for the year ended December 31, 2020. Use the format presented in Figure 6.5 “Investing Activities Section of Statement of Cash Flows (Home Store, Inc.)”.
2. How much cash was provided by (used by) investing activities? Briefly describe what this amount tells us about the company.

26. **Financing Activities Section.** The following information is from the noncurrent liabilities and owners’ equity portions of Flash, Inc.’s balance sheet.

	December 31	
	2020	2019
Long-term notes payable	$350,000	$260,000
Bonds payable	54,000	87,000
Common stock	350,000	410,000
Retained earnings	880,000	720,000

The following activities occurred during 2020:

- Paid principal amount of $20,000 for long-term notes payable
- Received $110,000 for long-term notes payable
- Paid principal amount on bonds totaling $33,000
- Repurchased common stock for $60,000 cash
- Earned net income totaling $200,000
- Paid cash dividends totaling $40,000

Required:

1. Prepare the financing activities section of the statement of cash flows for Flash, Inc., for the year ended December 31, 2020. Use the format presented in Figure 6.6 “Financing Activities Section of Statement of Cash Flows (Home Store, Inc.)”.
2. How much cash was provided by (used by) financing activities? Briefly describe what this amount tells us about the company.

27. **Operating Activities Section Using the Indirect Method and Cash Ratios.** The following data are for Cycle Company.

	December 31	
	2020	2019
Current assets		
Cash	$ 80,000	$ 65,000
Accounts receivable	18,000	16,000
Merchandise inventory	15,500	20,000
Prepaid expenses	4,200	3,500
Current liabilities		
Accounts payable	35,400	36,600
Income tax payable	1,400	1,900

Other Data for the Year Ended December 31, 2020		
Net income	$ 40,000	From income statement
Depreciation expense	6,000	
Loss on sale of equipment	3,200	
Capital expenditures	28,000	From accounting records

Required:

1. Using the indirect method, prepare the operating activities section of the statement of cash flows for Cycle Company for the year ended December 31, 2020. Use the format presented in Figure 6.4 “Operating Activities Section of Statement of Cash Flows (Home Store, Inc.)”.
2. Calculate the following cash measures:
    1. Operating cash flow ratio
    2. Capital expenditure ratio
    3. Free cash flow

Problems

36. **Classifying Cash Flows.** Big Sky, Inc., had the following transactions during 2020:
    1. Issued common stock for $150,000 cash
    2. Paid $25,000 in principal on previously issued bonds
    3. Paid $300,000 in salaries and wages to employees
    4. Sold property for $45,000 cash
    5. Paid $3,000 in cash dividends

6. Received $600,000 from customers for cash sales
7. Paid $350,000 cash for merchandise
8. Converted bonds into common stock
9. Purchased a building for $850,000 cash
10. Paid $310,000 for operating expenses
11. Received $200,000 cash for the sale of long-term investments
12. Issued bonds for $87,000 cash
13. Repurchased common stock for $35,000 cash
14. Issued common stock to purchase land valued at $450,000
15. Paid $10,000 cash for interest on notes payable

Required:

Classify each transaction as one of the following: operating activity, investing activity, financing activity, or noncash transaction. Briefly explain your answer for each item.

37. **Prepare a Statement of Cash Flows, Indirect Method.** Glenbrook Company's most recent balance sheet, income statement, and other important information for 2020 are presented as follows.

Glenbrook Company
Balance Sheet
December 31, 2020 and
December 31, 2019

	2020	2019
Assets		
Current assets		
Cash	$ 139,000	$ 185,000
Accounts receivable	75,000	66,000
Merchandise inventory	113,000	116,000
Prepaid expenses	9,000	4,000
Noncurrent assets		
Property, plant, and equipment	761,000	705,000
Accumulated depreciation	(225,000)	(188,000)
Long-term investments	125,000	74,000
Total assets	$ 997,000	$ 962,000
Liabilities and owners' equity		
Current liabilities		
Accounts payable	$ 84,000	$ 68,000
Income tax payable	28,000	34,000
Noncurrent liabilities		
Bonds payable	54,000	38,000
Owners' equity		
Common stock	437,000	482,000
Retained earnings	394,000	340,000
Total liabilities and owners' equity	$ 997,000	$ 962,000

Glenbrook Company
Income Statement
for the Year Ended December 31, 2020

Sales	$640,000
Cost of goods sold	300,000
Gross margin	$340,000
Operating expenses	180,000
Depreciation expense	47,000
Operating income	$113,000
Interest expense	5,000
Loss on sale of equipment	2,000
Income before taxes	$106,000
Income tax expense	40,000
Net income	$ 66,000

Additional data for 2020 are as follows:

- Sold equipment with a book value of $30,000 (= $40,000 cost − $10,000 accumulated depreciation) for $28,000 cash
- Purchased equipment for $96,000 cash
- There were no sales of long-term investments (Hint: Solve for the purchase of long-term investments.)
- Issued bonds for $16,000 cash
- Repurchased common stock (treasury shares) for $45,000 cash
- Declared and paid $12,000 in cash dividends

Required:

1. Use the four steps described in the chapter to prepare a statement of cash flows for the year ended December 31, 2020, using the *indirect* method. Refer to the format presented in Figure 6.7 “Statement of Cash Flows (Home Store, Inc.)”.
2. Briefly describe the major changes in cash identified in the statement of cash flows.

38. **Prepare and Analyze a Statement of Cash Flows, Indirect Method.** Travel Supply, Inc.’s most recent balance sheet, income statement, and other important information for 2020 are presented as follows.

Travel Supply, Inc.
Balance Sheet
December 31, 2020 and
December 31, 2019

	2020	2019
Assets		
Current assets		
Cash	$ 85,000	$ 34,000
Accounts receivable	25,000	28,000
Merchandise inventory	83,000	65,000
Prepaid expenses	1,000	5,000
Noncurrent assets		
Property, plant, and equipment	245,000	221,000
Accumulated depreciation	(70,000)	(61,000)
Long-term investments	18,000	31,000
Total assets	$ 387,000	$ 323,000
Liabilities and owners' equity		
Current liabilities		
Accounts payable	$ 20,000	$ 30,000
Income tax payable	7,000	6,000
Noncurrent liabilities		
Notes payable	4,000	20,000
Owners' equity		
Common stock	225,000	217,000
Retained earnings	131,000	50,000
Total liabilities and owners' equity	$ 387,000	$ 323,000

Travel Supply, Inc.
Income Statement
for the Year Ended December 31, 2020

Sales	$ 445,000
Cost of goods sold	168,000
Gross margin	$ 277,000
Operating expenses	96,000
Depreciation expense	29,000
Operating income	$ 152,000
Interest expense	(2,000)
Gain on sale of equipment	5,000
Loss on sale of long-term investments	(4,000)
Income before taxes	$ 151,000
Income tax expense	48,000
Net income	$ 103,000

Additional data for 2020 are as follows:

- Sold equipment with a book value of $3,000 (= $23,000 cost − $20,000 accumulated depreciation) for $8,000 cash
- Purchased equipment for $47,000 cash
- Sold long-term investments for $9,000 cash and these investments had an original cost of $13,000
- Paid $16,000 cash for principal amount on notes payable
- Issued common stock for $8,000 cash
- Declared and paid $22,000 in cash dividends

Required:

1. Use the four steps described in the chapter to prepare a statement of cash flows for the year ended December 31, 2012, using the *indirect* method. Refer to the format presented in Figure 6.7 “Statement of Cash Flows (Home Store, Inc.)”.
2. The owner of Travel Supply, Inc., wants to know why cash only increased $51,000 even though the company had net income of $103,000, issued common stock for $8,000, and sold long-term investments for $9,000. Use the information in the statement of cash flows to briefly explain why cash only increased $51,000.

39. **Prepare a Statement of Cash Flows, Indirect Method; Analyze Using Cash Ratios.** Nolan Company’s most recent balance sheet, income statement, and other important information for 2012 are presented as follows.

Nolan Company
Balance Sheet
December 31, 2020 and
December 31, 2019

	2020	2019
Assets		
Current assets		
Cash	$ 165,000	$ 82,000
Accounts receivable	59,000	51,000
Merchandise inventory	86,000	90,000
Prepaid expenses	12,000	8,000
Noncurrent assets		
Property, plant, and equipment	155,000	172,000
Accumulated depreciation	(35,000)	(29,000)
Long-term investments	21,000	29,000
Total assets	$ 463,000	$ 403,000
Liabilities and owners' equity		
Current liabilities		
Accounts payable	25,000	22,000
Income tax payable	1,000	3,000
Noncurrent liabilities		
Bonds payable	30,000	11,000
Owners' equity		
Common stock	352,000	317,000
Retained earnings	55,000	50,000
Total liabilities and owners' equity	$ 463,000	$ 403,000

Nolan Company
Income Statement
for the Year Ended December 31, 2020

Sales	$ 615,000
Cost of goods sold	429,000
Gross margin	$ 186,000
Operating expenses	155,000
Depreciation expense	20,000
Operating income	$ 11,000
Interest expense	(3,000)
Gain on sale of equipment	8,000
Loss on sale of long-term investments	(2,000)
Income before taxes	$ 14,000
Income tax expense	5,000
Net income	$ 9,000

Additional data for 2020 are as follows:

- Sold equipment with a book value of $13,000 (= $27,000 cost − $14,000 accumulated depreciation) for $21,000 cash
- Purchased equipment for $10,000 cash
- Sold long-term investments for $6,000 cash and these investments had an original cost of $8,000
- Received $19,000 cash related to notes payable
- Issued common stock for $35,000 cash
- Declared and paid $4,000 in cash dividends

Required:

1. Use the four steps described in the chapter to prepare a statement of cash flows for the year ended December 31, 2020, using the *indirect* method. Refer to the format presented in Figure 6.7 “Statement of Cash Flows (Home Store, Inc.)”.
2. The owner of Nolan Company wants to know how cash more than doubled, from $82,000 to $165,000, given the company’s modest net income of $9,000. Use the information in the statement of cash flows to briefly explain why cash more than doubled.
3. Calculate the following cash measures:
    1. Operating cash flow ratio
    2. Capital expenditure ratio (Hint: Capital expenditures can be found in the *investing activities* section of the statement of cash flows prepared in part *a*.)
    3. Free cash flow

One Step Further: Skill-Building Cases

40. Internet Project: Statement of Cash Flows. Using the Internet, find the most recent annual report for a company of your choice. Print the statement of cash flows and include it with your response to the following requirements.

Required:

1. How much cash was provided by (used by) *operating* activities? Compare this amount to net income (often called *net earnings*) and explain why the two are different.
2. What method did the company use to prepare the *operating* activities section, direct or indirect? Explain.

3. How much cash was provided by (used by) *investing* activities? Which activity in this section had the biggest impact on investing cash flows?
4. How much cash was provided by (used by) *financing* activities? Which activity in this section had the biggest impact on financing cash flows?
5. Calculate free cash flow. Did the company generate enough cash from operating activities to cover capital expenditures? Explain.

Comprehensive Case

41. Ethics: Manipulating Data to Reach Target Cash Flow. Country Market, Inc., sells food and beverage products at its five retail stores. The company's fiscal year ends on December 31. The company's president and CEO, Jean Williams, just received a draft of the statement of cash flows from the controller, Stan Walker. Jean is very interested in the results since a significant part of her annual bonus depends on generating at least $400,000 in cash from *operating* activities. A summary of the statement is provided in the following:

Cash provided by operating activities	$ 380,000
Cash used by investing activities	(220,000)
Cash provided by financing activities	75,000
Net increase in cash	$ 235,000

Becky Swanson, the chief financial officer (CFO) for Country Market, is approached by Jean:

Jean:
Becky, have you seen the statement of cash flows?

Becky:
No, not yet. Last I heard Stan was just about done with it.

Jean:
He just dropped off a copy for my review.

Becky:
Excellent. How does it look?

Jean:
Overall it looks fine, but something must be wrong with the operating activities number. I assumed it would be well above $400,000. Can you take a look at it and make sure we exceed $400,000?

Becky:
I'll do what I can.

Jean:
Great. I knew I could depend on you.

Shortly after this discussion, Becky returned with revised numbers:

Becky:
Jean, here is the corrected statement of cash flows (see as follows). I was able to reclassify a portion of cash received from the sale of long-term investments to the operating activities section to get to $403,000.

Jean:
Excellent! Thanks, Becky, I knew you could do it!

Cash provided by operating activities	$ 403,000
Cash used by investing activities	(243,000)
Cash provided by financing activities	75,000
Net increase in cash	$ 235,000

Required:

1. What impact did the reclassification of cash flows have on the total net increase in cash? Explain.
2. Are Becky's actions ethical? Explain.
3. If you were the CFO, how would you handle Jean's request?

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Chapter 7 How Do Managers Use Financial and Nonfinancial Performance Measures?

Source: Photo courtesy of Jon Seidman, http://www.flickr.com/photos/jonseidman1988/4481833335/.

Sandy Masako is the CEO of a fast-food restaurant called Chicken Deluxe. The company operates hundreds of restaurants throughout North America and is choosing between two suppliers of soft drinks: Deep Fizz Company and Extreme Fizz, Inc. Consumer surveys indicate no significant preference between the two. Sandy is meeting with Dave Roberts, the CFO, and Karen Kraft, the purchasing manager, to discuss the company's options.

Sandy (CEO):
We have a big decision to make. Our soft drink contract is up at the end of this year, and we need to decide on a supplier for next year.

Karen (Purchasing Manager):
I've had preliminary discussions with both Deep Fizz and Extreme Fizz, and the costs of their products are about the same.

Dave (CFO):
Based on extensive surveys with our customers, they are not particularly concerned about which supplier we choose, as long as it's either Deep Fizz or Extreme Fizz.

Karen:
Both companies would like our business. This is a big contract for either of them!

Sandy:
OK, so we have two companies offering the same terms, and customers who would be satisfied with either company's products. Are there any other criteria we should consider?

Dave:
We must have a supplier that is on solid financial ground. If our supplier were to have financial difficulties that jeopardized product quality or timing of deliveries, we would be in a bind.

Karen:
I agree. We need to determine whether these companies are in good financial shape.

Dave:
I suggest we have our accounting staff evaluate their financial information by analyzing and comparing certain key financial measures.

Sandy:
What do you have in mind?

Dave:
My staff can look at financial trends and calculate several different ratios to evaluate the strength of each company's income statement and balance sheet. We can compare these ratios for both companies and also compare them to industry standards. This analysis should give us a better idea about the financial stability of each company.

Sandy:
Excellent! We have a few months to make our decision. How much time do you need?

Dave:
We can have it ready within a few weeks.

Sandy:
Great, let's plan on reviewing your analysis next month.

Chicken Deluxe is facing a supplier decision common to many companies. Financial stability is an important factor in deciding on a supplier, along with the quality of product and reliability of service. Chicken Deluxe must analyze financial information for Deep Fizz and Extreme Fizz to determine the financial condition of each company.

The analysis of a company's financial information typically follows a three-pronged approach. First, trends within a company's own financial information are analyzed, such as sales and earnings from one year to the next, using two methods—*trend analysis* and *common-size analysis*. Second, financial measures are compared between competitors. Finally, financial ratios are compared to industry averages. We discuss these three approaches next using **Coca-Cola** as an example. We will revisit the decision facing Chicken Deluxe later in the chapter.

7.1 Trend Analysis of Financial Statements

Learning Objectives

1. Perform trend analysis to evaluate financial statement information.

Question: How is trend analysis used to evaluate the financial health of an organization?

Answer: Trend analysis evaluates an organization's financial information over a period of time. Periods may be measured in months, quarters, or years, depending on the circumstances. The goal is to calculate and analyze the amount change and percent change from one period to the next.

For example, in fiscal years 2019 and 2018, **Coca-Cola** had the operating income shown as follows. (Amounts are in millions. To convert to the actual amount, simply multiply the amount given times one million. For example, $10,086 × 1,000,000 = $10,086,000,000. Thus **Coca-Cola** had operating income of $10,086,000 in 2019.)

	Amount 2019	Amount 2018	Amount Change	Percent Change
Operating income	$10,086	$9,152	?	

Although readers of the financial information can see that operating income increased from 2018 to 2019, the exact dollar amount of the change and the percent change is more helpful in evaluating the company's performance. The dollar amount of change is calculated as follows:

Key Equation

Amount of change = Current year amount – Base year amount

Amount of change = Current year amount−Base year amount $934 =$10,086−$9,152

Question: As you can see, operating income increased by $934 million from 2018 to 2019. Is this a significant increase for **Coca-Cola** *?*

Answer: Most of us consider $934 million to be a huge amount, but the only way to gauge the true significance of this amount for **Coca-Cola** is to calculate the percent change from 2018 to 2019. The percent change is calculated as the current year amount minus the base year amount, divided by the base year amount.

Key Equation

Percent change = (Current year amount – Base year amount) ÷ Base year amount

The calculation that follows shows operating income increased 10.2 percent from 2018 to 2019. This is a significant increase and represents very positive results for **Coca-Cola**.

Percent change=(Current year amount−Base year amount)÷Base year amount %=($10,086−$9,152)÷$9,152

Trend Analysis for the Income Statement and Balance Sheet

Question: Trend analysis is often used to evaluate each line item on the income statement and balance sheet. How is this analysis prepared?

Answer: Figure 7.1 “Income Statement Trend Analysis for ” shows **Coca-Cola’s** income statement trend analysis, and Figure 7.2 “Balance Sheet Trend Analysis for ” shows **Coca-Cola’s** balance sheet trend analysis. Carefully examine each of these figures, including the comments.

Figure 7.1 Income Statement Trend Analysis for **Coca-Cola**

	2019	2018	$ Change	Percent Change
Revenues	$ 37,266	$ 34,300	2,966	8.6%
Cost of Goods and Services Sold	14,619	13,067	1,552	11.9%
GROSS PROFIT	22,647	21,233	1,414	6.7%
Selling, General and Administrative Expense	12,103	11,002	1,101	10.0%
Other Cost and Expense, Operating	458	1,079	(621)	(57%)
OPERATING INCOME	10,086	9,152	934	10.2%

Note: Percent change for each line item is found by dividing the increase (decrease) amount by the 2018 amount. For example, net sales 13.3 percent increase equals $2,966 ÷ $34,300.

Figure 7.1 ” shows that net sales increased by $2,966 million, or 8.6 percent. Cost of goods sold had a corresponding increase of $1,552 million, or 11.9 percent. The higher increase for cost of goods sold in relation to sales indicates that costs that go into the product are increasing in cost more than Coca Cola is able to increase the sales price of the product. The increase in net sales and related increase in cost of goods sold resulted in an increase in gross margin of $1,414, or 6.7 percent. The increase in selling and administrative expenses of $1,414 million, or 10 percent, outpaced the increase in net sales. This was offset by the 57% drop in

other costs and expenses. Combined these changes resulted in a relatively health increase in operating income as noted above of $934 million or 10.2 percent. The significant decrease in other expenses comes because of the drop in costs for the bottling operation as those operations were refranchised in 2018 so that costs were eliminated (this information is found in the footnotes to the financial statements).

Figure 7.2 Balance Sheet Trend Analysis for **Coca-Cola**

	2019	2018	$ Change	% Change
Cash and Short Term Investments	$ 11,175	$ 16,115	$ (4,940)	(30.7%)
Accounts Receivable, net	3,971	3,685	286	7.8%
Inventory	3,379	3,071	308	10.0%
Prepaid and Other Current Assets	1,886	2,059	(173)	(8.4%)
Long Term Investments	28,366	27,101	1,265	4.7%
Property, Plant and Equipment, Net	10,838	9,598	1,240	12.9%
Intangible Assets, Net	26,766	21,587	5,179	24.0%
	$86,381	$83,216	3,165	3.8%
Accounts payable and accrued expenses	11,312	9,533	1,779	18.7%
Notes and Loans Payable, Current	15,247	18,838	(3,591)	-19.1%
Accrued income taxes	414	411	3	0.7%
Long Term Debt	27,516	25,376	2,140	8.4%
Other Liabilities	10,794	10,000	794	7.9%
Common Stock	18,914	18,280	634	3.5%
Retained Earnings	52,311	50,420	1,891	3.8%
Less: Treasury Stock	(50,127)	(49,642)	485	1.0%
Total Liabilities and Equity	$86,381	$83,216		

Note: Percent change for each line item is found by dividing the increase (decrease) amount by the 2018 amount. For example, cash and cash equivalents 30.7 percent decrease equals $4,940 ÷ $16,155.

Current Assets and Current Liabilities

Question: What does the balance sheet trend analysis tell us about current assets and current liabilities for **Coca-Cola** *?*

Answer: The above analysis shows that cash and cash equivalents decreased by $4,940 million, or 30.7 percent. **Coca-Cola's** statement of cash flows would provide detailed information regarding this increase. We covered the cash flow statement in the last chapter. Accounts receivable increased 7.8 percent, and merchandise inventory increased 10 percent. Other current assets decreased 8.4 percent. We would expect accounts receivable and inventory to increase when the company was able to increase sales as shown in our analysis of the income statement.

Moving to current liabilities, accounts payable and accrued liabilities increased by 18.7 percent, loans and notes payable decreased 19.1 percent, and accrued taxes increased .7 percent.

Noncurrent Assets and Noncurrent Liabilities

Question: What does the balance sheet trend analysis above tell us about noncurrent assets and noncurrent liabilities for **Coca-Cola** *?*

Answer: The above shows that long-term investments increased 4.7 percent. Property, plant, and equipment increased 12.9 percent, and intangible assets increased by a significant 24 percent. Both items appearing under noncurrent liabilities increased, with a 8.4 percent increase in long-term debt and a 7.9 percent increase in other liabilities.

Shareholders' Equity

Question: What does the balance sheet trend analysis above tell us about shareholders' equity for **Coca-Cola** *?*

Answer: Common stock increased 3.5 percent, and retained earnings increased 3.8 percent. Treasury stock increased just 1 percent.

Big Picture Balance Sheet Trend Analysis

Question: What are some of the key big picture items identified in the balance sheet trend analysis shown above?

Answer: Overall, total assets increased by 3.8 percent. Of course, total liabilities and shareholders' equity also increased by the same amount. The increases identified in almost every asset, liability, and shareholders' equity line item are significant. Growth in sales made it necessary to have more inventory and accounts receivable. Growth in acquisitions fueled an increase in both tangible and intangible assets that were financed by adding more long term debt.

This analysis points to the reason we perform trend analysis—to identify the increases and decreases in dollar amounts from one year to the next and to take a close look at unusual trends.

Trend Analysis over Several Years

Question: The trend analysis just described works well when comparing financial data for two years. However, many prefer to review trends over more than two years. How might a trend analysis for several years be prepared?

Answer: A common approach is to establish the oldest year as the base year and compute future years as a percentage of the base year. For example, **Coca-Cola** had the following net sales for each of the past five years (in millions):

	2019	**2018**	**2017**	**2016**	**2015**
Net sales	$37,266	$34,300	$36,212	$41,863	$44,294

Comparing 2019 to the past 5 years, we see that 2019 reverses a troubling trend of dropping sales for the past four years. Just looking at 2 years may hide this turnaround whether you consider it a healthy restart or just a positive bump in a continued slide.

Business in Action 7.1

Trends Presented in Annual Reports

Most public companies present trend information in their annual reports. For example, **Intel** shows net revenues, gross margin, research and development costs, operating income, and net income for the past five years. **Nike** and **PepsiCo** both show the percent

change in selected income statement line items for the past two years. **Costco Wholesale Corporation** presents selected income statement information for the past five years. The fact that these financial data are provided in the annual report confirms the importance of presenting trend information to shareholders.

Sources: **Intel**, "Annual Report, 2019," http://www.intel.com; **Nike**, "Annual Report, 2019," http://www.nike.com; **PepsiCo**, "Annual Report, 2019," http://www.pepsico.com; **Costco Wholesale Corporation**, "Annual Report, 2019," http://www.costco.com.

7.2 Common-Size Analysis of Financial Statements

Learning Objectives

1. Perform common-size analysis to evaluate financial statement information.

Question: How is common-size analysis used to evaluate the financial health of an organization?

Answer: Common-size analysis converts each line of financial statement data to an easily comparable amount measured in percent form. Income statement items are stated as a percent of net sales, and balance sheet items are stated as a percent of total assets (or total liabilities and shareholders' equity); also called vertical analysis. (also called *vertical analysis*) converts each line of financial statement data to an easily comparable, or common-size, amount measured as a percent. This is done by stating income statement items as a percent of net sales and balance sheet items as a percent of total assets (or total liabilities and shareholders' equity). For example, **Coca-Cola** had net income of $8,920 million and net sales of $37,267 million for 2019. The common-size percent is simply net income divided by net sales, or 23.9 percent (= $8,920 ÷ $37,267).

There are two reasons to use common-size analysis: (1) to evaluate information from one period to the next within a company and (2) to evaluate a company relative to its competitors. Common-size analysis answers such questions as "how do our current assets as a percent of total assets compare with last year?" and "how does our net income as a percent of net sales compare with that of our competitors?"

Using Common-Size Analysis to Evaluate Trends within a Company

Question: How is a formal common-size analysis prepared, and what does it tell us for **Coca-Cola** *?*

Answer: Figure 7.3 "Common-Size Income Statement Analysis " presents the common-size analysis for **Coca-Cola's** income statement, and Figure 7.4 "Common-Size Balance Sheet Analysis " shows the common-size analysis for **Coca-Cola's** balance sheet. As you look at these figures, notice that net sales are used as the base for the income statement, and total assets (or total liabilities and shareholders' equity) are used as the base for the balance sheet. That is, for the income statement, each item is measured as a percent of net sales, and for the balance sheet, each item is measured as a percent of total assets (or total liabilities and shareholders' equity).

Figure 7.3 Common-Size Income Statement Analysis for **Coca-Cola**

	2019	% of Sales	**2018**	% of Sales
Revenues	$ 37,266	100%	$ 34,300	100%
Cost of Goods and Services Sold	14,619	39%	13,067	38%
GROSS PROFIT	22,647	61%	21,233	62%
Selling, General and Administrative Expense	12,103	32%	11,002	32%
Other Cost and Expense, Operating	458	1%	1,079	3%
OPERATING INCOME	10,086	27%	9,152	27%
Interest income	563	2%	689	2%
Interest expense	946	3%	950	3%
Equity income (loss) – net	1,049	3%	1,008	3%
Other income (loss) – net	34	0%	(1,674)	-5%
INCOME BEFORE INCOME TAXES	10,786	29%	8,225	24%
Income taxes	1,801	5%	1,749	5%
CONSOLIDATED NET INCOME	8,985	24%	6,476	19%

Note: All percentages use net sales as the base. For example, 2019 cost of goods sold percent of 39 percent equals $14,619 cost of goods sold ÷ $37,266 net sales. Note that rounding issues sometimes cause subtotals in the percent column to be off by a small amount.

In general, managers prefer expenses as a percent of net sales to *decrease* over time, and profit figures as a percent of net sales to *increase* over time. As you can see in Figure 7.3 “Common-Size Income Statement Analysis “, **Coca-Cola’s** gross margin as a percent of net sales decreased from 2018 to 2019 (62 percent versus 61 percent). Operating income stayed the same (27 percent for both years). Income before taxes increased significantly from 24 percent in 2018 to 29 percent in 2019 due primarily to the loss in 2018. This caused net income to increase as well, from 19 percent in 2018 to 24 percent in 2019. In the expense category, cost of goods sold as a percent of net sales increased which is not a positive sign but this was offset by the drop in other costs and expenses. Selling and administrative expenses was unchanged as a percent of sales for both years as was interest expense, equity income and income tax expense.

Figure 7.4 Common-Size Balance Sheet Analysis for **Coca-Cola**

	2019	% of Assets	**2018**	% of Assets
Cash and Short Term Investments	$ 11,175	13%	$ 16,115	19%
Accounts Receivable, Inet	3,971	5%	3,685	4%
Inventory	3,379	4%	3,071	4%
Prepaid and Other Current Assets	1,886	2%	2,059	2%
Long Term Investments	28,366	33%	27,101	33%
Property, Plant and Equipment, Net	10,838	13%	9,598	12%
Intangible Assets, Net	26,766	31%	21,587	26%
Total Assets	$ 86,381	100%	$ 83,216	100%
Accounts payable and accrued expenses	11,312	13%	9,533	11%
Notes and Loans Payable, Current	15,247	18%	18,838	23%
Accrued income taxes	414	0%	411	0%
Long Term Debt	27,516	32%	25,376	30%
Other Liabilities	10,794	12%	10,000	12%
Common Stock	18,914	22%	18,280	22%
Retained Earnings	52,311	61%	50,420	61%
Less: Treasury Stock	(50,127)	-58%	(49,642)	-60%
Total Liabilities and Equity	$ 86,381		$ 83,216	

As you can see from the composition of assets, liabilities, and shareholders' equity accounts changed slightly from 2018 to 2019. Notable changes occurred for cash (from 19 to 13%) intangible assets (from 26 to 31%), current loans payable (23% to 18%). Other assets and liabilities did not change much in relation to total assets.

Using Common-Size Analysis to Evaluate Competitors

Question: To this point, we have used common-size analysis to evaluate just one company, **Coca-Cola** *. Common-size analysis is, however, also an effective way of comparing two companies with different levels of revenues and assets. For example, suppose one company has operating income of $100,000, and a competing company has operating income of $2,000,000. If both companies have similar levels of net sales and total assets, it is reasonable to assume that the more profitable company is the better performer. However, most companies are not the same size. How do we compare companies of different sizes?*

Answer: This is where common-size analysis can help. Common-size analysis enables us to compare companies on equal ground. So that by converting dollar amounts into percentages, we can compare Coca Cola with 37 billion in sales with a start up beverage

company with only $3 million in sales. If both are converted to percentages they can be analyzed side by side to see which one is the most profitable and how the composition of their assets and liabilities compare.

Common-size analysis is obviously crucial to comparative analysis. In fact, some sources of industry data present the information exclusively in a common-size format, and most of the accounting software available today has been engineered to facilitate this type of analysis.

Key Takeaways

- Common-size analysis converts each line of financial statement data to an easily comparable amount measured as a percent. Income statement items are stated as a percent of net sales and balance sheet items are stated as a percent of total assets (or total liabilities and shareholders' equity). Common-size analysis allows for the evaluation of information from one period to the next within a company and between competing companies.

7.3 Ratio Analysis of Financial Information

Learning Objectives

1. Use ratio analysis to measure profitability, short-term liquidity, long-term solvency, and market valuation.

Question: Although reviewing trends and using common-size analysis provides an excellent starting point for analyzing financial information, managers, investors, and other stakeholders also use various ratios to assess the financial performance and financial condition of organizations. What are the four categories of ratios used to evaluate the financial health of an organization?

Answer: The four categories of ratios presented in this chapter are as follows (in order of presentation):

1. Ratios used to measure *profitability* (focus is on the income statement)
2. Ratios used to measure *short-term liquidity* (focus is on short-term liabilities)
3. Ratios used to measure *long-term solvency* (focus is on long-term liabilities)
4. Ratios used to measure *market valuation* (focus is on market value of the company)

For each ratio, we explain the meaning and provide the formula

Table 7.1 "Financial Ratio Formulas" summarizes the formulas for all the ratios presented in this section, and Table 13.2 "Summary of Financial Ratios for " shows the ratio results for **Coca-Cola**, **PepsiCo**, and the industry averages that will be covered throughout this section.

Table 7.1 Financial Ratio Formulas

Profitability Measures
1. Gross margin ratio = Gross margin/Net sales Indicates the gross margin generated for each dollar in net sales. 2. Profit margin ratio=Net income/Net sales Indicates the profit generated for each dollar in net sales. 3. Return on assets=Net income/Average total assets Indicates how much net income was generated from each dollar in average assets invested. 4. Return on common shareholders' equity=(Net income − Preferred dividends) / Average common shareholders' equity Indicates how much net income was generated from each dollar of common shareholders' equity. 5. Earnings per share=(Net income − Preferred dividends) / Weighted average common shares outstanding Indicates how much net income was earned for each share of common stock outstanding.
Short-Term Liquidity Measures
6. Current ratio=Current assets/ Current liabilities Indicates whether a company has sufficient current assets to cover current liabilities. 7. Quick ratio= (Cash + Marketable securities + Short-term receivables) / Current liabilities Alternate = Total Current Assets less inventory and other current assets) / Current liabilities Indicates whether a company has sufficient quick assets to cover current liabilities. 8. Receivables turnover ratio=Credit sales / Average accounts receivable Indicates how many times receivables are collected in a given period. 9. Average collection period=365 days / Receivables turnover ratio Indicates how many days it takes on average to collect on credit sales. 10. Inventory turnover ratio=Cost of goods sold / Average inventory Indicates how many times inventory is sold and restocked in a given period. 11. Average sale period=365 days / Inventory turnover ratio Indicates how many days it takes on average to sell the company's inventory.
Long-Term Solvency Measures
12. Debt to assets=Total liabilities / Total assets Indicates the percentage of assets funded by creditors. 13. Debt to equity=Total liabilities / Total shareholders' equity Indicates the amount of debt incurred for each dollar that owners provide. 14. Times interest earned=Net income + Income tax expense + Interest expense / Interest expense Indicates the company's ability to cover its interest expense related to long-term debt with current period earnings.

Before we discuss the various ratios, it is important to note that different terms are often used in financial statements to describe the same item. For example, some companies use the term *net revenues* instead of *net sales*, and the income statement is often called the *statement of earnings*, or *consolidated statement of earnings*.

Profitability Ratios

Question: Analysts, shareholders, suppliers, and other stakeholders often want to evaluate profit trends within a company and compare a company's profits with competitors' profits. What are the five common ratios used to evaluate company profitability?

Answer: The five ratios used to evaluate *profitability* are as follows:

1. Gross margin ratio
2. Profit margin ratio
3. Return on assets
4. Return on common shareholders' equity
5. Earnings per share

The application of these ratios was covered in our earlier Principles of Financial Accounting textbooks.

Short-Term Liquidity Ratios

Question: Suppliers and other short-term lenders often want to evaluate whether companies can meet short-term obligations. What are the four common ratios used to evaluate short-term liquidity?

Answer: The four ratios used to evaluate *short-term liquidity* are as follows:

1. Current ratio
2. Quick ratio
3. Receivables turnover ratio (often converted to *average collection period*)
4. Inventory turnover ratio (often converted to *average sale period*)

The application of these ratios was covered in our earlier Principles of Financial Accounting textbooks.

Long-Term Solvency Ratios

Question: Banks, bondholders, and other long-term lenders often want to evaluate whether companies can meet long-term obligations. What are the three common ratios used to evaluate long-term solvency?

Answer: The three ratios used to evaluate *long-term solvency* are as follows:

1. Debt to assets
2. Debt to equity
3. Times interest earned

Debt to Assets

The debt to assets ratio can be expressed as a percentage or as just a ratio of liabilities to assets. The higher the percentage of assets are financed with debt the more leveraged the company is and the more risk of bankruptcy. With this additional risk comes a higher chance for large returns – this concept of leverage was covered in Principles of Managerial Accounting 1.

Debt to Equity

A variation of the debt to assets ratio is the debt to equity ratio. Calculated as total liabilities divided by total shareholders' equity, this calculation measures the balance of liabilities and shareholders' equity used to fund assets. The debt to equity ratio is total liabilities divided by total shareholders' equity. Like Debt to Assets, the higher the debt to equity the more leveraged the company is and the higher risk of not being able to meet the long term obligations. It can be expressed as a ratio or a percentage.

Times Interest Earned

The times interest earned is calculated as income before income tax expense and interest expense divided by interest expense; also called interest coverage ratio. It measures the company's ability to cover its interest expense related to long-term debt with current period earnings. The times interest earned ratio is net income before income tax expense and interest expense divided by interest expense. Unlike the other solvency ratios, this generally is not expressed as a percentage but rather as a number of times. Income was able to cover the interest expense 6.4 times which means the company generated profits sufficient to pay its interest 6.4 times. With this ratio, the higher the number the less leverage and risk of bankruptcy exists.

Key Takeaways

- Shareholders, creditors, and analysts often evaluate a company's profitability. Five ratios used to evaluate *profitability* are the gross margin ratio, the profit margin ratio, return on assets, return on common shareholders' equity, and earnings per share. Suppliers and other short-term creditors often evaluate whether a company can meet short-term obligations. Four ratios used to evaluate *short-term liquidity* are the current ratio, the quick ratio, the receivables turnover ratio (often converted to average collection period), and the inventory turnover ratio (often converted to average sale period). Banks, bondholders, and other long-term lenders often evaluate whether companies can meet long-term obligations. Three ratios used to evaluate *long-term solvency* are debt to assets, debt to equity, and times interest earned.

Sandy:
Let's get started! Dave, what do you have for us?

Dave:
I used several different financial ratios to evaluate profitability, short-term liquidity, long-term solvency, and market valuation for Deep Fizz Company and Extreme Fizz, Inc., Here is a summary of the results. Items 1 through 4 show that both companies are doing very well with regard to profitability, and exceed the industry average in all four categories. Earnings per share are not relevant for comparative purposes because different companies have different amounts of shares outstanding.

Sandy:
The profitability measures look good for both companies. What about the balance sheet?

Dave:
For the most part, Extreme Fizz has the edge on short-term liquidity, with top marks for all short-term liquidity measures. However, Deep Fizz is not far behind. Based on items 6 through 11, I consider both companies to have strong short-term liquidity. The only concern is with Deep Fizz's slow inventory turnover, which is well below Extreme Fizz and the industry average.

Sandy:
What about long-term solvency? Given both companies have strong profitability and excellent short-term liquidity, my biggest concern is whether these companies are able to meet long-term obligations.

Dave:
The short answer is both companies will be able to meet long-term obligations as indicated in the debt to assets, debt to equity, and times interest earned ratios.

Sandy:
So what do we get from all this information?

Dave:
Both companies are solid. We shouldn't have to worry about either company having financial difficulties in the near future.

Karen:
Looks like we'll have to review other factors in deciding which company to use as our supplier.

Sandy:
I agree. Thanks, Dave, for your analysis. If nothing else, this puts my mind at ease about whichever company we ultimately select as our supplier.

As you can see from the Chicken Deluxe example, analysts use many different financial measures to evaluate financial performance. In the case of Deep Fizz and Extreme Fizz, both companies appear to be strong performers. Armed with this information, management can confidently choose either company knowing the winner will be on solid financial ground for years to come.

7.5 Nonfinancial Performance Measures: The Balanced Scorecard

Learning Objectives

1. Develop and analyze nonfinancial performance measures using a balanced scorecard.

Question: Although financial measures are important for evaluation purposes, many organizations use a mix of financial and nonfinancial measures to evaluate performance. For example, airlines track on-time arrival percentages carefully, and delivery companies like Federal Express (FedEx) and United Parcel Service (UPS) monitor percentages of on-time deliveries. The balanced scorecard uses several alternative measures to evaluate performance. What is a balanced scorecard and how does it help companies to evaluate performance?

Answer: The balanced scorecard is a balanced set of measures that organizations use to motivate employees and evaluate performance. These measures are typically separated into four perspectives outlined in the following. (Dr. Robert S. Kaplan and Dr. David P. Norton created the balanced scorecard, and it is actively promoted through their company, Balanced Scorecard Collaborative. More information can be found at the following link https://balancedscorecard.org/

1. **Financial.** Measures that shareholders, creditors, and other stakeholders use to evaluate financial performance.
2. **Internal business process.** Measures that management uses to evaluate efficiency of existing business processes.
3. **Learning and growth.** Measures that management uses to evaluate effectiveness of employee training.
4. **Customer.** Measures that management uses to evaluate whether the organization is meeting customer expectations.

The goal is to link these four perspectives to the company's strategies and goals. For example, a high percentage of on-time arrivals is likely an important goal from the perspective of the *customer* of an airline. A high percentage of defect-free computer chips is likely an important goal from the *internal business process* perspective of a computer chip maker. A high number of continuing education hours is likely an important goal from the *learning and growth* perspective for tax personnel at an accounting firm. Measures from a *financial* perspective were covered earlier in this chapter.

Companies that use the balanced scorecard typically establish several measures for each perspective. Table 13.4 "Balanced Scorecard Measures" lists several examples of these measures.

Table 7.2 Balanced Scorecard Measures

Financial	Internal Business Process	Learning and Growth	Customer
Gross margin ratio	Defect-free rate	Hours of employee training	Customer satisfaction (survey)
Return on assets	Customer response time	Employee satisfaction (survey)	Number of customer complaints
Receivables turnover	Capacity utilization	Employee turnover	Market share
Inventory turnover	New product development time	Number of employee accidents	Number of returned products

Measures established across the four perspectives of the balanced scorecard are linked in a way that motivates employees to achieve company goals. For example, if the company wants to increase the defect-free rate and reduce product returns, effective

employee training and low employee turnover will help in achieving this goal. The idea is to establish company goals first, then create measures that motivate employees to reach company goals.

Key Takeaways

- Most organizations use a mix of financial and nonfinancial measures to evaluate performance. The balanced scorecard approach uses a balanced set of measures separated into four perspectives—financial, internal business process, learning and growth, and customer. The last three perspectives tend to include nonfinancial measures, such as hours of employee training or number of customer complaints, to evaluate performance. The goal is to link financial and nonfinancial measures to the company's strategies and goals.

Check Yourself

Assume Chicken Deluxe, the fast-food restaurant franchise featured in this chapter, uses a balanced scorecard. Provide at least two examples of measures that Chicken Deluxe might use for each of the following perspectives of the balanced scorecard:

1. Financial
2. Internal business process
3. Learning and growth
4. Customer

Solution

1. Answers will vary. Several examples of financial measures are as follows:
   - Gross margin ratio
   - Profit margin ratio
   - Return on assets
   - Receivables turnover
   - Inventory turnover
2. Answers will vary. Several examples of internal business process measures are as follows:
   - Capacity utilization
   - Amount of food spoilage
   - Order response time
3. Answers will vary. Several examples of learning and growth measures are as follows:
   - Hours of employee training
   - Employee satisfaction
   - Employee turnover
   - Number of employee accidents
4. Answers will vary. Several examples of customer perspective measures are as follows:
   - Customer satisfaction
   - Number of customer complaints
   - Market share
   - Amount of food returned

End-of-Chapter Exercises

Questions

1. What is trend analysis? Explain how the percent change from one period to the next is calculated.
2. What is common-size analysis? How is common-size analysis information used?
3. Explain the difference between trend analysis and common-size analysis.

4. Name the ratios used to evaluate profitability. Explain what the statement “evaluate profitability” means.
5. Name the ratios used to evaluate short-term liquidity. Explain what the statement “evaluate short-term liquidity” means.
6. Explain the difference between the current ratio and the quick ratio.
7. Name the ratios used to evaluate long-term solvency. Explain what the term “long-term solvency” means.
8. What is the balanced scorecard? Briefly describe the four perspectives of the balanced scorecard.

Brief Exercises

13. **Evaluating Suppliers at Chicken Deluxe.** Refer to the dialogue at Chicken Deluxe presented at the beginning of the chapter and the follow-up dialogue immediately following.

    Required:

    1. What is the big decision that Chicken Deluxe is facing?
    2. Briefly describe the results of Dave’s analysis of the two suppliers.

14. **Trend Analysis.** The following income statement is for **Apple, Inc.**

	September 28,	September 29,
	2019	**2018**
Net sales:		
Products	$ 213,883	$ 225,847
Services	46,291	39,748
Total net sales	260,174	265,595
Cost of sales:		
Products	144,996	148,164
Services	16,786	15,592
Total cost of sales	161,782	163,756
Gross margin	98,392	101,839
Operating expenses:		
Research and development	16,217	14,236
Selling, general and administrative	18,245	16,705
Total operating expenses	34,462	30,941
Operating income	63,930	70,898
Other income/(expense), net	1,807	2,005
Income before provision for income taxes	65,737	72,903
Provision for income taxes	10,481	13,372
Net income	$ 55,256	$ 59,531

Required:

Prepare a trend analysis of the income statements from 2018 to 2019. Use the format shown in the chapter as a guide. (Round percent computations to one decimal place.)

15. **Common-Size Analysis.** Refer to the income statement for **Apple, Inc.,** in Brief Exercise 14.

Required:

Prepare a common-size analysis of the income statements for 2018 and 2019. Use the format shown in the chapter as a guide. (Round percent computations to one decimal place.)

16. **Gross Margin and Profit Margin Ratios.** Refer to the income statement for **Apple, Inc.,** in Brief Exercise 14.

Required:

Compute the following profitability ratios for 2019, and provide a brief explanation after each ratio (round computations to one decimal place):

1. Gross margin ratio
2. Profit margin ratio

17. **Current and Quick Ratios.** A condensed balance sheet for **Apple, Inc.,** appears in the following.

	September 28, 2019
ASSETS:	
Current assets:	
Cash and cash equivalents	$ 48,844
Marketable securities	51,713
Accounts receivable, net	22,926
Inventories	4,106
Vendor non-trade receivables	22,878
Other current assets	12,352
Total current assets	162,819
Non-current assets:	
Marketable securities	105,341
Property, plant and equipment, net	37,378
Other non-current assets	32,978
Total non-current assets	175,697
Total assets	$ 338,516
LIABILITIES AND SHAREHOLDERS' EQUITY:	
Current liabilities:	
Accounts payable	$ 46,236
Other current liabilities	37,720
Deferred revenue	5,522
Commercial paper	5,980
Term debt	10,260
Total current liabilities	105,718

Non-current liabilities:	
Term debt	91,807
Other non-current liabilities	50,503
Total non-current liabilities	142,310
Total liabilities	248,028
Commitments and contingencies	
Shareholders' equity:	
Common stock and additional paid-in capital, $0.00001	
par value: 12,600,000 shares authorized; 4,443,236 and	
4,754,986 shares issued and outstanding, respectively	45,174
Retained earnings	45,898
Accumulated other comprehensive income/(loss)	(584)
Total shareholders' equity	90,488
Total liabilities and shareholders' equity	$ 338,516

Required:

Compute the following short-term liquidity ratios for 2019, and provide a brief explanation after each ratio (round computations to two decimal places):

1. Current ratio
2. Quick ratio

18. **Long-Term Solvency Ratios.** Refer to the condensed balance sheet for **Apple, Inc.,** in Brief Exercise 17.

Required:

Compute the following long-term solvency ratios for 2019, and provide a brief explanation after each ratio (round computations to two decimal places):

1. Debt to assets
2. Debt to equity

19. **Balanced Scorecard.** Provide two nonfinancial measures likely used by delivery companies like **FedEx** and **UPS**.

Exercises:

20. Trend Analysis. The following condensed income statement is for **CarMax, Inc.**, a large retailer of used vehicles.

SALES AND OPERATING REVENUES:	2019	2018
REVENUES	20,319,987	18,173,100
TOTAL COST OF SALES	17,597,647	15,692,509
GROSS PROFIT	2,722,340	2,480,591
CARMAX AUTO FINANCE INCOME	456,030	438,690
Selling, general and		
administrative expenses	1,940,067	1,730,275
Interest expense	83,007	75,792
Other (income) expense	(5,690)	408
Earnings before income taxes	1,160,986	1,112,806
Income tax provision	272,553	270,393
NET EARNINGS	$ 888,433	$ 842,413

Required:

1. Prepare a trend analysis of the income statements from 2018 to 2019. Use the format shown in the chapter as a guide. (Round computations to one decimal place.)

What does the trend analysis prepared in requirement **a** tell you about the company?

21. Common-Size Analysis. Refer to the condensed income statement for **CarMax, Inc.,** in Exercise 20.

Required:

1. Prepare a common-size analysis of the income statements for 2019 and 2018. Use the format shown in the chapter as a guide. (Round computations to one decimal place.)
2. What does the common-size analysis in requirement **a** tell you about the company?

22. **Profitability Ratios.** Refer to the condensed income statement for **CarMax, Inc.,** in Exercise 20 and to the company's balance

sheet shown as follows.

ASSETS		
CURRENT ASSETS:	**2019**	**2018**
Cash and cash equivalents	$ 58,211	$ 46,938
Restricted cash from collections on auto loans receivable	481,043	440,669
Accounts receivable, net	191,090	139,850
Inventory	2,846,416	2,519,455
Other current assets	86,927	67,101
TOTAL CURRENT ASSETS	3,663,687	3,214,013
Auto loans receivable, net	13,551,711	12,428,487
Property and equipment, net	3,069,102	2,828,058
Deferred income taxes	89,842	61,346
Operating lease assets	449,094	–
Other assets	258,746	185,963
TOTAL ASSETS	$ 21,082,182	$ 18,717,867
CURRENT LIABILITIES:		
Accounts payable	$ 737,144	$ 593,171
Accrued expenses and other current liabilities	331,738	318,204
Accrued income taxes	1,389	3,784
Current portion of operating lease liabilities	30,980	–
Short-term debt	40	1,129
Current portion of long-term debt	9,251	10,177
Current portion of non-recourse notes payable	424,165	385,044
TOTAL CURRENT LIABILITIES	1,534,707	1,311,509
Long-term debt, excluding current portion	1,778,672	1,649,244
Non-recourse notes payable, excluding current portion	13,165,384	12,127,290
Operating lease liabilities, excluding current portion	440,671	–
Other liabilities	393,873	272,796

TOTAL LIABILITIES	17,313,307	15,360,839
Common Stock	81,541	83,739
Capital in excess of par value	1,348,988	1,237,153
Accumulated other comprehensive loss	(150,071)	(68,010)
Retained earnings	2,488,417	2,104,146
TOTAL SHAREHOLDERS' EQUITY	3,768,875	3,357,028
TOTAL LIABILITIES AND SHAREHOLDERS' EQUITY	$ 21,082,182	$ 18,717,867

Required:

Compute the following profitability ratios for 2019, and provide a brief explanation after each ratio (round percentage computations to one decimal place and earnings per share to two decimal places):

1. Gross margin ratio
2. Profit margin ratio
3. Return on assets
4. Return on common shareholders' equity
5. Earnings per share (assume weighted average shares outstanding totaled 223,449,000 shares)

23. **Short-Term Liquidity Ratios.** Refer to the condensed income statement for **CarMax, Inc.,** in Exercise 20 and to the company's balance sheet in Exercise 22.

    Required:

    Compute the following short-term liquidity ratios for 2019, and provide a brief explanation after each ratio (round computations to two decimal places):

    1. Current ratio
    2. Quick ratio
    3. Receivables turnover ratio and average collection period (assume all sales are on account)
    4. Inventory turnover ratio and average sale period

24. **Long-Term Solvency Ratios.** Refer to the condensed income statement for **CarMax, Inc.,** in Exercise 20 and to the company's balance sheet in Exercise 22.

    Required:

    Compute the following long-term solvency ratios for 2019, and provide a brief explanation after each ratio (round computations to two decimal places):

    1. Debt to assets
    2. Debt to equity
    3. Times interest earned

25. **Balanced Scorecard Customer Measures.** Tech University has more than 10,000 students enrolling in courses each term. The management would like to develop a balanced scorecard to assess performance.

    Required:

    Provide at least three customer measures Tech University can use on its balanced scorecard. Assume students are the customers.

Problems

26. Trend Analysis and Common-Size Analysis. The following condensed income statement and balance sheet are for **Nordstrom, Inc.**, a large retailer of apparel.

	2019	2018
Net sales	$15,132	$15,480
Credit card revenues, net	392	380
Total revenues	15,524	15,860
Cost of sales and related buying and occupancy costs	9,932	10,155
Selling, general and administrative expenses	4,808	4,868
Earnings before interest and income taxes	784	837
Interest expense, net	102	104
Earnings before income taxes	682	733
Income tax expense	186	169
Net earnings	$496	$564

	2019	2018
Assets		
Current assets:		
Cash and cash equivalents	$ 853	$ 957
Accounts receivable, net	179	148
Merchandise inventories	1,920	1,978
Prepaid expenses and other	278	291
Total current assets	3,230	3,374
Land, property and equipment, net	4,179	3,921
Operating lease right-of-use assets	1,774	—
Goodwill	249	249
Other assets	305	342
Total assets	$ 9,737	$ 7,886
Liabilities and Shareholders' Equity		
Current liabilities:		
Accounts payable	$ 1,576	$1,469
Accrued salaries, wages and related benefits	510	580

Current portion of operating lease liabilities	244		—		
Other current liabilities	1,190		1,324		
Current portion of long-term debt	—		8		
Total current liabilities	3,520		3,381		
Long-term debt, net	2,676		2,677		
Deferred property incentives, net	4		457		
Non-current operating lease liabilities	1,875		—		
Other liabilities	683		498		
Shareholders' equity:					
Common stock, no par value: 1,000 shares authorized; 155.6 and 157.6 shares issued and outstanding	3,129		3,048		
Accumulated deficit	(2,082)		(2,138)		
Accumulated other comprehensive loss	(68)		(37)		
Total shareholders' equity	979		873		
Total liabilities and shareholders' equity	$9,737		$ 7,886		

Required:

1. Prepare a trend analysis of the income statements from 2018 to 2019. Use the format shown in the chapter as a guide. (Round computations to one decimal place.)
2. Prepare a trend analysis of the balance sheets from 2018 to 2019. Use the format shown in the chapter as a guide. (Round computations to one decimal place.)
3. Prepare a common-size analysis of the income statements for 2018 and 2019. Use the format shown in the chapter as a guide. (Round computations to one decimal place.)
4. Prepare a common-size analysis of the balance sheets for 2018 and 2019. Use the format shown in the chapter as a guide. (Round computations to one decimal place.)
5. What does the common-size analysis prepared in requirements **d** and **e** tell you about the company?

27. Profitability and Short-Term Liquidity Ratios. Refer to the information presented in Problem 26 for **Nordstrom**.

Required:

1. Compute the following profitability ratios for 2019, and provide a brief explanation after each ratio (round percentage computations to one decimal place and earnings per share to two decimal places):
    1. Gross margin ratio
    2. Profit margin ratio
    3. Return on assets
    4. Return on common shareholders' equity
    5. Earnings per share (weighted average shares outstanding totaled 218,800,000 shares)
2. Compute the following short-term liquidity ratios for 2019, and provide a brief explanation after each ratio (round computations to two decimal places):

1. Current ratio
2. Quick ratio
3. Receivables turnover ratio and average collection period (assume all sales are on account)
4. Inventory turnover ratio and average sale period

28. Long-Term Solvency Ratios Refer to the information presented in Problem 26 for **Nordstrom**.

Required:

1. Compute the following long-term solvency ratios for 2019, and provide a brief explanation after each ratio (round computations to two decimal places):
    1. Debt to assets
    2. Debt to equity
    3. Times interest earned

29. Income Statement Trend, Common-Size, and Profitability Analysis. The following condensed income statement and balance sheet are for **Starbucks Corporation**, a large retailer of specialty coffee with stores throughout the world.

STARBUCKS CORPORATION			
CONSOLIDATED STATEMENTS OF EARNINGS			
(in millions, except per share data)			
	Sep 29,	Sep 30,	Oct 1,
Fiscal Year Ended	2019	2018	2017
Net revenues:			
Company-operated stores	$ 21,544.40	$ 19,690.30	$ 17,650.70
Licensed stores	2,875.00	2,652.20	2,355.00
Other	2,089.20	2,377.00	2,381.10
Total net revenues	26,508.60	24,719.50	22,386.80
Cost of sales	8,526.90	7,930.70	7,065.80
Store operating expenses	10,493.60	9,472.20	8,486.40
Other operating expenses	371.00	554.90	518.00
Depreciation and amortization expenses	1,377.30	1,247.00	1,011.40
General and administrative expenses	1,824.10	1,708.20	1,408.40
Restructuring and impairments	135.80	224.40	153.50
Total operating expenses	22,728.70	21,137.40	18,643.50
Income from equity investees	298.00	301.20	391.40
Operating income	4,077.90	3,883.30	4,134.70
Gain resulting from acquisition of joint			
venture	–	1,376.40	–
Net gain resulting from divestiture of			
certain operations	622.80	499.20	93.50
Interest income and other, net	96.50	191.40	181.80
Interest expense	(331.00)	(170.30)	(92.50)
Earnings before income taxes	4,466.20	5,780.00	4,317.50
Income tax expense	871.60	1,262.00	1,432.60
Net earnings including noncontrolling			
interests	3,594.60	4,518.00	2,884.90

	Net earnings/(loss) attributable to		
	noncontrolling interests	(4.60)	(0.30)	0.20
	Net earnings attributable to Starbucks	$ 3,599.20	$ 4,518.30	$ 2,884.70
	Earnings per share – basic	$ 2.95	$ 3.27	$ 1.99
	Earnings per share – diluted	$ 2.92	$ 3.24	$ 1.97
	Weighted average shares outstanding:			
	Basic	1,221.20	1,382.70	1,449.50
	Diluted	1,233.20	1,394.60	1,461.50

STARBUCKS CORPORATION		
CONSOLIDATED BALANCE SHEETS		
(in millions, except per share data)		
	Sep 29,	Sep 30,
	2019	2018
ASSETS		
Current assets:		
Cash and cash equivalents	$ 2,686.60	$ 8,756.30
Short-term investments	70.50	181.50
Accounts receivable, net	879.20	693.10
Inventories	1,529.40	1,400.50
Prepaid expenses and other current assets	488.20	1,462.80
Total current assets	5,653.90	12,494.20
Long-term investments	220.00	267.70
Equity investments	396.00	334.70
Property, plant and equipment, net	6,431.70	5,929.10
Deferred income taxes, net	1,765.80	134.70
Other long-term assets	479.60	412.20
Other intangible assets	781.80	1,042.20
Goodwill	3,490.80	3,541.60
TOTAL ASSETS	$ 19,219.60	$ 24,156.40
LIABILITIES AND SHAREHOLDERS' EQUITY/(DEFICIT)		

Current liabilities:		
Accounts payable	$ 1,189.70	$ 1,179.30
Accrued liabilities	1,753.70	1,752.50
Accrued payroll and benefits	664.60	656.80
Income taxes payable	1,291.70	102.80
Stored value card liability and current portion of		
deferred revenue	1,269.00	1,642.90
Current portion of long-term debt	–	349.90
Total current liabilities	6,168.70	5,684.20
Long-term debt	11,167.00	9,090.20
Deferred revenue	6,744.40	6,775.70
Other long-term liabilities	1,370.50	1,430.50
Total liabilities	25,450.60	22,980.60
Shareholders' equity/(deficit):		
Common stock ($0.001 par value) – authorized,		
2,400.0 shares; issued and outstanding, 1,184.6 and		
1,309.1 shares, respectively	1.20	1.30
Additional paid-in capital	41.10	41.10
Retained earnings/(deficit)	(5,771.20)	1,457.40
Accumulated other comprehensive loss	(503.30)	(330.30)
Total shareholders' equity/(deficit)	(6,232.20)	1,169.50
Noncontrolling interests	1.20	6.30
Total equity/(deficit)	(6,231.00)	1,175.80
TOTAL LIABILITIES AND SHAREHOLDERS' EQUITY/(DEFICIT)	$ 19,219.60	$ 24,156.40

Required:

1. Prepare a trend analysis of the income statements from 2018 to 2019. Use the format shown in the chapter as a guide. (Round computations to one decimal place.)
2. Identify all items that changed by more than 20 percent in the trend analysis prepared in requirement **a**, and briefly comment on the results.
3. Prepare a common-size analysis of the income statements for 2019 and 2018. Use the format shown in the chapter as a guide. (Round computations to one decimal place.)
4. What does the common-size analysis prepared in requirement **c** tell you about the company?
5. Compute the following profitability ratios for 2019, and provide a brief explanation after each ratio (round percentage computations to one decimal place and earnings per share to two decimal places):
    1. Gross margin ratio

2. Profit margin ratio
3. Return on assets
4. Return on common shareholders' equity
5. Earnings per share (assume weighted average shares outstanding totaled 748,300,000 shares)

30. Short-Term Liquidity, Long-Term Solvency, and Market Valuation. Refer to the information presented in Problem 29 for **Starbucks**.

Required:

1. Compute the following short-term liquidity ratios for 2019, and provide a brief explanation after each ratio (round computations to two decimal places):
   1. Current ratio
   2. Quick ratio
   3. Receivables turnover ratio and average collection period (assume all sales are on account)
   4. Inventory turnover ratio and average sale period

   Compute the following long-term solvency ratios for 2019, and provide a brief explanation after each ratio (round computations to two decimal places):
   1. Debt to assets
   2. Debt to equity
   3. Times interest earned

31. Internet Project: Financial Statement Analysis. Using the Internet, find the most recent annual report (or form 10K) for a manufacturing or retail company of your choice. Most companies have links to the information at their Web sites under titles, such as *investor relations* or *financial reports*. Print the income statement and balance sheet for the company selected and include these documents with your response to the following requirements.

Required:

1. Compute the following profitability ratios for the most current year, and provide a brief explanation after each ratio (round percentage computations to one decimal place):
   1. Gross margin ratio
   2. Profit margin ratio
   3. Return on assets
   4. Return on common shareholders' equity
2. Compute the following short-term liquidity ratios for the most current year, and provide a brief explanation after each ratio (round computations to two decimal places):
   1. Current ratio
   2. Quick ratio
   3. Receivables turnover ratio and average collection period (assume all sales are on account)
   4. Inventory turnover ratio and average sale period
3. Compute the following long-term solvency ratios for the most current year, and provide a brief explanation after each ratio (round computations to two decimal places):
   1. Debt to assets
   2. Debt to equity
4. Provide a one-page written report summarizing your results in requirements **a**, **b**, and **c**. Identify any areas of concern as well as areas of strength for the company.

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8: Appendix Joint Costs

Appendix: Making Decisions Involving Joint Costs

Learning Objectives

1. Analyze the impact that joint costs have on decision making.

Question: When two or more products are produced from a single input, these products are called joint products. *For example, lumber companies often must deal with joint products (different types of lumber) resulting from one input (a log). How do the concepts of joint products and joint costs help a lumber company establish a cost for each of its products?*

Answer: Suppose Oregon Lumber Company takes a log (the single input) and mills it into two types of products: high quality Grade A lumber, and lower quality Grade B lumber. Grade A lumber and Grade B lumber are examples of joint products, and the cost of the logs and related manufacturing process costs are examples of joint costs.

The following represents the information for Oregon Lumber for the month of June. Joint costs for the month total $250,000. Notice that the split-off point is the point at which identifiable products emerge from the production process. The issue is how to allocate joint costs—the $250,000 in production costs incurred prior to the split-off point—to the resulting joint products.

Two methods are commonly used to allocate these joint costs to the joint products: the *physical quantities method* and the *sales value method*. We discuss each of these methods next.

The Physical Quantities Method

Question: The physical quantities method *allocates joint costs based on a physical measure of output. Assume Oregon Lumber produces 600,000 board feet of Grade A lumber and 200,000 board feet of Grade B lumber during June. How would Oregon Lumber use this information to allocate $250,000 in joint production costs to each grade of lumber?*

Answer: Oregon Lumber would allocate 75 percent of the joint costs to Grade A lumber (75 percent = 600,000 Grade A board feet ÷ 800,000 total board feet), and 25 percent of the joint costs to Grade B lumber.

Grade A allocation:

$187,500 allocation = $250,000 joint costs × (600,000 Grade A board feet ÷ 800,000 total board feet)

Grade B allocation:

$62,500 allocation = $250,000 joint costs × (200,000 Grade B board feet ÷ 800,000 total board feet)

Figure A "Joint Product Profitability for Oregon Lumber Company: Physical Quantities Method" presents the profitability of each joint product for the month using the physical quantities method assuming Grade A lumber sells for $0.40 per board foot and Grade B lumber sells for $0.30 per board foot.

Figure A Joint Product Profitability for Oregon Lumber Company: Physical Quantities Method

	Grade A	Grade B	Total
Sales revenue	$240,000[a]	$60,000[b]	$300,000
Joint costs allocated	187,500[c]	62,500[d]	250,000
Profit (loss)	$ 52,500	$ (2,500)	$ 50,000

[a] $240,000 = $0.40 per board foot × 600,000 Grade A board feet.

[b] $60,000 = $0.30 per board foot × 200,000 Grade B board feet.

[c] $187,500 = $250,000 joint costs × (600,000 Grade A board feet ÷ 800,000 total board feet).

[d] $62,500 = $250,000 joint costs × (200,000 Grade B board feet ÷ 800,000 total board feet).

Although Grade B lumber appears to be unprofitable, elimination of Grade B lumber sales would *not* increase overall profit for Oregon Lumber. Grade B lumber contributes $60,000 to covering joint costs. Thus elimination of Grade B lumber sales would result in a decrease in overall profit of $60,000. The $62,500 in joint cost allocated to Grade B lumber would simply be reallocated to Grade A lumber.

The Sales Value Method

Question: A different approach to allocating joint costs to joint products is the sales value method *, which allocates joint costs based on the relative sales value of each product at the split-off point. How would Oregon Lumber allocate joint production costs using this method?*

Answer: Because sales revenue totals $240,000 for Grade A lumber and $60,000 for Grade B lumber, 80 percent of the joint costs are allocated to Grade A lumber (80 percent = $240,000 Grade A revenue ÷ $300,000 total revenue), and 20 percent of the joint costs are allocated to Grade B lumber:

Grade A allocation:

$200,000 allocation = $250,000 joint costs × ($240,000 Grade A sales value ÷ $300,000 total sales value)

Grade B allocation:

$50,000 allocation = $250,000 joint costs × ($60,000 Grade B sales value ÷ $300,000 total sales value)

Figure B "Joint Product Profitability for Oregon Lumber Company: Sales" presents the profitability of each joint product for the month using the sales value method, again assuming Grade A lumber sells for $0.40 per board foot, and Grade B lumber sells for $0.30 per board foot.

Figure B Joint Product Profitability for Oregon Lumber Company: Sales

	Grade A	Grade B	Total
Sales revenue	$240,000[a]	$60,000[b]	$300,000
Joint costs allocated	200,000[c]	50,000[d]	250,000
Profit	$ 40,000	$ 10,000	$ 50,000

[a] $240,000 = $0.40 per board foot × 600,000 Grade A board feet.

[b] $60,000 = $0.30 per board foot × 200,000 Grade B board feet.

[c] $200,000 = $250,000 joint costs × ($240,000 Grade A sales value ÷ $300,000 total sales value).

[d] $50,000 = $250,000 joint costs × ($60,000 Grade B sales value ÷ $300,000 total sales value).

The sales value method assumes that profit as a percent of sales will remain the same across all products. For example, Figure B shows that Grade A lumber has a profit margin ratio of 16.67 percent (= $40,000 profit ÷ $240,000 sales), as does Grade B lumber (= $10,000 profit ÷ $60,000 sales). This method also ensures that joint costs allocated to each product will not exceed sales revenue for each product (unless total joint costs are higher than total revenue).

As you review both methods and the results, notice that the total column for both methods of joint cost allocation is the same. The issue is *not* with the overall results. The issue is how to allocate joint costs to each joint product.

Deciding Whether to Process Further

Question: Assume Oregon Lumber Company has the option of processing Grade B lumber further into a finished product by sanding the lumber and painting it with primer. The sanded and painted Grade B lumber sells for $0.45 per board foot rather than $0.30 for the unfinished Grade B lumber. The additional cost to sand and paint the Grade B lumber is $0.05 per board foot. Should Oregon Lumber process Grade B lumber further into finished lumber?

Answer: The answer depends on whether the additional revenue exceeds the additional cost of processing Grade B lumber further. Since the additional revenue of $0.15 per board foot (= $0.45 finished price − $0.30 unfinished price) is greater than the additional

$0.05 per board foot processing cost, Oregon Lumber should process the Grade B lumber further into finished lumber. Profit increases $0.10 per board foot as a result of processing further (= $0.15 additional revenue − $0.05 additional cost).

Oregon Lumber will decide whether or not to process Grade B lumber further regardless of how joint costs are allocated to Grade A and Grade B lumber. In a sense, joint costs are sunk costs with respect to this decision, and will not influence future processing decisions. Thus joint costs incurred *prior* to the split-off point are irrelevant to the decision whether to process further *after* the split-off point.

Key Takeaways

- Two or more products made from a single input are called joint products. The costs of the single input and related manufacturing process costs must be allocated to each of the joint products. The physical quantities method allocates joint costs based on a physical measure of output (e.g., pounds or yards of material). The sales value method allocates joint costs based on the relative sales value for each of the joint products. Regardless of the allocation method used, total joint costs and total profit remain the same. Companies must often decide whether to process a joint product further. If as a result of processing the product further, additional sales revenue exceeds additional costs, the wise decision is to process further.

Check Yourself

Fresh Veggies, Inc., purchased 10,000 pounds of fresh apples from a local grower for $4,000. The apples were separated into high-quality Grade A apples (3,000 pounds) and lower-quality Grade B apples (7,000 pounds). Fresh Veggies sells Grade A apples for $0.80 per pound and Grade B apples for $0.50 per pound.

1. Allocate joint costs to each product using the physical quantities method (pounds), and calculate the profit or loss for each product.
2. Allocate joint costs to each product using the relative sales value method, and calculate the profit or loss for each product.
3. Assume Grade B apples can be processed further into dried apple slices for an additional $0.20 per pound. Customers are willing to pay $0.65 per pound for dried apple slices. Should Fresh Veggies, Inc., process the Grade B apples further?

Solution

1.

	Grade A Apples	Grade B Apples	Total
Sales revenue	$2,400[a]	$3,500[b]	$5,900
Joint costs allocated	1,200[c]	2,800[d]	4,000
Profit	$1,200	$ 700	$1,900

[a] $2,400 = $0.80 per pound × 3,000 pounds of Grade A apples.

[b] $3,500 = $0.50 per pound × 7,000 pounds of Grade B apples.

[c] $1,200 = $4,000 joint costs × (3,000 pounds of Grade A apples ÷ 10,000 total pounds).

[d] $2,800 = $4,000 joint costs × (7,000 pounds of Grade B apples ÷ 10,000 total pounds).

2.

	Grade A Apples	Grade B Apples	Total
Sales revenue	$2,400[a]	$3,500[b]	$5,900
Joint costs allocated	1,627[c]	2,373[d]	4,000
Profit	$ 773	$ 1,127	$1,900

[a] $2,400 = $0.80 per pound × 3,000 pounds of Grade A apples.

[b] $3,500 = $0.50 per pound × 7,000 pounds of Grade B apples.

[c] $1,627 (rounded) = $4,000 joint costs × ($2,400 Grade A sales value ÷ $5,900 total sales value).

[d] $2,373 (rounded) = $4,000 joint costs × ($3,500 Grade B sales value ÷ $5,900 total sales value).

3. Because the additional revenue of $0.15 per pound (= $0.65 price with further processing − $0.50 without further processing) is less than the additional $0.20 per pound processing cost, Fresh Veggies should *not* process the Grade B apples further into dried apples. Profit decreases $0.05 per pound (= $0.20 additional cost − $0.15 additional revenue) as a result of processing further.

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