openstax™

Principles of Accounting

Volume 2

Managerial Accounting

4

Job Order Costing

Figure 4.1 Hallie Refinishing Furniture. Companies can generally choose from two systems—job order costing or process costing—to account for the costs involved in making a product. Job order costing is the optimal decision when costs are readily assigned to the individual product. Managers should consider their options to select the best accounting system for their company's production and pricing. (credit: modification of "120425-staining-wood-hand-brush" by r. nial bradshaw/Flickr, CC BY 2.0)

Chapter Outline

LO **4.1** Distinguish between Job Order Costing and Process Costing

LO **4.2** Describe and Identify the Three Major Components of Product Costs under Job Order Costing

LO **4.3** Use the Job Order Costing Method to Trace the Flow of Product Costs through the Inventory Accounts

LO **4.4** Compute a Predetermined Overhead Rate and Apply Overhead to Production

LO **4.5** Compute the Cost of a Job Using Job Order Costing

LO **4.6** Determine and Dispose of Underapplied or Overapplied Overhead

LO **4.7** Prepare Journal Entries for a Job Order Cost System

LO **4.8** Explain How a Job Order Cost System Applies to a Nonmanufacturing Environment

Why It Matters

Hallie graduated from college last year and moved to Tempe, Arizona, to begin her career. Before moving, she purchased a secondhand dresser for $35 and spent $25 on refinishing materials. After two hours of work, she posted a picture of the dresser on social media, and a friend offered her $100 to refinish another dresser exactly the same way.

Fortunately, Hallie understands cost accounting and knew she needed to calculate the cost to refinish another

dresser. She found a similar dresser for $65. She knows that the refinishing materials will cost $25, and thus before adding in any cost for labor she is already at a cost of $90, without considering any overhead, such as electricity to run her sander.

Hallie estimated that her labor costs should be $20 per hour. The total cost then would be $130, and accepting less would mean accepting less for her labor. For a business in this situation, agreeing to the $100 offer would be considered a loss. If Hallie accepts the $100 price before checking her costs, she would have received only $10 for her labor (the sales price of $100 less the $90 cost of the dresser and materials).

Hallie didn't know if she would lose a potential customer by raising the price, so she found a different style dresser costing $25. A sales price of $100 would be fair with the two hours to refinish at $20 per hour and a materials cost of $25. She offered her friend the original style dresser for $130 or the alternate style dresser for $100.

As this example illustrates, it was essential for Hallie to know the cost to complete her project. It is also essential for all types and sizes of organizations to know the costs to complete their project. Manufacturing organizations need to know the costs of production, retail organizations need to know the cost to sell their products, and service organizations need to know the cost of providing their services. Management strives to eliminate unnecessary costs and needs to know the costs associated with using large pieces of equipment as well as seemingly insignificant office supplies. Cost accounting involves measuring and reporting the cost of production or service, while also providing data to determine the cost of the individual unit produced.

4.1 Distinguish between Job Order Costing and Process Costing

Pet Smart, H&R Block, Chili's, and Marshalls are popular chains often found at the same shopping center, even though they are very different businesses. Although they have a retail store, the Pet Smart Corporation also manufactures large volumes of its own products, whereas H&R Block prepares taxes for individual customers. Chili's prepares food, and its wait staff provides a service, whereas Marshalls sells a variety of products at retail.

The management of each business relies on knowing each cost when making decisions, such as setting the sales price, planning production and staffing schedules, and ordering materials. Although these companies share a common location, which suggests similar rental costs, all the other costs vary significantly. Because of these cost differences, each company must have a system for gathering its cost data. For example, Pet Smart manufactures Great Choice squeaker balls in large batches and collects cost data through a process costing system. A process costing system is often used to trace and determine production costs when similar products or services are provided. The concept and mechanics of a process costing system are addressed in Process Costing.

Since a typical tax return can vary significantly from one taxpayer to the next, H&R Block provides a service that they customize for each customer. Its cost data are collected via a job order cost system, which is designed to allow for individualized products or services.

Marshalls does not produce a product yet still needs a system to assign overhead costs to the products it sells. (Overhead was addressed in Building Blocks of Managerial Accounting.) And while Chili's has the same nationwide menu, it needs a system to collect the costs for each menu item within each location.

While companies may choose different cost accounting systems, each system must be capable of accumulating the costs incurred and allocating the costs to the product. Each costing system also requires the ability to obtain and analyze the cost data, and the more detailed the information needed, the higher the cost of collecting the data. The choice of cost accumulation system depends on the variety and type of products or

services sold, or the type of manufacturing processes employed. The system used should be determined by weighing the cost of collecting the data and the benefit of having that information.

Companies use different costing systems for determining the cost of custom products than they do for determining the cost of mass-produced products. When products are custom ordered, knowing the cost of the materials, labor, and overhead is critical to determining the sales price. As an easy example, think of a tailor who alters, repairs, and makes custom clothes for customers. If a customer orders a custom-made suit, the specific fabric, detail of any special features, and the time involved in sewing are all factors that will determine the total cost and, therefore, the selling price of the garment. Each component of the cost of producing the clothing will be tracked as it occurs, thus improving the accuracy of determining the price. However, in mass production, wherein one batch leads to a second batch, stopping the process to properly identify the materials, labor, and overhead costs used for each batch does not provide enough valuable data to justify determining the individual costing of each product. For example, in the case of a mass-produced clothing item, such as jeans, a company like Levi's will track costs for a batch of jeans rather than for a pair of jeans. Levi's had over $4.9 billion in revenue in 2017 generated from the many different styles and brands of clothing items they produce and sell. It would be difficult, and not cost effective, to track the cost of each individual clothing item; rather, it is more efficient to track the costs in each phase of the clothing-making process. Levi's can then accumulate the costs of the phases of production to determine the total cost of production for a batch and allocate those costs over the number of pairs of jeans made. This process allows them to determine the cost of each item.

Even retail companies need to know the cost of the purchased products before the sales price is set. While it seems simple to think of the sales price as the purchase price plus a markup, determining the markup costs needs to be an accurate process in order to ensure the sale price is higher than the product cost. To properly capture the information necessary for decision-making, there are different costing systems that track costs in order to determine sales prices, and to measure profits and manufacturing efficiency.

As previously mentioned, the two traditional types of costing systems are job order costing and process costing. Each anticipates or determines unit costs of products being manufactured and/or services being provided prior to year-end. Companies may decide to use only one or a combination of methods. This chapter examines job order costing and demonstrates how it differs from process costing. Process Costing and other costing systems (Activity-Based, Variable, and Absorption Costing) are covered in other chapters.

In this chapter, you will also learn the terminology used to track costs within the job order cost system and how to segregate and aggregate these costs to determine the costs of production in a job order costing environment. You will also learn how to record these job costs and where they appear on financial statements.

Job Order Costing versus Process Costing

Job order costing is an accounting system that traces the individual costs directly to a final job or service, instead of to the production department. It is used when goods are made to order or when individual costs are easy to trace to individual jobs, assuming that the additional information provides value. In these circumstances, the individual costs are easy to trace to the individual jobs.

For example, assume that a homeowner wants to have a custom deck added to her home. Also assume that in order to fit her lot's topography and her anticipated uses for the addition, she needs a uniquely designed deck. Her contractor will design the deck, price the necessary components (in this case, the direct materials, direct labor, and overhead), and construct it.

The final cost will be unique to this project. If another homeowner wanted the contractor to construct a deck,

the contractor would go through the same design and pricing process, and you would expect that the design and costs would not be the same as those of the deck in the first example, since the decks would differ from one another.

The job order costing method also works well for companies such as movie production companies, print service providers, advertising agencies, building contractors, accounting firms, consulting entities, and repair service providers. For example, *Star Wars: The Last Jedi* is believed to have cost $200 million to produce, whereas *Logan* only cost $97 million. The production processes for both films differed significantly, so that the accumulated costs for each job also differed significantly. Both were made in 2017.[1]

In contrast, process costing is used when the manufacturing process is continuous, so it is difficult to establish how much of each material is used and exactly how much time is invested in each unit of finished product. Therefore, in process costing, costs are accounted for by the production process or production department instead of by the product or by the job. This method works well for manufacturers of products such as Titleist golf balls, Kellogg's cereal, Turkey Hill ice cream, CITGO gasoline, Dow Chemicals, or Sherwin Williams' paints. However, process costing is not limited to basic manufacturing activities: It can also be used in the manufacturing of more complex items, such as small engines. A process costing system assigns costs to each department as the costs are incurred, and the costs to produce one unit are calculated based on the information from the production department. Unit costs are determined after total production costs are determined.

One factor that can complicate the choice between job order costing and process costing is the growth of automation in the production process, which typically is accompanied by a reduction in direct labor. The cost of the increase in equipment (typically reflected as a depreciation expense) is allocated to overhead, while the decreased need for labor usually reduces the direct labor cost. Because of these issues, some companies choose a hybrid system, using process costing to account for mass producing a part and using job order costing to account for assembling some of those individual parts into a custom product. Table 4.1 summarizes the use of these two systems.

Job Order and Process Cost Systems

	Job Order Cost System	Process Cost System
Product type	Custom order	Mass production
Examples	Signs, buildings, tax returns	Folding tables, toys, buffet restaurants
Cost accumulation	Job lot	Accumulated per process
Work in process inventory	Individual job cost sheets	Separate work in process inventory department
Record keeping	Individual job cost sheets	Production cost report

Table 4.1 This table shows some of the differences between job order costing and process costing.

1 "Production Costs and Global Box Office Revenue of Star Wars Movies from 1977 to 2018 (in million U.S. dollars)." The Statistics Portal. https://www.statista.com/statistics/311356/star-wars-production-costs-box-office-revenue/.

To illustrate how a company can determine whether to use job order costing or process costing, consider the cost accounting options for a local restaurant. Macs & Cheese makes specialty macaroni and cheese, and the company wants to erect a special sign on an already constructed billboard outside a stadium. It wants to use this space to target stadium customers; thus, the company wants a sign built specifically for that site. Dinosaur Vinyl is secured as the sign manufacturer and would use job order costing to account for the associated manufacturing costs because of the unique nature of the sign, including the art work involved. However, if Macs & Cheese was designing a costing system for the specialty food product they market, they typically would use a process costing approach because their product is made and marketed in homogeneous, similar batches.

LINK TO LEARNING

Dynamic Systems provides bar code-traceable software that helps companies track the costs associated with production (https://openstax.org/l/50barcode) . The company explains the difference between job order cost systems and process cost systems to their customers who often ask if their job order cost software is also the process cost software.

Organization of Flow of Goods through Production

Regardless of the costing method used (job order costing, process costing, or another method), manufacturing companies are generally similar in their organizational structure and have a similar flow of goods through production. The diagram in Figure 4.2 shows a partial organizational chart for sign manufacturer Dinosaur Vinyl. The CEO has several direct reporting units—Financing, Production, Information Technology, Marketing, Human Resources, and Maintenance—each with a director responsible for several departments.

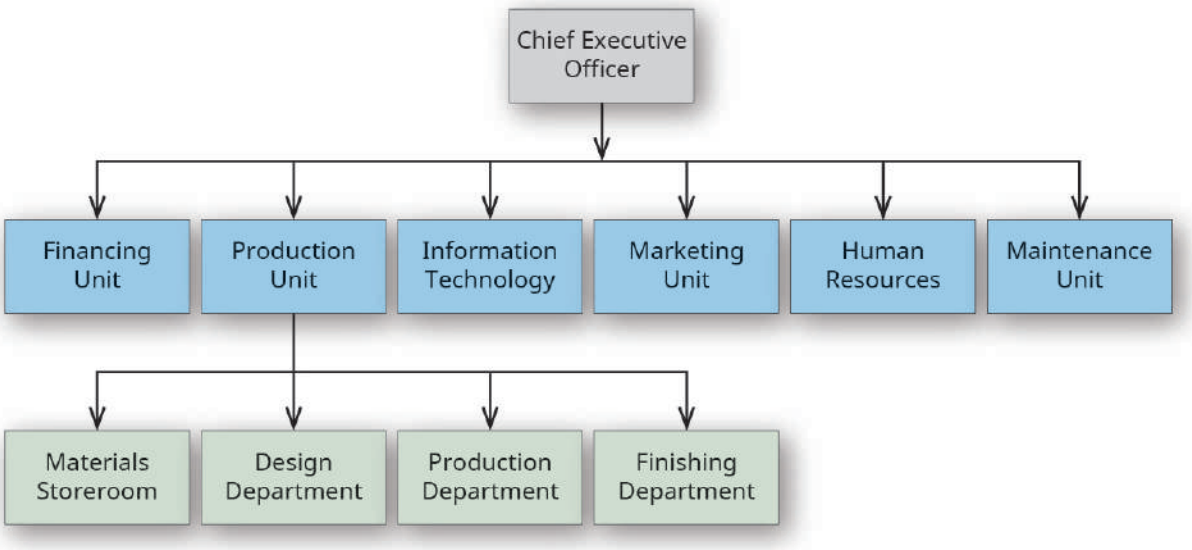


Figure 4.2 Organizational Chart for a Manufacturing Company. The different units within Dinosaur Vinyl illustrate the two main cost categories of a manufacturing company: manufacturing costs (the production unit), and selling and administrative costs. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

The diagram also shows the departments that report to the production unit director and gives an indication as to the flow of goods through production. The flow of goods through production is more evident in Figure 4.3, which depicts Dinosaur Vinyl as a simple factory with three stages of production.

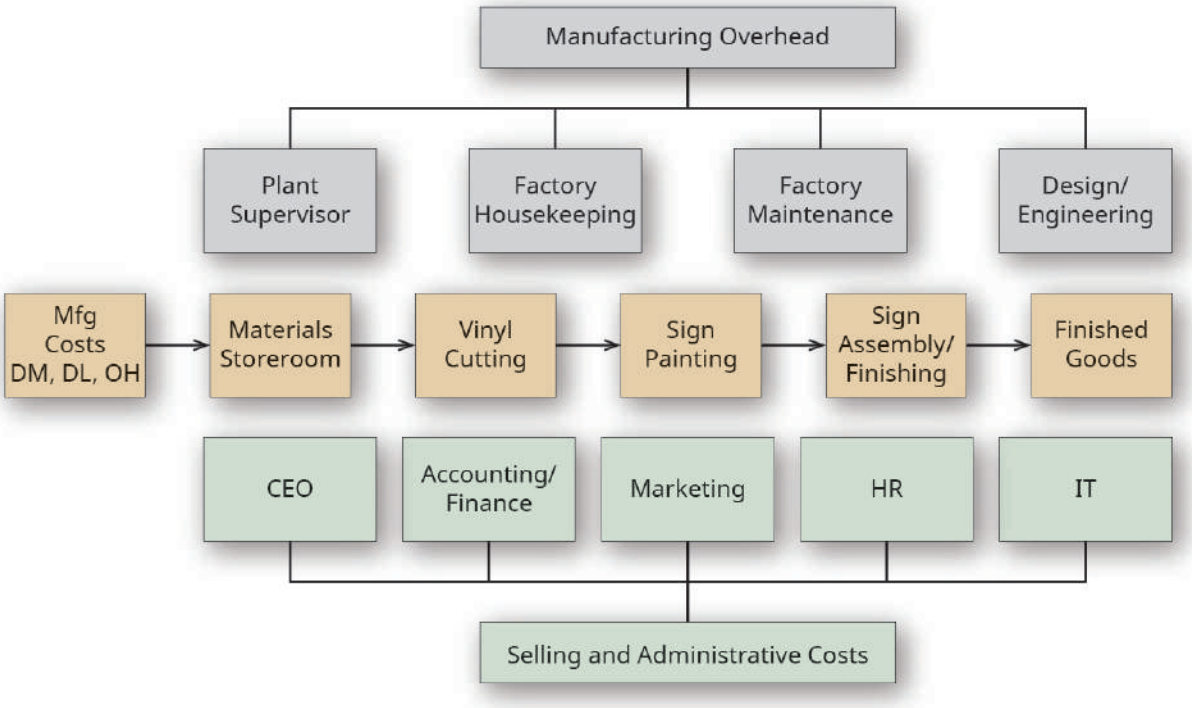


Figure 4.3 Factory Layout for Dinosaur Vinyl. The flow of goods and areas of manufacturing versus administrative costs are more easily seen by looking at the factory layout for Dinosaur Vinyl. The departments across the bottom represent administrative costs, whereas the departments in the middle represent manufacturing costs—although Design/Engineering can sometimes be considered part of administrative costs, depending on how management chooses to categorize those costs. The departments listed across the top represent examples of manufacturing overhead. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Raw materials are stored in the materials storeroom and delivered to the appropriate production department—cutting, painting, or assembly/finishing. The design department uses direct labor to create the design specifications, and, when completed, it sends them to the production department. The production department uses the material and design specifications and adds additional labor to create the sign. The sign is transferred to the finishing department for final materials and labor, before the sign is installed or delivered to the customer.

Manufacturing Costs

In a manufacturing environment, the **manufacturing costs** are also called *product costs* and include all expenses used to manufacture the product: direct materials, direct labor, and manufacturing overhead. To review these costs, see Building Blocks of Managerial Accounting. The total of these costs becomes the cost of ending inventory and later becomes the cost of goods sold when the product is sold. Both job order costing and process costing use categorized cost information to make decisions and evaluate the effectiveness of the cost tracking process. Because of the difference in how each of the two costing systems track costs, different terminology is used. Thus, it is important to separate product costs from period costs, and it is sometimes important to separate product costs into **prime costs** and **conversion costs**. Prime costs are costs that include

the primary (or direct) product costs: direct materials and direct labor. Conversion costs are costs that include the expenses necessary to convert direct materials into a finished product: direct labor and manufacturing overhead. Their relationship is shown in Figure 4.4.

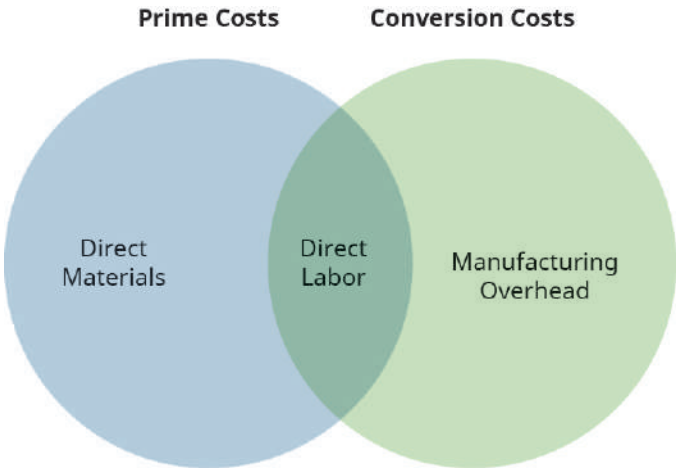


Figure 4.4 Manufacturing Costs. Management sometimes needs additional information to make decisions and needs the costs categorized as prime costs or conversion costs. Prime costs and conversion costs are not included together as direct labor is included in both categories. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Job order costing systems assign costs directly to the product by assigning direct materials and direct labor to the work in process (WIP) inventory. As you learned in Building Blocks of Managerial Accounting, direct materials are the components that can be directly traced to the products produced, whereas direct labor is the labor cost that can be directly traced to the products produced.

Material and labor costs that cannot be traced directly to the product produced are included in the overhead costs that are allocated in the production costing process. Overhead is applied to each product based on an activity base, which will be explained in Compute a Predetermined Overhead Rate and Apply Overhead to Production.

The assignment of direct materials and direct labor to each production unit illustrates the job order costing system's focus on prime costs, in contrast to the process costing system, which assigns costs to the department and focuses on direct materials and conversion costs, which are composed of a combination of direct labor and overhead. Process costs will be demonstrated in Process Costing.

Selling and Administrative Costs

Selling and administrative costs (S&A) are period costs, and these costs are expensed as incurred, instead of being included in the product's costs, as they move through the relevant inventory accounts. A **period cost** is a cost tied to a specific time period, such as a month, quarter, or year, instead of being associated with a particular job order. For example, if a company paid an insurance company $12,000 for one year's liability insurance coverage, the first month's expense would be $1,000. This expense would not be related to a particular job order, but instead would be classified as a period cost, and in this case recorded monthly as an administrative expense. Selling costs are the expenses related to the promotion and sale of the company's products, whereas administrative costs are the expenses related to the operations of the company. The S&A

costs are considered period costs because they include costs of departments not directly associated with manufacturing but necessary to operate the business. Some examples include research and development costs, marketing costs, sales commissions, administration building rent, the CEO's salary expense, and accounting, payroll, and IT department expenses.

YOUR TURN

Maria's Market

A grocery store's analysis of a recent customer survey finds an increasing number of customers interested in being able to custom-order meals to go. Maria sees this as an opportunity to enter a niche market for busy families or individuals who want home-cooked meals with a variety of options and combinations, but who have little time. Maria already has an expansive deli, bakery, and prepared foods section in the store and sees this opportunity as a viable option to increase sales and its customer base. With meals to go, customers can choose from an array of options and can indicate the quantity of each item and the time of pickup. The customer simply pulls up in a designated spot at Maria's and the food is brought to their car, packaged, and ready to take home to enjoy.

What type of costing system will work best for the Maria's Market? What sales price information, cost information, and other options are important to this decision?

Solution

A job order cost system will work well for this store. In addition to specific price and cost, these are other important considerations.

- The optimal sales price should be set to encourage customers to purchase the meals.
- The materials, labor, and overhead cost should be considered for each meal option.
  - Direct material costs may include the cost of the protein, grain, and vegetable option, as well as the cost of the packing containers.
  - The direct labor cost is for employees who are directly involved in preparing the meals.
  - Manufacturing overhead includes the cost of gloves used when preparing the meals, the cost of employees who support but are not directly involved in preparing the meals, and the cost to operate the oven.
- The cost of the various meal options should all be less than the sales price.
- The meal options should change to take advantage of seasonal items.
- There may be a need to vary the sales price, depending on the combinations selected.

Recording Costs in Job Order Costing versus Process Costing

Both job order costing and process costing track the costs of materials, labor, and overhead as components of virtually all products. The process of production does not change because of the costing method: The costing method is chosen based on the process of production and is intended to provide the most accurate representation of the costs incurred in the production process.

Maintaining accounting records for each system has its advantages. A job order costing system uses a **job cost sheet** to keep track of individual jobs and the direct materials, direct labor, and overhead associated with each job. The focus of a job order costing system is tracking costs per job, since each job is unique and therefore has different costs relative to other jobs. Maintaining this information is typically more expensive than process costing, and it is often used for the production of smaller, more individualized jobs because the benefit of knowing the cost of each product outweighs the additional cost of maintaining a job order costing system.

In contrast, a process costing system does not need to maintain the cost for individual jobs because the jobs use a continual system of production, and the items are typically not significantly unique but instead are basically equivalent. The accounting emphasis is in keeping records for the individual departments, which is useful for large batches or runs. Process costing is the optimal system to use when the production process is continuous and when it is difficult to trace a particular input cost to an individual product. Process costing systems assign costs to each department as the costs are incurred. The costs to produce one unit are calculated, based on the information from the production department. Therefore, the focus of process costing systems is on measuring and assigning the conversion costs to the proper department in order to best determine the cost of individual units.

Under either costing method, accounting theory explains why it is important to understand when costs become expenses. A primary reason for separating production costs from other company expenses is the **expense recognition principle**, which requires costs to be expensed when they match the revenue being earned and to separate the costs of production from other costs for the proper timing of recognition of expenses. Think about measuring the profit from the sale of an item, say a TV, in a nonmanufacturing environment. It is logical to subtract the costs associated with buying the TV in order to determine the profit, before applying other costs from that sale. Suppose the TV was purchased as inventory by the store in January and sold to a customer in March. This requires that the cost of the TV not be recorded as an expense (cost of goods sold) until March, when the sale from the TV is recorded, thus matching the revenue with the expense. Until that time, the TV and its cost are considered inventory. This same idea applies to the manufacturing process.

Per the expense recognition principle, product costs—the direct materials, direct labor, and manufacturing overhead incurred to produce the job—are expensed on the income statement for the period of the sale as cost of goods sold when the completed job is sold. If the products are not sold, their costs remain in ending inventory.

Prior to the sale of the product, separating production costs and assigning them to the product results in these costs remaining with the inventory. Until they are sold, the costs incurred are reflected in an assortment of inventory accounts, such as raw materials inventory, work in process inventory, and finished goods inventory.

In contrast, period costs are not directly related to the production process and are expensed during the period in which they are incurred. This approach matches administrative and other expenses shown on the income statement in the same period in which the company earns income.

4.2 Describe and Identify the Three Major Components of Product Costs under Job Order Costing

In order to set an appropriate sales price for a product, companies need to know how much it costs to produce an item. Just as a company provides financial statement information to external stakeholders for decision-making, they must provide costing information to internal managerial decision makers. Virtually every tangible

product has direct materials, direct labor, and overhead costs that can include indirect materials and indirect labor, along with other costs, such as utilities and depreciation on production equipment. To account for these and inform managers making decisions, the costs are tracked in a cost accounting system.

While the flow of costs is generally the same for all costing systems, the difference is in the details: Product costs have material, labor, and overhead costs, which may be assessed differently. In most production facilities, the raw materials are moved from the raw materials inventory into the work in process inventory. The work in process involves one or more production departments and is where labor and overhead convert the raw materials into finished goods. The movement of these costs through the work in process inventory is shown in Figure 4.5.

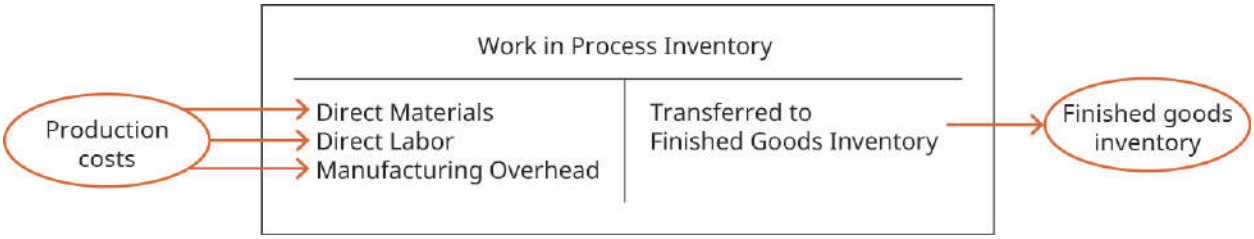


Figure 4.5 Work in Process Inventory. Direct materials, direct labor, and manufacturing overhead enter the work in process inventory as the costs associated with the products that are in production. Once the products are completed, their costs are transferred to the finished goods inventory. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

At this stage, the completed products are transferred into the finished goods inventory account. When the product is sold, the costs move from the finished goods inventory into the cost of goods sold.

While many types of production processes could be demonstrated, let's consider an example in which a contractor is building a home for a client. The accounting system will track direct materials, such as lumber, and direct labor, such as the wages paid to the carpenters constructing the home. Along with these direct materials and labor, the project will incur manufacturing overhead costs, such as indirect materials, indirect labor, and other miscellaneous overhead costs. Samples of these costs include indirect materials, such as nails, indirect labor, such as the supervisor's salary, assuming that the supervisor is overseeing several projects at the same time, and miscellaneous overhead costs such as depreciation on the equipment used in the construction project.

As direct materials, direct labor, and overhead are introduced into the production process, they become part of the work in process inventory value. When the home is completed, the accumulated costs become part of the finished goods inventory value, and when the home is sold, the finished goods value of the home becomes the cost of goods sold. Figure 4.6 illustrates the flow of these costs through production.

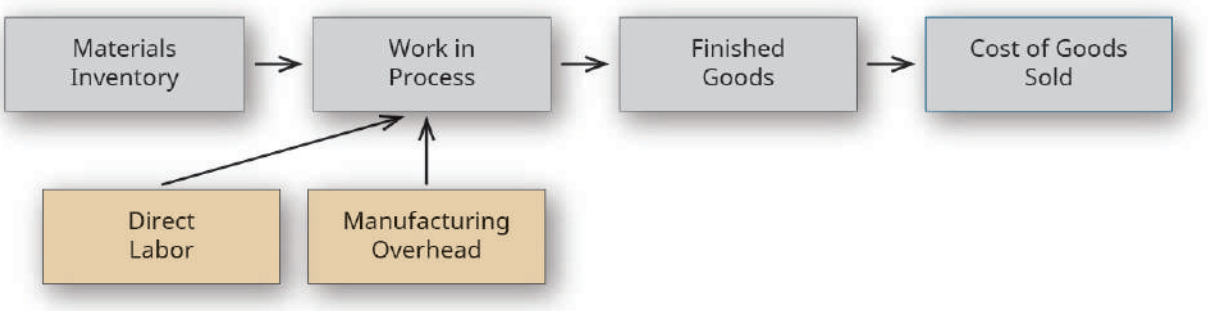


Figure 4.6 Flow of Materials from Raw Materials to Finished Goods. Accounting methods track a product's material, labor, and overhead costs, as it moves through production. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

The three general categories of costs included in manufacturing processes are direct materials, direct labor, and overhead. Note that there are a few exceptions, since some service industries do not have direct material costs, and some automated manufacturing companies do not have direct labor costs. For example, a tax accountant could use a job order costing system during tax season to trace costs. The one major difference between the home builder example and this one is that the tax accountant will not have direct material costs to track. The few assets used will typically be categorized as overhead.

A benefit of knowing the production costs for each job in a job order costing system is the ability to set appropriate sales prices based on all the production costs, including direct materials, direct labor, and overhead. The unique nature of the products manufactured in a job order costing system makes setting a price even more difficult. For each job, management typically wants to set the price higher than its production cost. Even if management is willing to price the product as a loss leader, they still need to know how much money will be lost on each product. To achieve this, management needs an accounting system that can accurately assign and document the costs for each product.

If you're not familiar with the concept of a loss leader, a simple example might help clarify the concept. A **loss leader** is a product that is sold at a price that is often less than the cost of producing it in order to entice you to buy accessories that are necessary for its use. For example, you might pay $50 or $60 for a printer (for which the producer probably does not make any profit) in order to then sell you extremely expensive printer cartridges that only print a few pages before they have to be replaced. However, even pricing a product as a loss leader requires analysis of the three categories of costs: direct materials, direct labor, and overhead.

Direct Materials

Direct materials are those materials that can be directly traced to the manufacturing of the product. Some examples of direct materials for different industries are shown in Table 4.2. In order to respond quickly to production needs, companies need raw materials inventory on hand. While production volume might change, management does not want to stop production to wait for raw materials to be delivered. Further, a company needs raw materials on hand for future jobs as well as for the current job. The materials are sent to the production department as it is needed for production of the products.

Common Direct Materials by Industry

Industry	Direct Materials
Automotive	Iron, aluminum, glass, rubber
Cell phones	Glass, various metals, plastic
Furniture	Wood, leather, vinyl
Jewelry	Gold, silver, diamonds, rubies
Pharmaceuticals	Natural or synthetic biological ingredients

Table 4.2

Each job begins when raw materials are put into the work in process inventory. When the materials are requested for production, a materials requisition slip is completed and shows the exact items and quantity requested, along with the associated cost. The completed form is signed by the requestor and approved by the manager responsible for the budget.

Returning to the example of Dinosaur Vinyl's order for Macs & Cheese's stadium sign, Figure 4.7 shows the **materials requisition form** for Job MAC001. This form indicates the quantity and specific items to be put into the work in process. It also transfers the cost of those items to the work in process inventory and decreases the raw materials inventory by the same amount. The raw materials inventory department maintains a copy to document the change in inventory levels, and the accounting department maintains a copy to properly assign the costs to the particular job.

MATERIALS REQUISITION FORM
Dinosaur Vinyl, Inc.

Material Requisition No.: 3392
Job No.: MAC001
Date of Request: 4/5/2017
Date Needed: 4/5/2017

Description	Quantity	Unit Cost	Total Cost
Raw materials inventory: Vinyl	1	$300	$300
Raw materials inventory: Black ink	2	50	100
Raw materials inventory: Red ink	1	60	60
Raw materials inventory: Gold ink	1	60	60
Raw materials inventory: Grommets	12	10	120
Raw materials inventory: Framing wood	40	1.50	60
			$700

Requested by: john ming Date: 4/5/17
Authorized by: Jula Clark Date: 4/5/17

Figure 4.7 Materials Requisition Form for Job MAC001. The materials requisition form allows different departments to track and account for the direct materials needed to manufacture the product. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Dinosaur Vinyl has a beginning inventory of $1,000 in *raw materials: vinyl*, and $300 in each of its ink inventories: *raw materials: black ink*, *raw materials: red ink*, and *raw materials: gold ink*. In order to have enough inventory on hand for all of its jobs, it purchases $10,000 in vinyl and $500 in black ink. The T-accounts in Figure 4.8 show the stated beginning debit balances. An additional $10,000 of vinyl and $500 of black ink were then purchased for anticipated use, providing the demonstrated final account balances. The red ink and gold ink balances did not change, since no additional quantities were purchased.

The beginning balances and purchases in each of these accounts are illustrated in Figure 4.8.

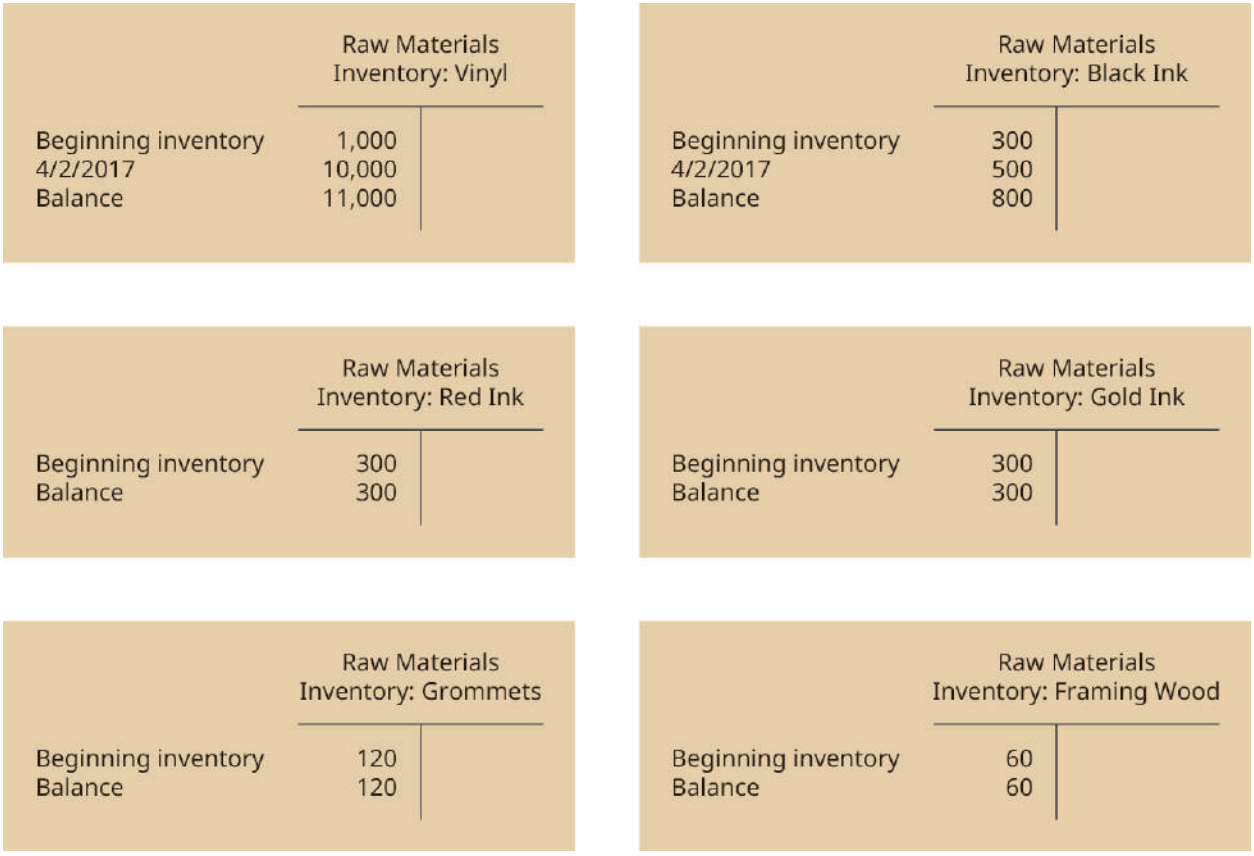


Figure 4.8 Beginning Balances and Purchases. These T-accounts show the balances for the raw materials inventory. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Traditional billboards with the design printed on vinyl include direct materials of vinyl and printing ink, plus the framing materials, which consist of wood and grommets. The typical billboard sign is 14 feet high by 48 feet wide, and Dinosaur Vinyl incurs a vinyl cost of $300 per billboard. The price for the ink varies by color. For this job, Dinosaur Vinyl needs two units of black ink at a cost of $50 each, one unit of red ink and one unit of gold ink at a cost of $60 each, twelve grommets at a cost of $10 each, and forty units of wood at a cost of $1.50 per unit. The total cost of direct materials is $700, as shown in Figure 4.9.

Item	Units	Cost per Unit	Item Cost	Total Cost
Production Department				
Vinyl	1	$ 300	$300	
Black ink	2	50	100	
Red ink	1	60	60	
Gold ink	1	60	60	$520
Finishing Department				
Grommets	12	$ 10	$120	
Framing wood	40	1.50	60	180
Total Direct Materials				$700

Figure 4.9 Direct Materials Needed for Job MAC001. The costs for direct materials needed by both the production and finishing departments are shown. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Some items are more difficult to measure per unit, such as adhesives and other materials not directly traceable to the final product. Their costs are assigned to the product as part of manufacturing overhead as indirect materials.

When Dinosaur Vinyl requests materials to complete Job MAC001, the materials are moved from raw materials inventory to work in process inventory. We will use the beginning inventory balances in the accounts that were provided earlier in the example. The requisition is recorded on the job cost sheet along with the cost of the materials transferred. The costs assigned to job MAC001 are $300 in vinyl, $100 in black ink, $60 in red ink, and $60 in gold ink. During the finishing stages, $120 in grommets and $60 in wood are requisitioned and put into work in process inventory. The costs are tracked from the materials requisition form to the work in process inventory and noted specifically as part of Job MAC001 on the preceding job order cost sheet. The movement of goods is illustrated in Figure 4.10.

Raw Materials Inventory: Vinyl		
Beginning inventory	1,000	
4/2/2017	10,000	
4/2/2017		300
Balance	10,700	

Raw Materials Inventory: Grommets		
Beginning inventory	300	
4/14/2017		120
Balance	180	

Raw Materials Inventory: Black Ink		
Beginning inventory	300	
4/2/2017	500	
4/2/2017		100
Balance	700	

Raw Materials Inventory: Framing Wood		
Beginning inventory	300	
4/14/2017		60
Balance	240	

Raw Materials Inventory: Red Ink		
Beginning inventory	300	
4/2/2017		60
Balance	240	

Work in Process Inventory		
4/2/2017	520	
4/14/2017	180	

Raw Materials Inventory: Gold Ink		
Beginning inventory	300	
4/2/2017		60
Balance	240	

Figure 4.10 Movement of Goods. These T-accounts illustrate the tracking of costs from raw materials inventory to the work in process inventory as the product moves through the manufacturing process. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Each of the T-accounts traces the movement of the raw materials from inventory to work in process. The vinyl and ink were used first to print the billboard, and then the billboard went to the finishing department for the grommets and frame, which were moved to work in process after the vinyl and ink. The final T-account shows the total cost for the raw materials placed into work in process on April 2 (vinyl and ink) and on April 14 (grommets and wood). The journal entries to reflect the flow of costs from raw materials to work in process to finished goods are provided in the section describing how to Prepare Journal Entries for a Job Order Cost System.

Direct Labor

Direct labor is the total cost of wages, payroll taxes, payroll benefits, and similar expenses for the individuals who work directly on manufacturing a particular product. The direct labor costs for Dinosaur Vinyl to complete Job MAC001 occur in the production and finishing departments. In the production department, two individuals

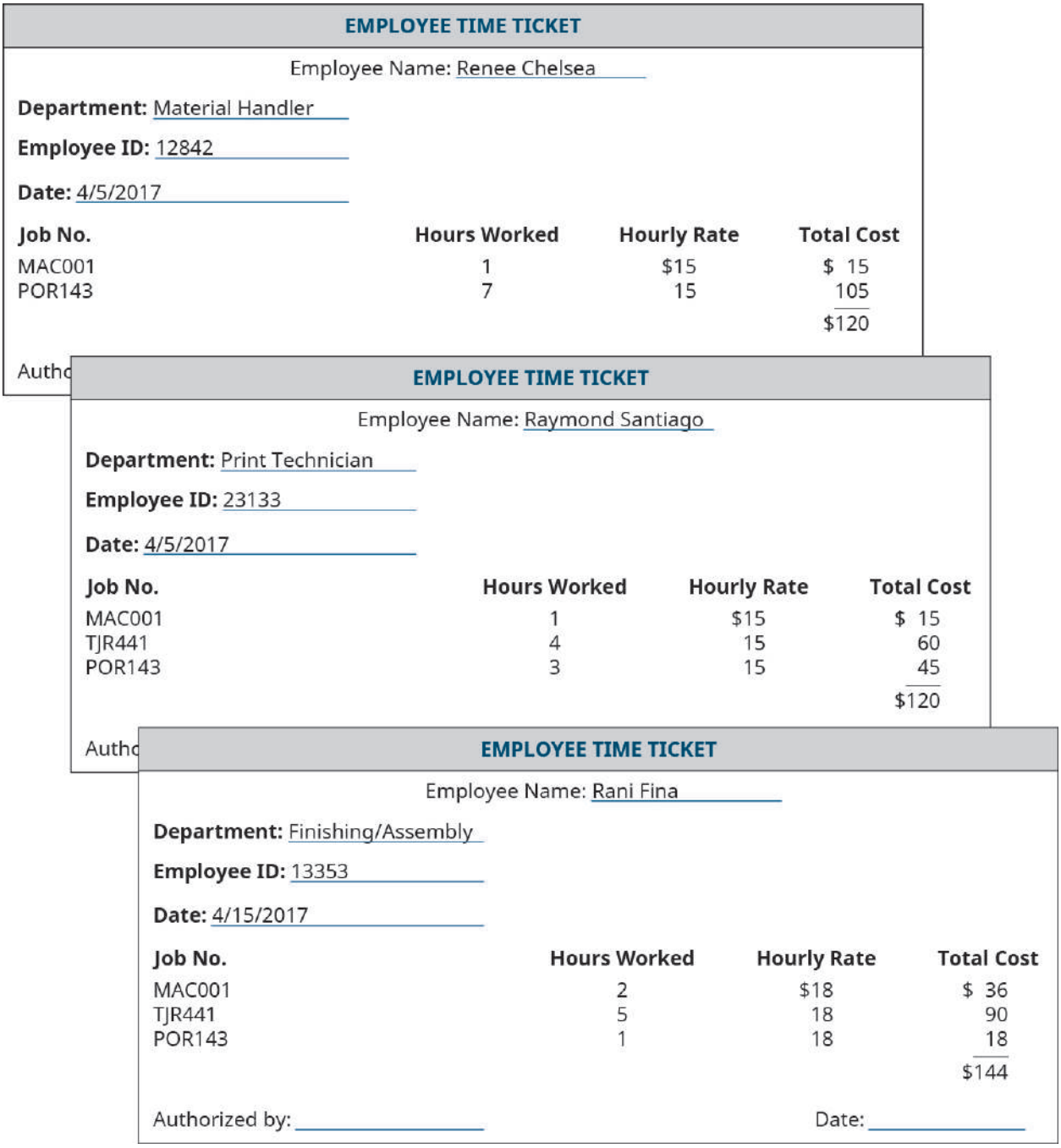
each work one hour at a rate of $15 per hour, including taxes and benefits. The finishing department's direct labor involves two individuals working one hour each at a rate of $18 per hour. Figure 4.11 shows the direct labor costs for Job MAC001.

Item	Hours	Rate per Hour	Item Cost	Total Cost
Production Department				
Material Handler	1	$15	$15	
Print Technician	1	15	15	$30
Finishing Department				
Production Assistant	1	$18	$18	
Production Assistant	1	18	18	36
Total Direct Labor				$66

Figure 4.11 Direct Labor for Job MAC001. Labor costs account for individuals working directly on the product. Individuals whose contributions are indirect will be tracked under manufacturing overhead. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Job MAC001 is also manufactured with the work of individuals whose contributions cannot be directly traced to the product: These indirect labor costs are assigned to the product as part of manufacturing overhead.

A company can use various methods to trace employee wages to specific jobs. For example, employees may fill out **time tickets** that include job numbers and time per job, or workers may scan bar codes of specific jobs when they begin a job task. Figure 4.12 shows what time tickets might look like on Job MAC001. Please note that in the employee time tickets that are displayed, each employee worked on more than one job. However, we are only going to track the expenses for Job MAC001.



EMPLOYEE TIME TICKET

Employee Name: Renee Chelsea

Department: Material Handler

Employee ID: 12842

Date: 4/5/2017

Job No.	Hours Worked	Hourly Rate	Total Cost
MAC001	1	$15	$ 15
POR143	7	15	105
			$120

Autho

EMPLOYEE TIME TICKET

Employee Name: Raymond Santiago

Department: Print Technician

Employee ID: 23133

Date: 4/5/2017

Job No.	Hours Worked	Hourly Rate	Total Cost
MAC001	1	$15	$ 15
TJR441	4	15	60
POR143	3	15	45
			$120

Autho

EMPLOYEE TIME TICKET

Employee Name: Rani Fina

Department: Finishing/Assembly

Employee ID: 13353

Date: 4/15/2017

Job No.	Hours Worked	Hourly Rate	Total Cost
MAC001	2	$18	$ 36
TJR441	5	18	90
POR143	1	18	18
			$144

Authorized by: _____ Date: _____

Figure 4.12 Employee Time Tickets. Time tickets (or time cards) are one method a company can use to track direct labor costs per individual and per job. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

When the accounting department processes time tickets, the costs are assigned to the individual jobs, resulting in labor costs being recorded on the work in process inventory, as shown in Figure 4.13.

	Work in Process Inventory
4/2/2017	520
4/5/2017	30
4/14/2017	180
4/15/2017	36

Figure 4.13 Costs Accounted for in the Work in Process Inventory. The direct material costs of $520 and $180, and the direct labor costs of $30 and $36 assigned to Job MAC001 are shown. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Manufacturing Overhead

Recall that the costs of a manufactured item are direct materials, direct labor, and manufacturing overhead. Costs that support production but are not direct materials or direct labor are considered overhead. **Manufacturing overhead** has three components: indirect materials, indirect labor, and overhead.

Indirect Materials

Indirect material costs are derived from the goods not directly traced to the finished product, like the sign adhesive in the Dinosaur Vinyl example. Tracking the exact amount of adhesive used would be difficult, time consuming, and expensive, so it makes more sense to classify this cost as an indirect material.

Indirect materials are materials used in production but not traced to specific products because the net informational value from the time and effort to trace the cost to each individual product produced is impossible or inefficient. For example, a furniture factory classifies the cost of glue, stain, and nails as indirect materials. Nails are often used in furniture production; however, one chair may need 15 nails, whereas another may need 18 nails. At a cost of less than one cent per nail, it is not worth keeping track of each nail per product. It is much more practical to track how many pounds of nails were used for the period and allocate this cost (along with other costs) to the overhead costs of the finished products.

Indirect Labor

Indirect labor represents the labor costs of those employees associated with the manufacturing process, but whose contributions are not directly traceable to the final product. These would include the costs of the factory floor supervisor, the factory housekeeping staff, and factory maintenance workers. For Dinosaur Vinyl, for example, labor costs for the technician who maintains the printers would be indirect labor. It would be too time consuming to determine how much of the technician's time is attributable to each sign being produced. It makes much more sense to classify that labor expense as indirect labor.

It is important to understand that the allocation of costs may vary from company to company. What may be a direct labor cost for one company may be an indirect labor cost for another company or even for another department within the same company. Deciding whether the expense is direct or indirect depends on its task. If the employee's work can be directly tied to the product, it is direct labor. If it is tied to the factory but not to the product, it is indirect labor. If it is tied to the marketing department, it is a sales and administrative expense, and not included in the cost of the product. For example, salaries of factory employees assembling parts are direct labor, salaries of factory employees performing maintenance are indirect labor, and salaries of employees in the marketing department are sales and administration expenses.

Overhead

The last category of manufacturing overhead is the overhead itself. These costs are necessary for production but not efficient to assign to individual product production. Examples of typical overhead costs are production facility electricity, warehouse rent, and depreciation of equipment.

But note that while production facility electricity costs are treated as overhead, the organization's administrative facility electrical costs are not included as as overhead costs. Instead, they are treated as period costs, as office rent or insurance would be.

When both administrative and production activities occur in a common building, the production and period costs would be allocated in some predetermined manner. For example, if a 10,000 square foot building were physically allocated at 4,000 square feet for administrative purposes and 6,000 square feet for production, a company might allocate its annual $30,000 property tax expense on a 40%/60% basis, or $12,000 as a period cost for the administrative offices and a production (overhead) cost of $18,000.

LINK TO LEARNING

Do you know of a restaurant that was doing really well until it moved into a larger space? Often this happens because the owners thought their profits could handle the costs of the increased space. Unfortunately, they were not really aware of the production costs. Keeping track of product costs is critical for pricing and cost control. Read advice from restaurant owner John Gutekanst about the importance of understanding food costs (https://openstax.org/l/50pizza) and his approach to account for these in his pizzeria.

Accounting for Manufacturing Overhead

In all costing systems, the expense recognition principle requires costs to be recorded in the period in which they are incurred. The costs are expensed when matched to the revenue with which they are associated; this is commonly referred to as *having the expenses follow the revenues*. This explains why raw material purchases are not assigned to the job until the materials are requested. When companies use an inventory account, the product costs are expensed when the inventory is sold. It is common to have an item produced in one year, such as 2017, and expensed as cost of goods sold in a later year, such as 2018. In addition to the previously mentioned *revenue recognition* treatment, this treatment is justified under GAAP's *matching principle*. If the inventory has not been sold, the company has an inventory asset rather than an expense.

The expense recognition principle also applies to manufacturing overhead costs. The manufacturing overhead is an expense of production, even though the company is unable to trace the costs directly to each specific job. For example, the electricity needed to run production equipment typically is not easily traced to a particular product or job, yet it is still a cost of production. As a cost of production, the electricity—one type of manufacturing overhead—becomes a cost of the product and part of inventory costs until the product or job is sold. Fortunately, the accounting system keeps track of the manufacturing overhead, which is then applied to each individual job in the overhead allocation process.

ETHICAL CONSIDERATIONS

Ethical Job Order Costing

Job order costing requires the assignment of direct materials, direct labor, and overhead to each production unit. The primary focus on costs allows some leeway in recording amounts because the accountant assigns the costs. When jobs are billed on a cost-plus-fee basis, management may be tempted to overcharge the cost of the job. Cost-based contracts may include a guaranteed maximum, time and materials, or cost reimbursable contract. An example is the design and delivery of a corporate training program. The training company may charge for the hours worked by instructors in preparation and delivery of the course, plus a fee for the course materials.

One major issue in all of these contracts is adding too much overhead cost and fraudulent invoicing for unused materials or unperformed work by subcontractors. Management might be tempted to direct the accountant to avoid the appearance of going over the original estimate by manipulating job order costing. It is the accountant's job to ensure that the amounts recorded in the accounting system fairly represent the economic activity of the company, and the fair and proper allocation of costs.

Managers use the information in the manufacturing overhead account to estimate the overhead for the next fiscal period. This estimated overhead needs to be as close to the actual value as possible, so that the allocation of costs to individual products can be accurate and the sales price can be properly determined.

Properly allocating overhead to the individual jobs depends on finding a cost driver that provides a fair basis for the allocation. A **cost driver** is a production factor that causes a company to incur costs. An example would be a bakery that produces a line of apple pies that it markets to local restaurants. To make the pies requires that the bakery incur labor costs, so it is safe to say that pie production is a cost driver. It should also be safe to assume that the more pies made, the greater the number of labor hours experienced (also assuming that direct labor has not been replaced with a greater amount of automation). We assume, in this case, that one of the marketing advantages that the bakery advertises is 100% handmade pastries.

In traditional costing systems, the most common activities used as cost drivers are direct labor in dollars, direct labor in hours, or machine hours. Often in the production process, there is a correlation between an increase in the amount of direct labor used and an increase in the amount of manufacturing overhead incurred. If the company can demonstrate such a relationship, they then often allocate overhead based on a formula that reflects this relationship, such as the upcoming equation. In the case of the earlier bakery, the company could determine an overhead allocation amount based on each hour of direct labor or, in other cases, based on the ratio of anticipated total direct labor costs to total manufacturing overhead costs.

For example, assume that the company estimates total manufacturing overhead for the year to be $400,000 and the direct labor costs for the year to be $200,000. This relationship would lead to $2.00 of applied overhead for each $1.00 of direct labor incurred. The manufacturing overhead cost can be calculated and applied to each specific job, based on the direct labor costs. The formula that represents the overhead allocation relationship is shown, and it is the formula for overhead allocation:

$$\frac{\text{Estimated Annual Overhead Costs (\$)}}{\text{Expected Annual Activity (DL \$)}} = \text{Overhead Allocation Rate}$$

For example, Dinosaur Vinyl determined that the direct labor cost is the appropriate driver to use when establishing an overhead rate. The estimated annual overhead cost for Dinosaur Vinyl is $250,000. The total direct labor cost is estimated to be $100,000, so the allocation rate is computed as shown:

$$\frac{\text{Estimated Annual Overhead Costs (\$250,000)}}{\text{Expected Annual Activity (\$100,000)}} = \text{\$2.50 per \$1.00 Direct Labor Expense}$$

Since the direct labor expense for MAC001 is $66, the overhead allocated is $66 times the overhead application rate of $2.50 per direct labor dollar, or $165, as shown:

Overhead Allocated = $66 (Direct Labor) × $2.50 (Overhead Application Rate) = $165

Figure 4.14 shows the journal entry to record the overhead allocation.

JOURNAL			
Date	**Account**	**Debit**	**Credit**
4/18/17	Work in Process Inventory	165	
	Manufacturing Overhead		165
	To assign overhead to Job MAC001		

Work in Process Inventory	
4/2/2017	520
4/5/2017	30
4/14/2017	180
4/15/2017	36
4/18/2017	165

Figure 4.14 Overhead Allocation. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

THINK IT THROUGH

Franchise or Unique Venture?

You are deciding whether to purchase a pizza franchise or open your own restaurant specializing in pizza. List the expenses necessary to sell pizza and identify them as a fixed cost or variable cost; as a manufacturing cost or sales and administrative costs; and as a direct materials, direct labor, or overhead. For each overhead item, state whether it is an indirect material expense, indirect labor expense, or other. For each cost, identify its origination in a job order costing environment.

4.3 Use the Job Order Costing Method to Trace the Flow of Product Costs through the Inventory Accounts

Job order costing can be used for many different industries, and each industry maintains records for one or more inventory accounts. The manufacturing industry keeps track of the costs of each inventory account as the product is moved from raw materials inventory into work in process, through work in process, and into the finished goods inventory.

Conversely, typical companies in the merchandising industry sell products they do not manufacture and purchase their inventory in an already completed state. It is relatively easy to keep track of the inventory cost for a merchandising company through its application of first-in/first-out (FIFO), last-in/last-out (LIFO), weighted average, or specific identification inventory techniques on the unsold items. The primary difference in the four methods is the valuation of the cost of goods sold and the remaining ending inventory valuation, assuming that the company did not sell 100% of the inventory that they had available for sale during a given period. Companies are allowed to choose the method that they feel best represents their cost flows through their cost of goods sold and their ending inventory balances.

Not all service companies have inventory, and those companies do not have direct materials nor do they consider their work in process their inventory, since their final product is often an intangible asset, such as a legal document or tax return. Regardless of whether the service has inventory accounts, service companies all keep track of the direct labor and overhead costs incurred while completing each job in progress.

Inventory is an asset reported on the balance sheet, and each company needs to maintain accurate records for the cost of each type of inventory: raw materials inventory, work in process inventory, and finished goods inventory. All three costs are computed in a similar manner. You can see in Figure 4.15 that the general format is the same for maintaining all accounts, whether the company uses a job order, process, or hybrid cost system.

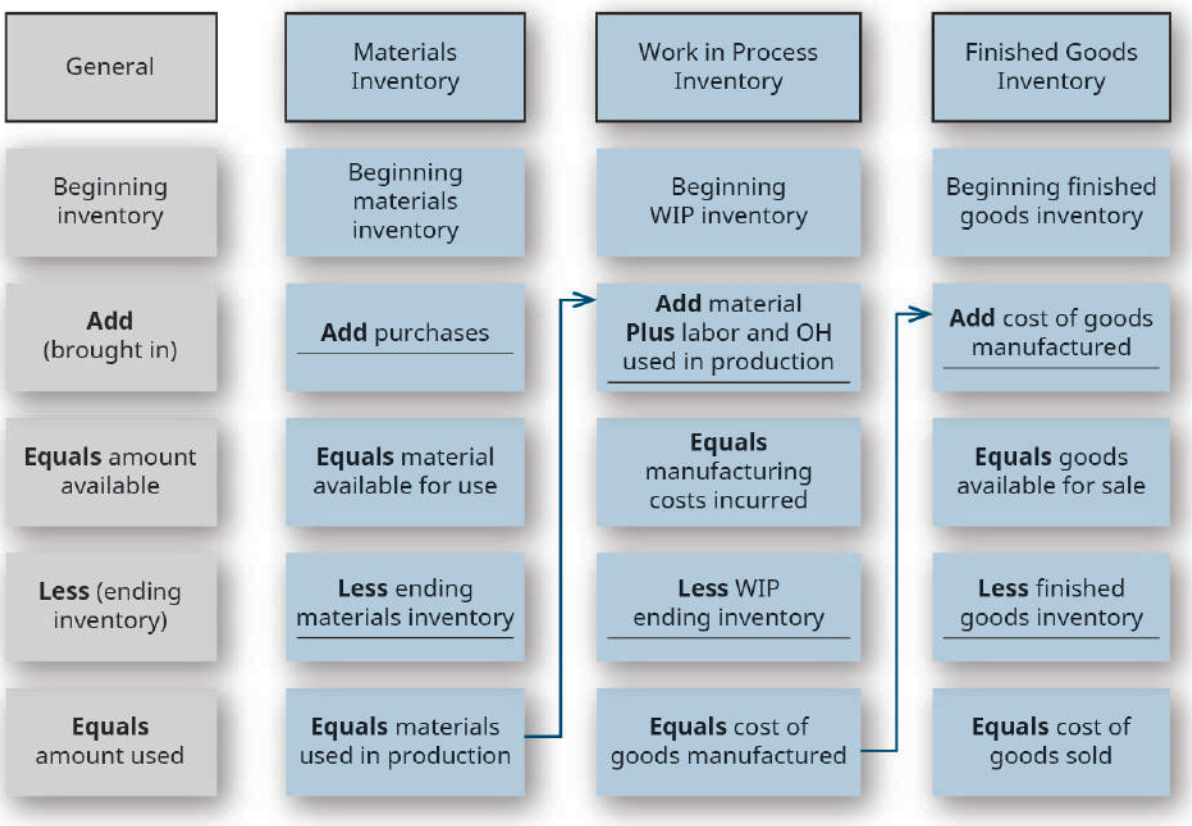


Figure 4.15 Cost of Inventory Accounts. Inventory is accounted for across the flow through production. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Each inventory account starts with a beginning balance at the start of an accounting period. During the period, if additional inventory is purchased, the new inventory amount is added to the beginning balance to calculate the total inventory available for use or sale. The ending inventory balance at the end of the accounting period can then be subtracted from the inventory available for use, and the total represents the cost of the inventory used during the period.

For example, if the beginning inventory balance were $400, and the company bought an additional $1,000, it would have $1,400 of inventory available for use. If the ending inventory balance were $500, the amount of inventory used during the period would be $900 ($400 + $1,000 = $1,400 – $500 = $900).

Raw Materials Inventory

Raw materials inventory is the total cost of materials that will be used in the production process. Usually, several accounts make up the raw materials inventory, and these can be actual accounts or accounts subsidiary to the general raw materials inventory account. In our example, Dinosaur Vinyl has several raw materials accounts: vinyl, red ink, black ink, gold ink, grommets, and wood.

Within the raw materials inventory account, purchases increase the inventory, whereas raw materials sent into production reduce it. It is easy to reconcile the amount of ending inventory and the cost of direct materials used in production, since the materials requisition form (Figure 4.7) keeps track of the inventory requested and sent into each specific job. Since the costs are transferred with production, the calculation shows the

amount of materials used in production:

Beginning materials inventory
+ Net materials purchased
= Materials available for use
− Ending raw materials inventory
= Materials used in production

Note: this equation can be easily modified with algebra to compute the cost of the ending raw materials inventory.

Materials available for use
− Materials used in production
= Ending raw materials inventory

Work in Process Inventory

In a job order cost system, the balance in the work in process inventory account is continually updated as job costs are recorded and is the total of all unfinished jobs, as shown on the individual job cost sheets.

The production cycle is a continuous cycle that begins with raw materials being transferred to work in process, moving through production, and ending as finished goods inventory. Typically, as goods are being produced, additional jobs are being started and finished, and the work in process inventory includes unit costs of jobs still in production at the end of the accounting period. At the end of the accounting cycle, there will be jobs that remain unfinished in the production cycle, and these represent the work in process inventory. The costs on the job order cost sheet help reconcile the cost of the items transferred to the finished goods inventory and the cost of the work in process inventory.

For example, Dinosaur Vinyl has completed Job MAC001. The total cost of $931 is transferred to the finished goods inventory:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
	Finished Goods Inventory	931	
	Work in Process Inventory		931
	To transfer Job MAC001 to Finished Goods		

At this point, we need to examine an important component of the costing process. The **cost of goods manufactured** (COGM) is the costs of all of the units that a company completed and transferred to the finished goods inventory during an accounting period. Obviously, the cost of goods manufactured is not just a single number that can be pulled from one location. We have to look at all costs included in the manufacturing process to determine the cost of goods manufactured. The calculation begins with the beginning balance in the work in process inventory, incorporates the new production costs incurred during the current period (typically a year), and then subtracts the ending balance in the work in process inventory since these costs will be included in the subsequent accounting period's cost of goods manufactured, as shown:

Beginning work in process inventory
+ Current manufacturing costs
Direct materials used in production
Direct labor
Overhead
= Manufacturing costs incurred
– Ending work in process inventory
= Cost of goods manufactured during the period (completed)

Note: this equation can be easily modified with algebra to compute the cost of the ending work in process inventory.

Manufacturing costs incurred
– Cost of goods manufactured
= Ending work in process inventory

Finished Goods Inventory

After each job has been completed and overhead has been applied, the product is transferred to the finished goods inventory where it stays until it is sold. As each job is transferred, the costs are summarized and transferred as well, and the job cost sheet is completed to show the actual production cost of the product and the sales price of the items produced.

A job order cost system continually updates each job cost sheet as materials, labor, and overhead are added. As a result, all inventory accounts are constantly maintained. The materials inventory balance is continually updated, as materials are purchased and requisitioned for individual jobs. The work in process inventory and finished goods inventory are master accounts, and their balances are determined by adding the total of the job cost sheets. The total of the incomplete jobs becomes the total work in process inventory, and the total of the completed and unsold jobs becomes the total of the finished goods inventory.

Similar to the raw materials and work in process inventories, the cost of goods sold can be calculated as shown:

Beginning finished goods
+ Cost of goods manufactured
= Goods available for sale
– Ending finished goods inventory
= Cost of goods sold

Note: this equation can be easily modified with algebra to compute the cost of the finished goods inventory.

Cost of goods available for sale
– Cost of goods sold
= Ending finished goods inventory

Cost of Goods Sold

The **cost of goods sold** is the manufacturing cost of the items sold during the period. It is calculated by adding the beginning finished goods inventory and the cost of goods manufactured to arrive at the cost of goods available for sale. The cost of goods available for sale less the ending inventory results in the cost of goods sold.

In our example, when the sale has occurred, the goods are transferred to the buyer, and the product is transferred from the finished goods inventory to the cost of goods sold. A corresponding entry is also made to record the sale. Dinosaur Vinyl's sales price for Job MAC001 was $2,000, and its cost of goods sold was $931:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
	Cost of Goods Sold	931	
	Finished Goods Inventory		931
	To transfer sold Job MAC001		
	Accounts Receivable	2,000	
	Sales		2,000
	To record sale of Job MAC001		

Figure 4.16 shows the flow to cost of goods sold.

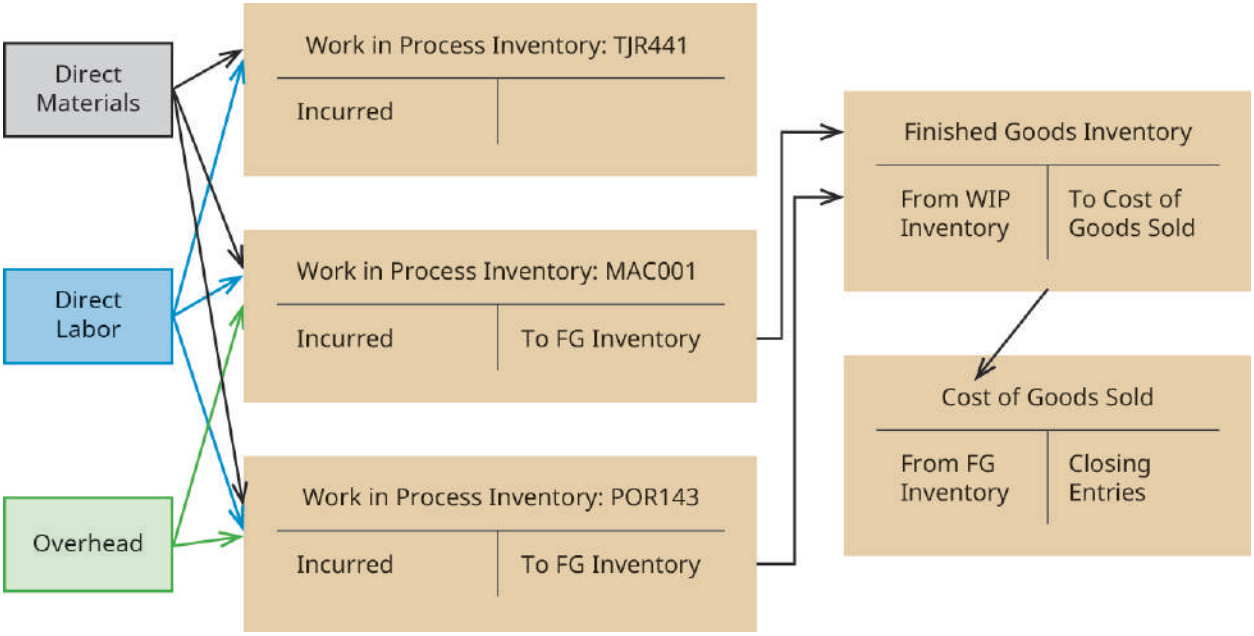
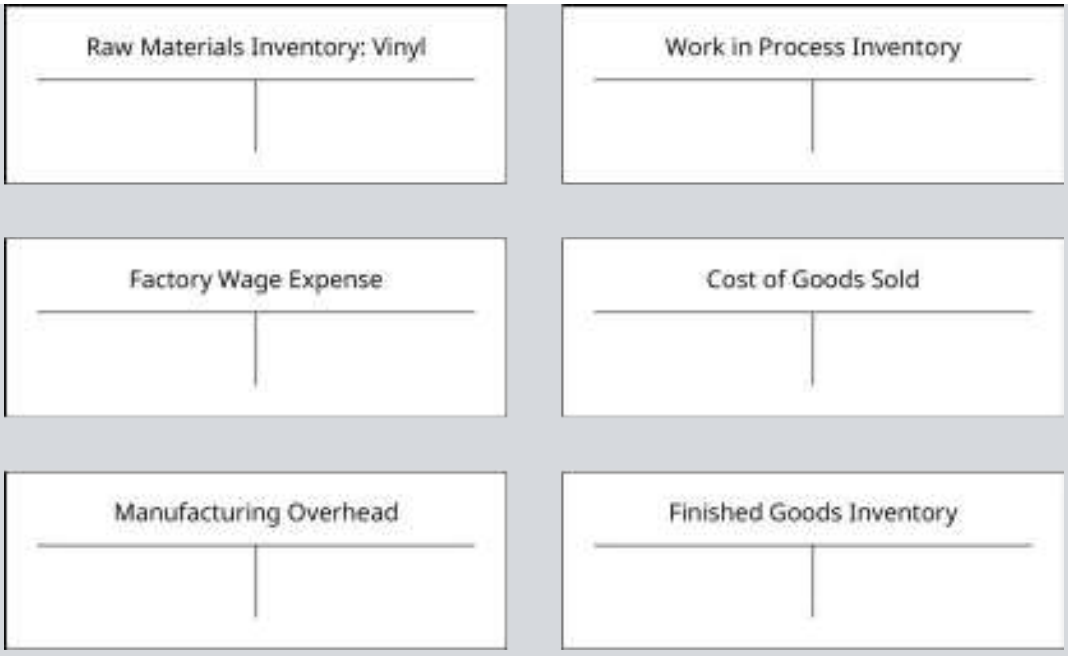


Figure 4.16 Flow of Manufacturing Costs under the Job Order Costing Method. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

YOUR TURN

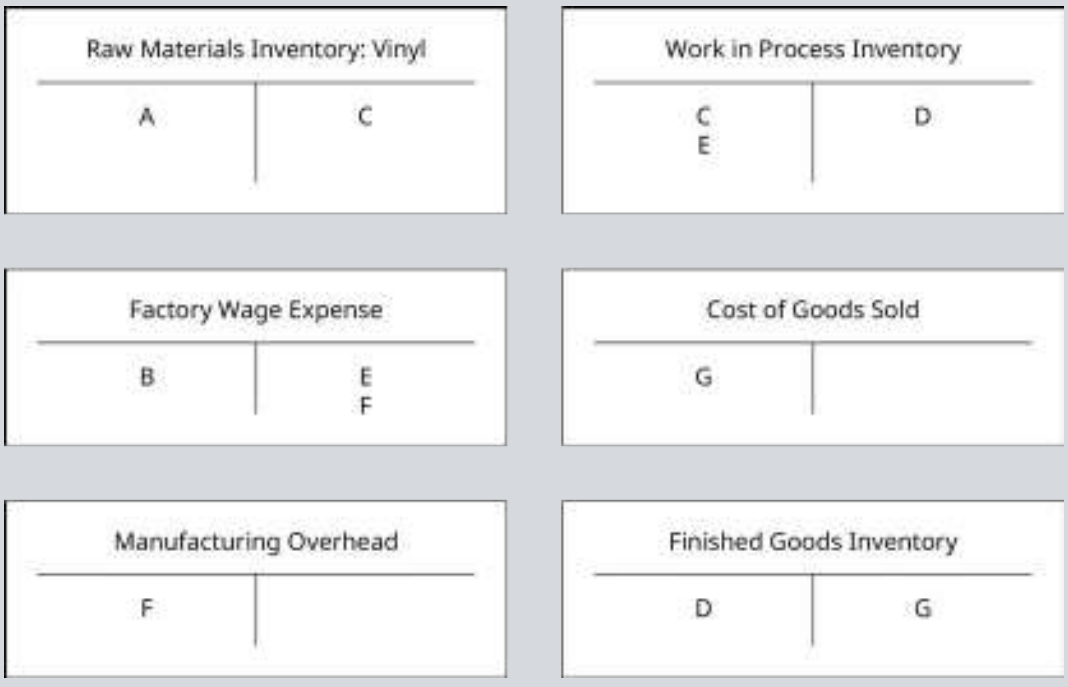
Tracking the Flow with Selected T-Accounts

Use the transaction letters to show the flow in and out of the T-accounts. Note: some items may be used more than once. Also, not every possible T-account entry is required in this exercise. For example, for the purchase of raw materials, the credit entry for either cash or accounts payable is not required.



A. Purchase raw materials inventory
B. Factory wage expense incurred
C. Issue raw materials inventory to Job P33
D. Factory wage allocated to Job P33
E. Factory wage allocated to overhead
F. Job P33 completed
G. Job P33 sold

Solution



4.4 Compute a Predetermined Overhead Rate and Apply Overhead to Production

Job order cost systems maintain the actual direct materials and direct labor for each individual job. Since production consists of overhead—indirect materials, indirect labor, and other overhead—we need a methodology for applying that overhead. Unfortunately, the nature of indirect material, indirect labor, and other overhead expenses makes it impossible to determine the exact amount of overhead for each specific job. For example, how do you know the cost of electricity and heat for manufacturing one job? And, if you did, is it fair to say products manufactured in January are more expensive than the same product manufactured in March because of heat expense?

Fundamental Characteristics of the Overhead Determination Environment

Added to these issues is the nature of establishing an overhead rate, which is often completed months before being applied to specific jobs. Establishing the overhead allocation rate first requires management to identify which expenses they consider manufacturing overhead and then to estimate the manufacturing overhead for the next year. Manufacturing overhead costs include all manufacturing costs except for direct materials and direct labor. Therefore, in order to estimate manufacturing overhead, management must estimate the future purchase prices of dozens, or sometimes hundreds, of individual components, such as utilities, raw materials, contract labor, or diesel fuel. Estimating overhead costs is difficult because many costs fluctuate significantly from when the overhead allocation rate is established to when its actual application occurs during the production process. You can envision the potential problems in creating an overhead allocation rate within these circumstances.

Before demonstrating the calculation of a predetermined overhead allocation rate, let’s review the basic principles of revenue recognition and expense. In accounting, there are three ways to recognize expenses:

1. Direct relationship between the expense and the associated revenue. This method is used for many costs, and the expense is recognized when a direct relationship exists. For example, sales commission expenses can be directly traced to product sales, and a commission expense is recorded when a sale is made.
2. Systematic and rational allocation of expenses. This approach is used when costs exist and there is an expected benefit, even though the costs cannot be directly traced to the benefit. The assigning of expenses to a product or time period must be done in an objective and consistent manner. Examples of such expenses would include equipment rental for a factory or property insurance for the factory.
   Both of these expenses (direct relationship and systematic and rational) are also examples of the types of expenses that compose manufacturing overhead. An example of the current revenue recognition principle is a company paying $4,800 a year for property insurance. Since production rates can vary month to month, most producers would allocate $400 each month for property insurance, and this cost would be incorporated into the total overhead costs anticipated when estimating a manufacturing overhead allocation rate.
   The direct benefit is that the product will be sold and the revenue recognized. The overhead is associated but cannot be directly traced to an individual product, so the overhead expenses need to be assigned in a systematic and rational manner.
3. Immediate recognition. This method is used when expenses exist but there is no direct expected benefit. In this case, the expense is recognized immediately. For example, research and development costs are necessary expenses but cannot be traced to a specific product, so they are expensed as incurred.

The allocation of overhead to the cost of the product is also recognized in a systematic and rational manner. The expected overhead is estimated, and an allocation system is determined. The actual costs are accumulated in a manufacturing overhead account. The overhead is then applied to the cost of the product from the manufacturing overhead account. The overhead used in the allocation is an estimate due to the timing considerations already discussed.

The application rate that will be used in a coming period, such as the next year, is often estimated months before the actual overhead costs are experienced. Often, the actual overhead costs experienced in the coming period are higher or lower than those budgeted when the estimated overhead rate or rates were determined. At this point, do not be concerned about the accuracy of the future financial statements that will be created using these estimated overhead allocation rates. You will learn in Determine and Disposed of Underapplied or Overapplied Overhead how to adjust for the difference between the allocated amount and the actual amount.

Despite improvements in technology and information flow, using the actual overhead to calculate the application rate is usually not possible because the actual overhead information is available too late for management to make decisions. Also, as you will learn, the results of the actual overhead costs, if they were available, could be misleading. Therefore, most manufacturing companies use predetermined overhead rates for these reasons:

- Overhead costs are not uniform throughout the year. An example is electricity costs that vary by weather and time of day.
- Some overhead costs are fixed, and the cost per unit varies with production. For example, rent may be $1,000 per month. If 500 units were made during one month, and 2,000 units were made the next month, the cost per unit would vary from $2 per unit to $0.50 per unit.
- The total number of units produced varies and is often known sooner than the cost of overhead. For example, a company may know it will have a contract to produce 100 custom units long before it knows the utility costs for the next year.

As previously described, a predetermined overhead rate is established prior to the beginning of the fiscal year and typically is not changed during the year. The predetermined rate is calculated as shown and is used to apply overhead costs to work in process:

$$\frac{\text{Estimated (budgeted) Overhead Cost}}{\text{Expected (budgeted) Level of Activity}} = \text{Predetermined Overhead Rate}$$

CONCEPTS IN PRACTICE

Overhead in the Movie Industry

The movie industry uses job order costing, and studios need to allocate overhead to each movie. Their amount of allocated overhead is not publicly known because while publications share how much money a movie has produced in ticket sales, it is rare that the actual expenses are released to the public.

It has been speculated that *Star Wars: The Force Awakens* cost $201,000,000, with $30,000,000 considered overhead. Studios have estimated that the higher the movie expenses, the more studio overhead is required, and it has also been estimated that 10% of the total cost is assigned to studio overhead.

Determining Estimated Overhead Cost

The estimated or budgeted overhead is the amount of overhead determined during the budgeting process and consists of manufacturing costs but, as you have learned, excludes direct materials and direct labor. Examples of manufacturing overhead costs include indirect materials, indirect labor, manufacturing utilities, and manufacturing equipment depreciation. Another way to view it is overhead costs are those production costs that are not categorized as direct materials or direct labor.

Selecting an Estimated Activity Base

As you have learned, the overhead needs to be allocated to the manufactured product in a systematic and rational manner. This allocation process depends on the use of a cost driver, which drives the production activity's cost. Examples can include labor hours incurred, labor costs paid, amounts of materials used in production, units produced, or any other activity that has a cause-and-effect relationship with incurred costs.

Direct labor hours, direct labor dollars, or machine hours are often chosen as the allocation base because those costs are associated with each product, and as the activity increases, so does the manufacturing overhead. In other words, the products that involve more direct labor hours, direct labor dollars, or machine hours also increase utility expenses, supervisor time (and thus indirect labor), equipment usage and the related depreciation expense, and so forth.

Traditionally, direct labor hours were used as the activity base, but technology continually decreases the amount of direct labor used in production, and machine hours or units produced have become more common activity bases. Management analyzes the costs and selects the activity as the **estimated activity base** because it drives the overhead costs of the unit.

Computing a Predetermined Overhead Rate

Dinosaur Vinyl uses the expenses from the prior two years to estimate the overhead for the upcoming year to be $250,000, as shown in Figure 4.17.

	Annual Estimate
Indirect labor	$ 5,000
Indirect materials	20,000
Utilities	75,000
Depreciation	90,000
Insurance	35,000
Interest expense	25,000
	$250,000

Figure 4.17 Dinosaur Vinyl's Estimated Overhead. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Dinosaur Vinyl also used its payroll records to estimate that it will spend $100,000 on direct labor. Using the predetermined overhead rate calculation, the overhead rate is $2.50 per direct labor dollar:

$$\frac{\text{Estimated (budgeted) Overhead Cost } (\$250{,}000)}{\text{Expected (budgeted) Level of Activity } (\$100{,}000)} = \$2.50 \text{ per Direct Labor Dollar}$$

Over the fiscal year, the actual costs are recorded as debits into the account called manufacturing overhead. When the overhead is applied to the jobs, the amount is first calculated using the application rate. If the total

labor paid for the job is $66, the overhead applied to the job is $2.50 times that amount, or $165. The entry to record the overhead for Job MAC001 is:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
	Work in Process Inventory	165	
	Manufacturing Overhead		165
	To apply overhead to Job MAC001		

That amount is added to the cost of the job, and the amount in the manufacturing overhead account is reduced by the same amount. At the end of the year, the amount of overhead estimated and applied should be close, although it is rare for the applied amount to exactly equal the actual overhead. For example, Figure 4.18 shows the monthly costs, the annual actual cost, and the estimated overhead for Dinosaur Vinyl for the year. While the total amounts are close to each other, they are not exact.

	Monthly Actual	Annual Amount	Annual Estimate
Indirect labor	$ 375	$ 4,500	$ 5,000
Indirect materials	1,500	18,000	20,000
Utilities	7,000	84,000	75,000
Depreciation	7,500	90,000	90,000
Insurance	2,917	35,000	35,000
Interest expense	2,083	25,000	25,000
	$21,000	$256,500	$250,000

Figure 4.18 Dinosaur Vinyl's Actual and Estimated Overhead. While the total amounts are close to each other, they are not an exact match. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Calculating Manufacturing Overhead Cost for an Individual Job

Figure 4.18 shows the monthly manufacturing actual overhead recorded by Dinosaur Vinyl. As explained previously, the overhead is allocated to the individual jobs at the predetermined overhead rate of $2.50 per direct labor dollar when the jobs are complete. When Job MAC001 is completed, overhead is $165, computed as $2.50 times the $66 of direct labor, with the total job cost of $931, which includes $700 for direct materials, $66 for direct labor, and $165 for manufacturing overhead.

LINK TO LEARNING

Companies need to make certain the sales price is higher than the prime costs and the overhead costs. This can be a difficult task in industries in which overhead costs change. In some industries, the company has no control over the costs it must pay, like tire disposal fees. To ensure that the company is profitable, an additional cost is added and the price is modified as necessary. In this example, the guarantee offered by Discount Tire (https://openstax.org/l/50tireguarantee) does not include the disposal fee in overhead and increases that fee as necessary.

4.5 Compute the Cost of a Job Using Job Order Costing

To summarize the job order cost system, the cost of each job includes direct materials, direct labor, and manufacturing overhead. While the product is in production, the direct materials and direct labor costs are included in the work in process inventory. The direct materials are requested by the production department, and the direct material cost is directly attached to each individual job, as the materials are released from raw materials inventory. The cost of direct labor is recorded by the employees and assigned to each individual job. When the allocation base is known, usually when the product is completed, the overhead is allocated to the product on the basis of the predetermined overhead rate.

LINK TO LEARNING

The construction industry typically uses job order costing and accounts for its costing (https://openstax.org/l/50construction) in a manner similar to the businesses profiled in this chapter.

Determining the Costs of an Individual Job Using Job Order Costing

When a job is completed, the costs of the job—the direct materials, direct labor, and manufacturing overhead—are totaled on the job cost sheet, and the total amount is transferred to finished goods at the same time the product is transferred, either physically or legally, such as in the case of a home built by a contractor. Finally, when the product is sold, the sale is recorded at the sale price, while the cost is transferred from finished goods inventory to the cost of goods sold expense account. Figure 4.19 shows the flow of costs from raw materials inventory to cost of goods sold.

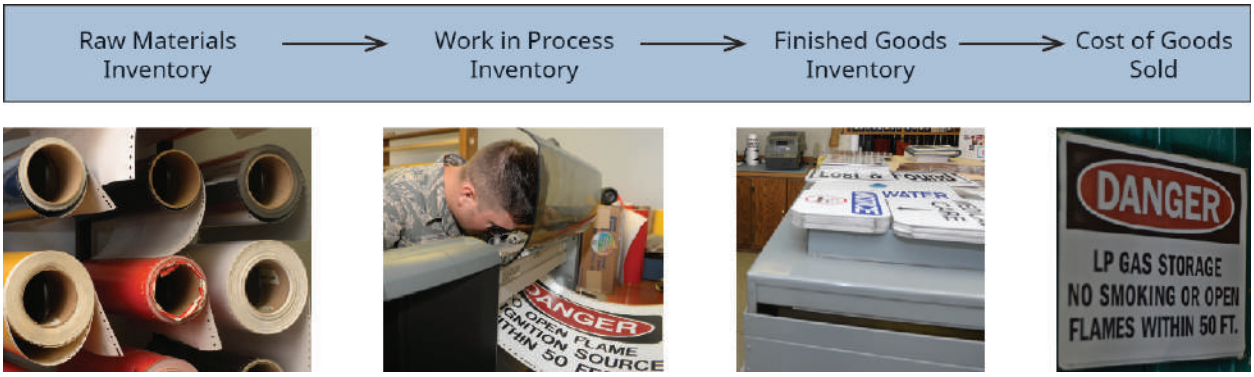


Figure 4.19 Flow of Costs during Production and Ultimate Sale or Transfer of Ownership. (credit "Raw Materials Inventory," "Work in Process Inventory," "Finished Goods Inventory": modifications of "160810-F-UY190-027.JPG," "160810-F-UY190-073.JPG," and "160810-F-UY190-105.JPG" by Jessica Weissman, Minot Air Force Base Public Affairs, Public Domain; credit Cost of Goods Sold": "Rustic Sign" by Grace Byrd/Flickr, CC BY 2.0)

At all points in the process, the work in process should include the cost of direct materials and direct labor. When the job is completed and overhead assigned, the overhead allocation increases the cost of the work in process inventory. The cost of each individual job is maintained on a job cost sheet, and the total of all the work in process job cost sheets equals the work in process inventory and the statement of cost of goods

manufactured, as you have learned.

A job cost sheet is a subsidiary ledger that identifies the individual costs for each job. Figure 4.20 shows the job cost sheet for Job MAC001.

JOB COST SHEET
Dinosaur Vinyl, Inc.

Job No.: 5416	**Customer No.:** 2501723
Customer: Macs & Cheese	**Date Started:** Dec. 22, 2018
Units Ordered: 1	**Date Completed:** Feb. 22, 2019

Direct Material	Units	Price	Amount
Vinyl	1	$300	$ 300
Black printing ink	2	50	100
Red printing ink	1	60	60
Gold printing ink	1	60	60
Grommets	12	10	120
Framing wood	40	1.5	60
Total Direct Materials			$ 700
Direct Labor	**Hours**	**Wage Rate**	**Amount**
Material Handler	1	$ 15	$ 15
Print Technician	1	15	15
Production Assistants	2	18	36
Total Direct Labor			$ 66
Manufacturing Overhead	**Base Units**	**Rate**	**Amount**
Direct Labor Cost	66	$ 2.5	$ 165
Total Manufacturing Overhead			$ 165
Total Job Cost			$ 931
Total Revenue			$2,000

Figure 4.20 Job Cost Sheet for Job MAC001. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Sample Cost Information for Dinosaur Vinyl

Dinosaur Vinyl worked on three jobs during the month: POR143, MAC001, and TRJ441, and a fourth Job SWM505 had been finished and moved to the finished goods inventory account during the previous month.

At the beginning of the month, the company had a beginning raw materials inventory balance of $2,500, and during the month, it purchased an additional $10,500, giving it a total of $13,000 in raw materials available for use in production.

The following example will examine four different production jobs. Each of the four will be at beginning stages at either the beginning of the current month or the end of the current month.

1. Job POR 143: This job was the only work in process inventory at the beginning of the current month, and it had $1,000 in direct material costs, and $0 of direct labor costs already allocated to the work in process inventory. During the current month, additional direct materials of $200 and direct labor of $150 were added to POR143. An overhead cost of $375 was applied to POR143 at the predetermined overhead rate of $2.50 per direct labor dollar. It was finished during the month and transferred to the finished goods inventory. The sale was not finalized during the month, so it continues to be part of the finished goods inventory.

2. Job MAC 001: This job was started and completed during the month. Since the job began in and was completed in the same month, there was no beginning balance in the work in process inventory. During the month it incurred $700 in direct materials costs, $66 in direct labor, and $165 of overhead applied to the job before it was transferred to the finished goods inventory upon completion. The sale was finalized during the month at a sale price of $2,000, so the costs were transferred from finished goods inventory to cost of goods sold.
3. Job TRJ441: This job was started during the current month. Its costs consist of $500 in direct material cost, $150 in direct labor expenses, and $375 in applied overhead. The job remains in the work in process inventory awaiting assembly.
4. Job SWM505: At the beginning of the month, this job was completed and already in the finished goods inventory at a cost of $1,531. Since it was completed, it did not incur any additional costs in the current month. It was sold during the month for $3,500, and the costs were transferred from the finished goods inventory to cost of goods sold.

The cost of raw materials used is calculated as shown:

Beginning RM inventory	$ 2,500
Purchases	10,500
Materials available for use	13,000
Ending RM inventory	11,600
Materials used in production	$ 1,400

The individual job cost sheets show the $1,400 worth of materials used in production:

POR143	$ 200
MAC001	700
TJR441	500
	$1,400

The cost of goods manufactured is accounted for as shown:

	POR143	MAC001	TJR441	Total
Materials added	$200	$700	$ 500	$1,400
Labor added	150	66	150	366
Overhead applied	375	165	375	915
Total added during month	$725	$931	$1,025	$2,681
	POR143	**MAC001**	**TJR441**	**Total**
Beginning WIP inventory	$1,000	$ 0	$ 0	$1,000
Materials, labor, & OH added	725	931	1,025	2,681
Manufacturing costs incurred	1,725	931	1,025	3,681
Ending WIP inventory	0	0	1,025	1,025
Cost of Goods Manufactured	$1,725	$931	$ 0	$2,656

Notice the costs for Job TJR441 are included in the work in process inventory, whereas the costs for POR143 and MAC001 were transferred to the cost of goods manufactured. The costs of the jobs transferred are shown in the cost of goods sold and the finished goods inventory:

	SWM505	POR143	MAC001	TJR441	Total
Beginning FG inventory	$1,531	$ 0	$ 0	$0	$1,531
Cost of Goods Manufactured	0	1,725	931	0	2,656
Goods Available for Sale	1,531	1,725	931	0	4,187
Ending FG inventory	0	1,725	0	0	1,725
Cost of Goods Sold	$1,531	$ 0	$931	$0	$2,462

Mechanics of Job Order Costing for Dinosaur Vinyl

The amounts in raw materials, work in process, and finished goods inventories compose the total cost for each account, whereas the job cost sheets contain the costs for each individual job. A summary of the jobs for Dinosaur Vinyl is given in Figure 4.21.

	SWM505	POR143	MAC001	TJR441	Total
Beginning balance	$1,531	$1,000	$ 0	$ 0	$2,531
Direct materials		200	700	500	1,400
Direct labor		150	66	150	366
Overhead applied		375	165	375	915
Total cost	$1,531	$1,725	$931	$1,025	$5,212
Status	Sold	Finished	Sold	Unfinished	
Final account location	COGS	FG	COGS	WIP	

Beginning WIP

Total for WIP, FG, & COGS

Figure 4.21 Summary of Dinosaur Vinyl's Jobs during the Year. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

THINK IT THROUGH

Allocating Costs

A manufacturing company has incurred these costs:

Purchase raw materials inventory	$15,000
Issue raw materials inventory to Job A	3,000
Factory wage expense incurred	23,000
Factory wage allocated to Job A	2,000
Factory wage allocated to overhead	500
Manufacturing overhead incurred	7,500
Manufacturing overhead allocated to Job A	1,000

What is the cost allocated to Job A? For any costs not used, explain why they are not used.

4.6 Determine and Dispose of Underapplied or Overapplied Overhead

As you've learned, the actual overhead incurred during the year is rarely equal to the amount that was applied to the individual jobs. Thus, at year-end, the manufacturing overhead account often has a balance, indicating overhead was either overapplied or underapplied.

If, at the end of the term, there is a debit balance in manufacturing overhead, the overhead is considered **underapplied overhead**. A debit balance in manufacturing overhead shows either that not enough overhead was applied to the individual jobs or overhead was underapplied. If, at the end of the term, there is a credit balance in manufacturing overhead, more overhead was applied to jobs than was actually incurred. This shows the actual amount was **overapplied overhead**.

The actual overhead costs are recorded through a debit to manufacturing overhead. The same account is credited when overhead is applied to the individual jobs in production, as shown:

Manufacturing Overhead	
Actual Cost	Applied Costs

Since the overhead is first recorded in the manufacturing overhead account, then applied to the individual jobs, traced through finished goods inventory, and eventually transferred to cost of goods sold, the year-end balance is eliminated through an adjusting entry, offsetting the cost of goods sold. If manufacturing overhead has a debit balance, the overhead is underapplied, and the resulting amount in cost of goods sold is understated. The adjusting entry is:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
	Cost of Goods Sold Manufacturing Overhead	$$$	 $$$

If manufacturing overhead has a credit balance, the overhead is overapplied, and the resulting amount in cost of goods sold is overstated. The adjusting entry is:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
	Manufacturing Overhead Cost of Goods Sold *Application of overhead to Cost of Goods Sold*	$$$	 $$$

Returning to our example, at the end of the year, Dinosaur Vinyl had actual overhead expenses of $256,500 and applied overhead expenses of $250,000, as shown:

Manufacturing Overhead	
Actual Costs $256,500	Applied Costs $250,000

Since manufacturing overhead has a debit balance, it is underapplied, as it has not been completely allocated. The adjusting journal entry is:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
	Cost of Goods Sold Manufacturing Overhead *Application of underapplied overhead to Cost of Goods Sold*	6,500	6,500

If the overhead was overapplied, and the actual overhead was $248,000 and the applied overhead was $250,000, the entry would be:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
	Manufacturing Overhead Cost of Goods Sold *Application of overapplied overhead to Cost of Goods Sold*	2,000	2,000

To adjust for overapplied or underapplied manufacturing overhead, some companies have a more complicated, three-part allocation to work in process, finished goods, and cost of goods sold. This method is typically used in the event of larger variances in their balances or in bigger companies. (You will learn more about this in future cost or advanced managerial accounting courses.)

YOUR TURN

Kraken Boardsports

Figure 4.22 (credit: modification of images provided courtesy of Kraken Boardsports, CC BY 4.0)

Kraken Boardsports manufactures winches for snow and ski boarders to snow ski without a mountain or water ski without a lake (Figure 4.22). End-of-year data show these overhead expenses:

Indirect materials	$25,000
Indirect labor	31,750
Depreciation of factory equipment	50,000
Factory utility expenses	17,500
Factory supervisor salaries	85,000

Kraken Boardsports had 6,240 direct labor hours for the year and assigns overhead to the various jobs at the rate of $33.50 per direct labor hour.

How much overhead was overapplied or underapplied during the year? What would be the journal entry to adjust manufacturing overhead?

Solution

The total overhead incurred is the total of:

Indirect materials	$ 25,000
Indirect labor	31,750
Depreciation of factory equipment	50,000
Factory utility expenses	17,500
Supervisor salaries	85,000
Actual overhead incurred	$209,250

The total overhead applied is $209,040, which is calculated as:

$33.50/direct labor hours × 6,240 direct labor hours.

The balance in manufacturing overhead is a debit balance of $210:

	Manufacturing Overhead	
	Actual Costs	Applied Costs
	$209,250	$209,040
Balance	210	

The adjusting journal entry is:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
	Cost of Goods Sold	210	
	Manufacturing Overhead		210

LINK TO LEARNING

Job order costing and overhead allocation are not new methods of accounting and apply to governmental units as well. See it applied in this 1992 report on Accounting for Shipyard Costs and Nuclear Waste Disposal Plans (https://openstax.org/l/50shipyard) from the United States General Accounting Office.

4.7 Prepare Journal Entries for a Job Order Cost System

Although you have seen the job order costing system using both T-accounts and job cost sheets, it is necessary to understand how these transactions are recorded in the company's general ledger.

Journal Entries to Move Direct Materials, Direct Labor, and Overhead into Work in Process

Dinosaur Vinyl keeps track of its inventory and orders additional inventory to have on hand when the production department requests it. This inventory is not associated with any particular job, and the purchases stay in raw materials inventory until assigned to a specific job. For example, Dinosaur Vinyl purchased an additional $10,000 of vinyl and $500 of black ink to complete Macs & Cheese's billboard. If the purchase is made on account, the entry is as shown:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
	Raw Materials Inventory: Vinyl	10,000	
	Raw Materials Inventory: Black ink	500	
	Accounts Payable		10,500
	To record purchase of vinyl and ink inventory		

As shown in Figure 4.20, for the production process for job MAC001, the job supervisor submitted a materials requisition form for $300 in vinyl, $100 in black ink, $60 in red ink, and $60 in gold ink. For the finishing process for Job MAC001, $120 in grommets and $60 in finishing wood were requisitioned. The entry to reflect these actions is:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
	Work in Process Inventory	700	
	Raw Materials Inventory: Vinyl		300
	Raw Materials Inventory: Black ink		100
	Raw Materials Inventory: Red ink		60
	Raw Materials Inventory: Gold ink		60
	Raw Materials Inventory: Grommets		120
	Raw Materials Inventory: Finishing wood		60
	To record requisition of vinyl and ink inventory		

The production department employees work on the sign and send it over to the finishing/assembly department when they have completed their portion of the job.

The direct cost of factory labor includes the direct wages paid to the employees and all other payroll costs associated with that labor. Typically, this includes wages and the payroll taxes and fringe benefits directly tied to those wages. The accounting system needs to keep track of the labor and the other related expenses assigned to a particular job. These records are typically kept in a time ticket submitted by employees daily.

On April 10, the labor time sheet totaling $30 is recorded for Job MAC001 through this entry:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
	Work in Process Inventory (MAC001)	30	
	Factory Wages Payable		30
	To record labor for Job MAC001		

The assembly personnel in the finishing/assembly department complete Job MAC001 in two hours. The labor is recorded as shown:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
	Work in Process Inventory	36	
	Factory Wages Payable		36
	To record labor for Job MAC001		

Indirect materials also have a materials requisition form, but the costs are recorded differently. They are first transferred into manufacturing overhead and then allocated to work in process. The entry to record the indirect material is to debit manufacturing overhead and credit raw materials inventory.

Indirect labor records are also maintained through time tickets, although such work is not directly traceable to a specific job. The difference between direct labor and indirect labor is that the indirect labor records the debit to manufacturing overhead while the credit is to factory wages payable.

Dinosaur Vinyl's time tickets indicate that $4,000 in indirect labor costs were incurred during the period. The entry is:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
	Manufacturing Overhead	4,000	
	Factory wages payable		4,000
	To record indirect labor for WIP inventories		

Dinosaur Vinyl also records the actual overhead incurred. As shown in Figure 4.18, manufacturing overhead costs of $21,000 were incurred. The entry to record these expenses increases the amount of overhead in the manufacturing overhead account. The entry is:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
	Manufacturing Overhead	21,000	
	Supplies Inventory		1,500
	Utilities Payable		7,000
	Accumulated Depreciation		7,500
	Prepaid Insurance		2,917
	Interest Payable		2,083
	To record April's overhead expenses		

The amount of overhead applied to Job MAC001 is $165. The process of determining the manufacturing overhead calculation rate was explained and demonstrated in Accounting for Manufacturing Overhead. The journal entry to record the manufacturing overhead for Job MAC001 is:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
	Work in Process Inventory	165	
	Manufacturing Overhead		165
	To apply overhead to Job MAC001		

Journal Entry to Move Work in Process Costs into Finished Goods

When each job and job order cost sheet have been completed, an entry is made to transfer the total cost from

the work in process inventory to the finished goods inventory. The total cost of the product for Job MAC001 is $931 and the entry is:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
	Finished Goods Inventory	931	
	Work in Process Inventory		931
	To recognize completion of Job MAC001		

Journal Entries to Move Finished Goods into Cost of Goods Sold

When the sale has occurred, the goods are transferred to the buyer. The product is transferred from the finished goods inventory to cost of goods sold. A corresponding entry is also made to record the sale. The sign for Job MAC001 had a sales price of $2,000 and a cost of $931. These are the entries to record the transfer of goods and sale to the buyer:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
	Cost of Goods Sold	931	
	Finished Goods Inventory		931
	To recognize sale of Job MAC001		
	Accounts Receivable	2,000	
	Sales		2,000
	To recognize sale of Job MAC001		

The resulting accounting is shown on the company's income statement:

DINOSAUR VINYL, INC. Income Statement	
Sales	$2,000
Cost of Goods Sold	931
Gross profit	$1,069

THINK IT THROUGH

Ongoing Overapplied Overhead

At the end of each year, manufacturing overhead is analyzed, and an adjusting entry is made to dispose of the under- or overapplied overhead. How would you advise a company that has had overapplied overhead for each of the last five years?

4.8 Explain How a Job Order Cost System Applies to a Nonmanufacturing Environment

Job order cost systems can be used beyond the manufacturing realm and are often used in the production of

services. The same cost tracking and journaling techniques apply, as the outcome still consists of materials, labor, and overhead. However, the terminology changes in a nonmanufacturing environment. For example, a movie production studio and an accounting firm produce movies and financial statement audits, respectively, instead of manufacturing units.

Fundamentals of the Job Order Costing Method for Service Entities

Instead of being dependent on materials, service industries depend on labor. Since their work is labor intensive, it makes sense to use labor as an activity base with billable hours often as the best allocation base. For example, in an audit, there often will be several accountants, with differing levels of experience and expertise involved in the assignment. The accounting firms have more billable hours at the staff level and fewer billable hours at the partner level. And since the firm bills the partner's time at a significantly higher rate than the staff, it makes sense to apply overhead at the billable hours instead of the billable costs.

In service industries, there is no manufacturing overhead because they are not manufacturing a product, but instead are providing a service. Accordingly, overhead is called **operating overhead**.

Another terminology difference is the inventory accounts. The jobs are considered movies or assignments in process, and are transferred to a cost of service sold account instead of to a finished goods inventory.

CONCEPTS IN PRACTICE

Tracking Costs in Healthcare

Healthcare is one of the industries that keeps track of materials, such as medicine. In this industry, direct labor is shown to the patient as the cost of the provider, such as a physician, physician assistant, or nurse practitioner. Indirect labor includes all other personnel from front desk staff to the nurse who gathers vital signs or a technician who performs tests. Patients do not see the overhead cost on their bill, but it is built into the invoice as part of the practitioner or testing fees.

Service Entity Use of a Job Order Costing System

To understand how a service provider uses a job order cost system, let's consider the case of IFixIT. IFixIT Systems is a Sony-authorized repair provider that fixes audiovisual equipment brought in by customers. IFixIT requires customers to pay $50 to diagnose the problem. IFixIt pays its employees $25 per hour and assigns overhead equal to its direct labor cost. The customers' bills do not show overhead and are instead itemized as parts plus labor, where the cost for parts is the original cost plus a markup, and the labor rate is $80 per hour.

A customer brought in his TV and paid the $50 diagnostic fee. IFixIT determined a new power cord was needed. To fix it, IFixIT purchases the part from its suppliers at $42 and pays $75 in direct labor for 3 hours at $25 per hour. Overhead is applied equal to the direct labor cost of $75. The customer is charged $310, consisting of $70 for the part and 3 hours of labor at a rate of $80 per hour. IFixIT records the journal entries shown:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
	Cash	50	
	Diagnosis revenue		50
	Diagnosis of Sony Bravia for Job 4740325		
	Repair in process	42	
	Accounts Payable		42
	Purchase of new power cord for Job 4740325		
	Repair in process	75	
	Salaries Payable		75
	Assigning labor to Job 4740325		
	Repair in process	75	
	Operating overhead		75
	Assigning overhead costs to Job 4740325		
	Cost of completed repair	192	
	Repair in Process		192
	Completion of Job 4740325		
	Cash	310	
	Repair revenue		310
	Completion of Job 4740325		

ETHICAL CONSIDERATIONS

Subcontractor Misrepresentation of Costs of Jobs Used to Overbill Clients

Construction is a typical industry where job order costing and related accounting misstatements can be used to commit fraud. A construction subcontractor might overstate the units of production accomplished, the units of labor, or the equipment actually used.[2] This occurs most commonly with subcontractor fraud, where the subcontractor does not perform the work but bills for it anyway.

Another complicating issue is that many subcontractors are disadvantaged business enterprises that are required by law to be included in governmental construction contracts. In Chicago, for example, McHugh Construction paid $12 million in fines to settle the claims that its disadvantaged business enterprise subcontractor did not perform work.[3] The subcontractor received a prison sentence, and a related party was put on probation. An accountant had to prepare the invoices that allowed this common type of scheme to operate.

2 Jim Schmid and Todd F. Taggart, "The Most Common Types of Construction Fraud," *Construction Business Owner*, November 2, 2011, http://www.constructionbusinessowner.com/insurance/risk-management/most-common-types-construction-fraud.

3 Kim Slowey, "Chicago Subcontractor Sentenced to 1-year Prison Term for DBE Fraud Scheme," *Construction Dive*, March 20, 2017, https://www.constructiondive.com/news/chicago-subcontractor-sentenced-to-1-year-prison-term-for-dbe-fraud-scheme/438441/.

Key Terms

conversion costs total of labor and overhead for a product; the costs that "convert" the direct material into the finished product

cost driver activity that is the reason for the increase or decrease of another cost; examples include labor hours incurred, labor costs paid, amounts of materials used in production, units produced, machine hours, or any other activity that has a cause-and-effect relationship with incurred costs

cost of goods manufactured manufacturing costs incurred less the ending work in process inventory

cost of goods sold expense account that houses all costs associated with getting a product ready for sale

direct labor labor directly related to the manufacturing of the product or the production of a service

direct materials materials used in the manufacturing process that can be traced directly to the product

estimated activity base total amount of the activity for the year

expense recognition principle (also, matching principle) matches expenses with associated revenues in the period in which the revenues were generated

indirect labor labor not directly involved in the active conversion of materials into finished products or the provision of services

indirect materials materials used in production but not efficiently traceable to a specific unit of production

job cost sheet document created for each job that includes all material, labor, and overhead costs for that job

job order costing information system that traces the individual costs directly to the final product and not to production departments

loss leader product sold at a price that is often less than the cost of producing it in order to entice customers to buy accessories that are necessary for its use

manufacturing costs total of all costs expended in the manufacturing process; generally consists of direct material, direct labor, and manufacturing overhead

manufacturing overhead costs incurred in the production process that are not economically feasible to measure as direct material or direct labor costs; examples include indirect material, indirect labor, utilities, and depreciation

materials requisition form form showing which specific raw materials and costs are transferred from raw materials inventory to work in process inventory

operating overhead overhead account used for service industries

overapplied overhead situation when the overhead applied to the individual jobs is greater than the actual overhead; when overhead is overapplied, the manufacturing overhead has a credit balance

period costs typically related to a particular time period instead of attached to the production of an asset; treated as an expense in the period incurred (examples include many sales and administrative expenses)

prime costs direct material expenses and direct labor costs

time ticket document used to record the particular job worked on by each employee

underapplied overhead situation when the overhead applied to the individual jobs is less than the actual overhead; when overhead is underapplied, the manufacturing overhead has a debit balance

Summary

4.1 Distinguish between Job Order Costing and Process Costing

- Job order costing (JOC) is the optimal costing method for producing custom goods or when it is easy to identify the cost directly with the product.

- A JOC system assigns costs to each individual job as the costs are incurred, so that at all points in the manufacturing process, the costs assigned to that particular job are known.

4.2 Describe and Identify the Three Major Components of Product Costs under Job Order Costing

- Direct materials are requested on a materials requisition form and recorded on the job cost sheet when transferred from raw materials inventory to the work in process inventory.
- Time tickets are used to accumulate the labor associated with particular jobs and assigned to those jobs on the job cost sheet.
- Manufacturing overhead costs are accumulated in the manufacturing overhead account and assigned to the individual jobs using the predetermined overhead rate.

4.3 Use the Job Order Costing Method to Trace the Flow of Product Costs through the Inventory Accounts

- Materials used in production include the beginning raw materials inventory and purchases, less the ending inventory. This amount is the amount added to the work in process inventory.
- The cost of goods manufactured includes the beginning work in process inventory, the materials used in production, the direct labor assigned to each job, and the manufacturing overhead costs assigned, less the costs remaining in the work in process inventory. This amount is transferred to the finished goods inventory.
- The cost of goods sold include the beginning finished goods inventory and the cost of goods manufactured during the period, less the ending inventory.
- When the job is completed, the costs are transferred from the work in process inventory to the finished goods inventory.
- When the jobs are sold, the costs are transferred from the finished goods inventory to the cost of goods sold.

4.4 Compute a Predetermined Overhead Rate and Apply Overhead to Production

- Expenses are recognized when they have a direct relationship with the associated revenue, when there is a systematic and rational method to allocate them, or immediately when there is no expected benefit.
- The estimated activity base is typically direct labor dollars or direct labor hours, and is based on an allocation base that increases or decreases as overhead increases or decreases.
- The predetermined overhead rate is the estimated overhead divided by the activity base.

4.5 Compute the Cost of a Job Using Job Order Costing

- Costs from the materials requisition sheet and time tickets are recorded on the job cost sheet.
- Overhead is allocated from the manufacturing overhead account to the individual jobs and recorded on the job cost sheet.
- Each job has its own job cost sheet, showing the materials, labor, and overhead for each job.

4.6 Determine and Dispose of Underapplied or Overapplied Overhead

- Overhead is allocated to individual jobs based on the estimated overhead costs for the year and may be overapplied or underapplied for the year.
- Overhead is underapplied when not all of the costs accumulated in the manufacturing overhead account are applied during the year.
- Overhead is overapplied when more overhead is applied to the jobs than was actually incurred.
- The amount of overhead overapplied or underapplied is adjusted into the cost of goods sold account.

4.7 Prepare Journal Entries for a Job Order Cost System

- Job cost sheets record the material, labor, and overhead costs for each job, whereas journal entries

actually transfer the costs into the work in process inventory, the finished goods inventory, and cost of goods sold.

4.8 Explain How a Job Order Cost System Applies to a Nonmanufacturing Environment

- Job order costing can be used in nonmanufacturing companies and with the same techniques, even though there are not any inventory accounts.

Multiple Choice

1. LO 4.1 Which of the following product situations is better suited to job order costing than to process costing?

A. Each product batch is exactly the same as the prior batch.
B. The costs are easily traced to a specific product.
C. Costs are accumulated by department.
D. The value of work in process is based on assigning standard costs.

2. LO 4.1 A job order costing system is most likely used by which of the following?

A. a pet food manufacturer
B. a paper manufacturing company
C. an accounting firm specializing in tax returns
D. a stereo manufacturing company

3. LO 4.1 Which of the following is a prime cost?

A. indirect materials
B. direct labor
C. administrative expenses
D. factory depreciation expenses

4. LO 4.1 Which of the following is a conversion cost?

A. raw materials
B. direct materials
C. administrative expenses
D. factory depreciation expenses

5. LO 4.1 During production, to what are the costs in job order costing applied?

A. manufacturing overhead
B. cost of goods sold
C. each individual product
D. each individual department

6. LO 4.2 Which document lists the inventory that will be removed from the raw materials inventory?

A. job cost sheet
B. purchase order
C. materials requisition form
D. receiving document

7. LO 4.2 Which document shows the cost of direct materials, direct labor, and overhead applied for each specific job?

A. job cost sheet
B. purchase order
C. materials requisition form
D. receiving document

8. LO 4.2 Which document lists the total direct materials used in a specific job?

A. job cost sheet
B. purchase order
C. materials requisition form
D. receiving document

9. LO 4.2 Which document lists the total direct labor used in a specific job?

A. job cost sheet
B. purchase order
C. employee time ticket
D. receiving document

10. LO 4.4 Assigning indirect costs to specific jobs is completed by which of the following?

A. applying the costs to manufacturing overhead
B. using the predetermined overhead rate
C. using the manufacturing costs incurred
D. applying the indirect labor to the work in process inventory

11. LO 4.4 In a job order cost system, which account shows the overhead used by the company?

A. work in process inventory
B. finished goods inventory
C. cost of goods sold
D. manufacturing overhead

12. LO 4.7 In a job order cost system, raw materials purchased are debited to which account?

A. raw materials inventory
B. work in process inventory
C. finished goods inventory
D. cost of goods sold

13. LO 4.7 In a job order cost system, overhead applied is debited to which account?

A. work in process inventory
B. finished goods inventory
C. manufacturing overhead
D. cost of goods sold

14. LO 4.7 In a job order cost system, factory wage expense is debited to which account?

A. raw materials inventory
B. work in process inventory
C. finished goods inventory
D. cost of goods sold

15. LO 4.7 In a job order cost system, utility expense incurred is debited to which account?

A. work in process inventory
B. finished goods inventory
C. manufacturing overhead
D. cost of goods sold

16. LO 4.7 In a job order cost system, indirect labor incurred is debited to which account?

A. work in process inventory
B. finished goods inventory
C. manufacturing overhead
D. cost of goods sold

17. LO 4.8 The activity base for service industries is most likely to be _____.

A. machine hours
B. administrative salaries
C. direct labor cost
D. direct labor hours

Questions

1. LO 4.1 A printing company manufactures notebooks of various sizes. The company manufactures 3,000 notebooks each day. Should the company use process costing or job order costing?

2. LO 4.1 Burnham Industries incurs these costs for the month:

Direct materials	$2,000
Direct labor	3,000
Factory depreciation expense	3,500
Factory utilities expense	750
CEO's salary	4,000

What is the prime cost?

3. LO 4.1 Choco’s Chocolates incurs these costs for the month:

Direct materials	$15,000
Direct labor	25,000
Factory depreciation expense	45,000
Factory utilities expense	2,000
Payroll staff's salary	15,000

What is the conversion cost?

4. LO 4.1 How do job order costing and process costing differ with respect to recording direct materials and direct labor?

5. LO 4.1 Why are product costs assigned to the product and period costs immediately expensed?

6. LO 4.3 Is the cost of goods manufactured the same as the cost of goods sold?

7. LO 4.3 From beginning to end, place these items in the order of the flow of goods.

A. cost of goods sold
B. raw materials inventory
C. finished goods inventory
D. work in process inventory

8. LO 4.4 How is the predetermined overhead rate determined?

9. LO 4.4 How is the predetermined overhead rate applied?

10. LO 4.5 Why are the overhead costs first accumulated in the manufacturing overhead account instead of in the work in process inventory account?

11. LO 4.6 Why is the manufacturing overhead account debited as expenses are recognized and then credited when overhead is applied?

12. LO 4.7 Match the concept on the left to its correct description.

A. job order costing	i. computes the overhead applied to each job
B. materials requisition sheet	ii. source document indicating the number of hours an employee worked on specific jobs
C. overapplied overhead	iii. source document indicating the raw materials assigned to a specific production job
D. predetermined overhead rate	iv. the cost accounting system used by pet food manufacturers
E. process costing	v. the cost accounting system used by law firms
F. time ticket	vi. the result when the actual overhead is less than the amount assigned to each specific job
G. underapplied overhead	vii. the result when the actual overhead is more than the amount assigned to each specific job

13. LO 4.8 When compared to manufacturing companies, service industries do not generally use _____ as a component of product cost.

Exercise Set A

EA1. LO 4.1 Little Things manufactures toys. For each item listed, identify whether it is a product cost, a period cost, or not an expense.

A. internet provider services
B. material expense
C. raw materials inventory
D. production equipment rental
E. showroom rental
F. factory employee salary
G. Human Resource Director salary

EA2. LO 4.2 Table 4.3 shows a list of expenses involved in the production of custom, professional lacrosse sticks.

A. For each item listed, state whether the cost should be applied to manufacturing or sales and administration.
B. If the cost is a manufacturing cost, state whether it is direct materials, direct labor, or manufacturing overhead.
C. If the cost is a manufacturing overhead cost, state whether it is indirect materials, indirect labor, or another type of manufacturing overhead.

Expenses Involved in Lacrosse Stick Production

Lacrosse Stick Production Costs	Manufacturing or Sales & Administration Cost?	If Manufacturing: Direct Materials, Direct Labor, or Overhead?	If Overhead: Indirect Materials, Indirect Labor, or Other?
Carbon, fiberglass			
Administrative building rent			
Accountant salary			
Factory building depreciation			
Strings for the pocket			
Advertising			
Production supervisor salary			
Paint for sticks			
Research and development costs			
Wages of person who strings the sticks			
Cutting machine depreciation			

Table 4.3

Expenses Involved in Lacrosse Stick Production

Lacrosse Stick Production Costs	Manufacturing or Sales & Administration Cost?	If Manufacturing: Direct Materials, Direct Labor, or Overhead?	If Overhead: Indirect Materials, Indirect Labor, or Other?
Human resources salaries			
Factory maintenance			

Table 4.3

EA3. LO 4.2 Burnham Industries incurs these costs for the month:

Direct materials	$2,000
Direct labor	3,000
Factory depreciation expense	3,500
Factory utilities expense	750
CEO's salary	4,000

A. What is the prime cost?
B. What is the conversion cost?

EA4. LO 4.3 Marzoni's records show raw materials inventory had a beginning balance of $200 and an ending balance of $300. If the cost of materials used during the month was $900, what were the purchases made during the month?

EA5. LO 4.3 Sterling's records show the work in process inventory had a beginning balance of $4,000 and an ending balance of $3,000. How much direct labor was incurred if the records also show:

Materials used	$1,500
Overhead applied	500
Cost of goods manufactured	7,500

EA6. LO 4.3 Logo Gear purchased $2,250 worth of merchandise during the month, and its monthly income statement shows cost of goods sold of $2,000. What was the beginning inventory if the ending inventory was $1,000?

EA7. LO 4.4 A company estimates its manufacturing overhead will be $750,000 for the next year. What is the predetermined overhead rate given the following independent allocation bases?

A. Budgeted direct labor hours: 60,000
B. Budgeted direct labor expense: $1,500,000
C. Estimated machine hours: 100,000

EA8. LO 4.4 Job order cost sheets show the following costs assigned to each job:

	Job 13	Job 14	Job 15
Direct materials	$7,560	$1,525	$3,290
Direct labor	3,760	3,824	3,796

The company assigns overhead at $1.25 for each direct labor dollar spent. What is the total cost for each of the jobs?

EA9. LO 4.4 A new company started production. Job 10 was completed, and Job 20 remains in production. Here is the information from job cost sheets from their first and only jobs so far:

Job 10	Hours	Total Cost
Direct materials		$ 765
Direct labor	75	1,575
Manufacturing overhead		60
Total cost		$2,400

Job 20	Hours	Total Cost
Direct materials		$ 145
Direct labor	113	2,373
Manufacturing overhead		90
Total cost		$2,608

Using the information provided,

A. What is the balance in work in process?
B. What is the balance in the finished goods inventory?
C. If manufacturing overhead is applied on the basis of direct labor hours, what is the predetermined overhead rate?

EA10. LO 4.5 K company production was working on Job 1 and Job 2 during the month. Of the $780 in direct materials, $375 in materials was requested for Job 1. Direct labor cost, including payroll taxes, are $23 per hour, and employees worked 18 hours on Job 1 and 29 hours on Job 2. Overhead is applied at the rate of $20 per direct labor hours. Prepare job order cost sheets for each job.

EA11. LO 4.7 A company has the following transactions during the week.

- Purchase of $1,000 raw materials inventory
- Assignment of $500 of raw materials inventory to Job 5
- Payroll for 20 hours with $1,000 assigned to Job 5
- Factory utility bills of $750
- Overhead applied at the rate of $10 per hour

What is the cost assigned to Job 5 at the end of the week?

EA12. LO 4.7 During the month, Job AB2 used specialized machinery for 450 hours and incurred $500 in utilities on account, $300 in factory depreciation expense, and $100 in property tax on the factory. Prepare journal entries for the following:

A. Record the expenses incurred.
B. Record the allocation of overhead at the predetermined rate of $1.50 per machine hour.

EA13. LO 4.7 Job 113 was completed at a cost of $5,000, and Job 85 was completed at a cost of $3,000 and sold on account for $4,500. Prepare journal entries for the following:

A. Completion of Job 113.
B. Completion and sale of Job 85.

EA14. LO 4.7 A company's individual job sheets show these costs:

	Job 131	Job 132	Job 133
Direct materials	$4,585	$8,723	$1,575
Direct labor	2,385	2,498	2,874

Overhead is applied at 1.25 times the direct labor cost. Use the data on the cost sheets to perform these tasks:

A. Apply overhead to each of the jobs.
B. Prepare an entry to record the assignment of direct materials to work in process.
C. Prepare an entry to record the assignment of direct labor to work in process.
D. Prepare an entry to record the assignment of manufacturing overhead to work in process.

EA15. LO 4.7 A summary of material requisition slips and time tickets, along with the overhead allocation, show these costs:

Job No.	Material Requisition Slips	Factory Labor Time Tickets	Overhead Applied
131	$ 505	$ 200	$ 70
132	251	260	91
133	393	180	63
134	340	300	105
Not job specific	76	145	0
	$1,565	$1,085	$329

A. Prepare an entry to record the assignment of direct material to work in process.
B. Prepare an entry to record the assignment of direct labor to work in process.
C. Prepare an entry to record the assignment of manufacturing overhead to work in process.

Exercise Set B

EB1. LO 4.1 Abuah Goods manufactures clothing. For each item listed, identify whether it is a product cost, a period cost, or not an expense.

A. pins to keep materials together while garment is being manufactured
B. real estate taxes on store
C. advertising expense
D. product inspector wages
E. shirts for sale
F. Chief Financial Officer salary
G. cost of goods sold

EB2. LO 4.2 Choco's Chocolates incurs the following costs for the month:

Direct materials	$15,000
Direct labor	25,000
Factory depreciation expense	45,000
Factory utilities expense	2,000
Payroll staff's salary	15,000

A. What is the prime cost?
B. What is the conversion cost?

EB3. LO 4.2 The table shows a list of expenses involved in the production of custom snowboard bindings.

A. For each item listed, state if the cost is manufacturing or sales and administration.
B. If the cost is a manufacturing cost, state if it is direct materials, direct labor, or manufacturing overhead.
C. If the cost is a manufacturing overhead cost, state if it is indirect materials, indirect labor, or another type of manufacturing overhead.

Snowboard Binding Production Costs

Snowboard Bindings Production Costs	Manufacturing or Sales & Administration Cost?	If Manufacturing: Direct Materials, Direct Labor, or Overhead?	If Overhead: Indirect Materials, Indirect Labor, or Other?
Aluminum			
Factory building rent			
Fiberglass framework for each pair of bindings			
Accountant salary			
Administration building depreciation			
Straps			
Advertising			
Production supervisor salary			
Glue			
Research and development costs			
Inspector wages			
Metal shaping machine depreciation			
Human resources salaries			

Table 4.4

Snowboard Binding Production Costs

Snowboard Bindings Production Costs	Manufacturing or Sales & Administration Cost?	If Manufacturing: Direct Materials, Direct Labor, or Overhead?	If Overhead: Indirect Materials, Indirect Labor, or Other?
Factory repair			

Table 4.4

EB4. LO 4.3 Masonry's records show the raw materials inventory had purchases of $1,000 and an ending raw materials inventory balance of $200. If the cost of materials used during the month was $900, what was the beginning inventory?

EB5. LO 4.3 Steinway's records show their work in process inventory had a beginning balance of $3,000 and an ending balance of $3,500. How much overhead was applied if the records also show the following:

Materials used	$2,500
Direct labor	5,000
Cost of goods manufactured	7,700

EB6. LO 4.3 Langston's purchased $3,100 of merchandise during the month, and its monthly income statement shows a cost of goods sold of $3,000. What was the beginning inventory if the ending inventory was $1,250?

EB7. LO 4.4 A company estimates its manufacturing overhead will be $840,000 for the next year. What is the predetermined overhead rate given each of the following independent allocation bases?

A. Budgeted direct labor hours: 90,615
B. Budgeted direct labor expense: $750,000
C. Estimated machine hours: 150,000

EB8. LO 4.4 Job order cost sheets show the following costs assigned to each job:

	Job 131	Job 132	Job 133	Total
Direct materials	$3,485	$39,853	$2,301	$45,639
Direct labor	2,353	34,245	2,037	38,635

The company assigns overhead at twice the direct labor cost. What is the total cost for each job?

EB9. LO 4.4 A new company started production. Job 1 was completed, and Job 2 remains in production. Here is the information from the job cost sheets from their first and only jobs so far:

Job 1	Hours	Total Cost
Direct materials		$ 375
Direct labor	231	5,313
Manufacturing overhead		4,620
Total cost		$10,308

Job 2	Hours	Total Cost
Direct materials		$ 405
Direct labor	85	1,955
Manufacturing overhead		1,700
Direct materials		$4,060

Using the information provided,

A. What is the balance in work in process?
B. What is the balance in finished goods inventory?
C. If manufacturing overhead is applied on the basis of direct labor hours, what is the predetermined overhead rate?

EB10. LO 4.5 Inez has the following information relating to Job AA5. Direct material cost was $200,000, direct labor was $36,550, and overhead applied on the basis of direct labor hours was $73,100. What was the predetermined overhead rate using the labor rate of $17 per hour?

EB11. LO 4.6 A company has the following information relating to its production costs:

Machine hours	25,000
Direct labor cost	$550,000
Indirect labor	45,000
Plant maintenance	259,300
Plant supervision	90,000
Plant depreciation	150,000
Plant utilities	48,000
Indirect materials	5,000

Compute the actual and applied overhead using the company's predetermined overhead rate of $23.92 per machine hour. Was the overhead overapplied or underapplied, and by how much?

EB12. LO 4.7 A company has the following transactions during the week.

- Purchase of $3,000 raw materials inventory
- Assignment of $700 of raw materials inventory to Job 7
- Payroll for 10 hours and $3,000 is assigned to Job 7
- Factory depreciation of $1,750
- Overhead applied at the rate of $200 per hour

What is the cost assigned to Job 7 at the end of the week?

EB13. LO 4.7 During the month, Job Arch2 used specialized machinery for 350 hours and incurred $700 in utilities on account, $400 in factory depreciation expense, and $200 in property tax on the factory. Prepare journal entries for the following:

A. Record the expenses incurred.
B. Record the allocation of overhead at the predetermined rate of $1.50 per machine hour.

EB14. LO 4.7 Job 113 was completed at a cost of $7,500, and Job 85 was completed at a cost of $2,300 and sold on account for $4,500. Prepare journal entries for the following:

A. Completion of Job 113.
B. Completion and sale of Job 85.

EB15. LO 4.7 A company's individual job sheets show these costs:

	Job 298	Job 299	Job 300
Direct material	$2,228	$23,945	$ 4,231
Direct labor	2,391	23,492	3,413
Overhead	?	?	?
Total	$8,803	$88,548	$13,617

Overhead is applied at 1.75 times the direct labor cost. Use the data on the cost sheets to perform these tasks:

A. Apply overhead to each of the jobs.
B. Prepare an entry to record the assignment of direct material to work in process.
C. Prepare an entry to record the assignment of direct labor to work in process.
D. Prepare an entry to record the assignment of manufacturing overhead to work in process.

EB16. LO 4.7 A summary of materials requisition slips and time tickets, along with the overhead allocation, show these costs:

Job Number	Material Requisition Slips	Factory Labor Time Tickets	Overhead Applied
AA001	$ 3,423	$ 5,004	$1,750
AA002	4,342	4,530	1,568
AA003	3,431	5,345	1,813
AA004	3,421	2,423	840
Not specific to one job	570	3,353	
	$15,187	$20,655	$5,971

A. Prepare an entry to record the assignment of direct material to work in process.
B. Prepare an entry to record the assignment of direct labor to work in process.
C. Prepare an entry to record the assignment of manufacturing overhead to work in process.

Problem Set A

PA1. LO 4.1 For each item listed, state whether a job order costing system or process costing system would be best.

A. cereal
B. team uniforms
C. houses
D. beach chairs
E. plastic
F. restaurant-specific pizza boxes
G. sneakers customized with number and colors

PA2. LO 4.4 York Company is a machine shop that estimated overhead will be $50,000, consisting of 5,000 hours of direct labor. The cost to make Job 0325 is $70 in aluminum and two hours of labor at $20 per hour. During the month, York incurs $50 in indirect material cost, $150 in administrative labor, $300 in utilities, and $250 in depreciation expense.

A. What is the predetermined overhead rate if direct labor hours are considered the cost driver?
B. What is the cost of Job 0325?
C. What is the overhead incurred during the month?

PA3. LO 4.4 Pocono Cement Forms expects $900,000 in overhead during the next year. It does not know whether it should apply overhead on the basis of its anticipated direct labor hours of 60,000 or its expected machine hours of 30,000. Determine the product cost under each predetermined allocation rate if the last job incurred $1,550 in direct material cost, 90 direct labor hours, and 75 machine hours. Wages are paid at $16 per hour.

PA4. LO 4.5 Job cost sheets show the following information:

Job	January	February	March	Completed	Sold
AA2	$2,500	$1,200		February	Not sold
AA4	4,838			January	February
AA5		3,250		February	March
AA3		3,409	$2,319	April	Not sold
Total	7,338	7,859	2,319		

What are the balances in the work in process inventory, finished goods inventory, and cost of goods sold for January, February, and March?

PA5. LO 4.5 Complete the information in the cost computations shown here:

Raw Materials	
Beginning inventory	$ 342
Purchases	1,533
Materials available for use	?
Ending inventory	321
Materials used in production	?

Work in Process Inventory	
Beginning inventory	$ 932
Materials used in production	?
Direct labor	1,535
Overhead applied	?
Manufacturing costs incurred	22,441
Ending inventory	935
Cost of Goods Manufactured	?

Finished Goods Inventory	
Beginning inventory	?
Cost of Goods Manufactured	?
Goods Available for Sale	$25,002
Ending inventory	?
Cost of Goods Sold	21,788

PA6. LO 4.5 During the year, a company purchased raw materials of $77,321, and incurred direct labor costs of $125,900. Overhead is applied at the rate of 75% of the direct labor cost. These are the inventory balances:

	Beginning	Ending
Raw materials inventory	$ 17,433	$ 16,428
Work in process inventory	241,439	234,423
Finished goods inventory	312,842	342,384

Compute the cost of materials used in production, the cost of goods manufactured, and the cost of goods sold.

PA7. LO 4.5 Freeman Furnishings has summarized its data as shown:

Depreciation of factory building	$100,000
Factory real estate taxes	15,000
Factory utility expenses	85,000
Indirect materials	32,000
Indirect labor	25,000
Direct labor cost	85,000
Direct labor hours incurred	23,500
Estimated direct labor hours	24,000
Raw materials purchased	$350,000
Raw materials, beginning inventory	30,000
Raw materials, ending inventory	28,000
Work in process, beginning inventory	51,000
Work in process, ending inventory	67,000
Estimated overhead	270,000

Compute the cost of goods manufactured, assuming that the overhead is allocated based on direct labor hours.

PA8. LO 4.6 Coop's Stoops estimated its annual overhead to be $85,000 and based its predetermined overhead rate on 24,286 direct labor hours. At the end of the year, actual overhead was $90,000 and the total direct labor hours were 24,100. What is the entry to dispose of the overapplied or underapplied overhead?

PA9. LO 4.6 Mountain Peaks applies overhead on the basis of machine hours and reports the following information:

	Budget	Actual
Overhead	$350,000	$352,000
Machine hours	50,000	49,000
Direct materials		$210,000
Direct labor		$350,000

A. What is the predetermined overhead rate?
B. How much overhead was applied during the year?
C. Was overhead over- or underapplied, and by what amount?
D. What is the journal entry to dispose of the over- or underapplied overhead?

PA10. LO 4.6 The actual overhead for a company is $74,539. Overhead was based on 6,000 direct labor hours and was $2,539 underapplied for the year.

A. What is the overhead application rate per direct labor hour?
B. What is the journal entry to dispose of the underapplied overhead?

PA11. LO 4.6 When setting its predetermined overhead application rate, Tasty Box Meals estimated its overhead would be $100,000 and would require 25,000 machine hours in the next year. At the end of the year, it found that actual overhead was $102,000 and required 26,000 machine hours.

A. Determine the predetermined overhead rate.
B. What is the overhead applied during the year?
C. Prepare the journal entry to eliminate the underapplied or overapplied overhead.

PA12. LO 4.7 The following data summarize the operations during the year. Prepare a journal entry for each transaction.

A. Purchase of raw materials on account: $3,000
B. Raw materials used by Job 1: $500
C. Raw materials used as indirect materials: $100
D. Direct labor for Job 1: $300
E. Indirect labor incurred: $50
F. Factory utilities incurred on account: $700
G. Adjusting entry for factory depreciation: $250
H. Manufacturing overhead applied as percent of direct labor: 200%
I. Job 1 is transferred to finished goods
J. Job 1 is sold: $3,000
K. Manufacturing overhead is overapplied: $100

PA13. LO 4.7 The following events occurred during March for Ajax Company. Prepare a journal entry for each transaction.

A. Materials were purchased on account for $35,429.
B. Materials were requisitioned to begin work on Job C15 in the amount of $25,259.
C. Direct labor expense for Job C15 was $24,129.
D. Actual overhead was incurred on account of $32,852.
E. Factory overhead was charged to Job C15 at the rate of 200% of direct labor.
F. Job C15 was transferred to finished goods at $97,646.
G. Job C15 was sold on account for $401,000.

PA14. LO 4.8 A movie production studio incurred the following costs related to its current movie:

A. Purchased office supplies on account: $33,000
B. Issued direct supplies: $22,512
C. Issued indirect supplies: $7,535
D. Time tickets showing direct labor: $32,503,230
E. Time tickets showing indirect labor: $574,326
F. Utilities expense on account: $957,323
G. Overhead applied: 10% of direct labor cost

Create journal entries for the listed transactions.

Problem Set B

PB1. LO 4.1 For each item listed, state whether a job order costing system or process costing system would be best.

A. television repair
B. cell phone charge cords
C. glassware with company logo
D. dog food
E. golf balls
F. hotel signs to welcome guests
G. highlighters and pens

PB2. LO 4.4 Rulers Company is a neon sign company that estimated overhead will be $60,000, consisting of 1,500 machine hours. The cost to make Job 416 is $95 in neon, 15 hours of labor at $13 per hour, and five machine hours. During the month, it incurs $95 in indirect material cost, $130 in administrative labor, $320 in utilities, and $350 in depreciation expense.

A. What is the predetermined overhead rate if machine hours are considered the cost driver?
B. What is the cost of Job 416?
C. What is the overhead incurred during the month?

PB3. LO 4.4 Event Forms expects $120,000 in overhead during the next year. It doesn't know whether it should apply overhead on the basis of its anticipated direct labor hours of 6,000 or its expected machine hours of 5,000. What would be the product cost under each predetermined allocation rate if the last job incurred $3,500 in direct material cost, 55 direct labor hours, and 55 machine hours? Wages are paid at $17 per hour.

PB4. LO 4.5 Summary information from a company's job cost sheets shows the following information:

Job	April	May	June	Completed	Sold
BB3	$3,500	$1,500		May	Not sold
BB4	9,231			April	May
BB5		2,540		May	June
BB6		3,230	$1,434	July	Not sold

What are the balances in the work in process inventory, finished goods inventory, and cost of goods sold for April, May, and June?

PB5. LO 4.5 Complete the information in the cost computations shown here:

Beginning Inventory	$74,323
Purchases	?
Materials available for use	?
Ending inventory	?
Materials used in production	78,413

Work in Process Inventory	
Beginning inventory	$253,210
Materials used in production	?
Direct labor	125,900
Overhead applied	94,425
Manufacturing costs incurred	?
Ending inventory	242,932
Cost of goods manufactured	?

Finished Goods Inventory	
Finished goods inventory	?
Beginning inventory	$333,149
Cost of goods manufactured	309,016
Goods available for sale	?
Ending inventory	354,235
Cost of goods sold	287,930

PB6. LO 4.5 During the year, a company purchased raw materials of $77,321 and incurred direct labor costs of $125,900. Overhead is applied at the rate of 75% of the direct labor cost. These are the inventory balances:

	Beginning	**Ending**
Raw materials inventory	$ 15,394	$ 17,432
Work in process inventory	57,304	53,721
Finished goods inventory	120,432	132,432

Compute the cost of materials used in production, the cost of goods manufactured, and the cost of goods sold.

PB7. LO 4.5 Freeman Furnishings has summarized its data as shown. Direct labor hours will be used as the activity base to allocate overhead:

Raw materials purchased	$320,000
Raw materials, beginning inventory	15,000
Raw materials, ending inventory	14,000
Work in process, beginning inventory	35,000
Work in process, ending inventory	37,000
Estimated overhead	300,000
Depreciation of factory building	50,000
Factory real estate taxes	7,382
Factory utility expenses	45,000
Indirect materials	20,000
Indirect labor	11,000
Direct labor cost	100,000
Direct labor hours incurred	24,000
Estimated direct labor hours	25,000

Compute the cost of goods manufactured.

PB8. LO 4.6 Queen Bee's Honey, Inc., estimated its annual overhead to be $110,000 and based its predetermined overhead rate on 27,500 direct labor hours. At the end of the year, actual overhead was $106,000 and the total direct labor hours were 29,000. What is the entry to dispose of the overapplied or underapplied overhead?

PB9. LO 4.6 Mountain Tops applies overhead on the basis of direct labor hours and reports the following information:

	Budget	Actual
Overhead	$450,000	$452,000
Direct labor hours	75,000	77,000
Direct materials		$195,000
Direct labor		$333,865

A. What is the predetermined overhead rate?
B. How much overhead was applied during the year?
C. Was overhead overapplied or underapplied, and by what amount?
D. What is the journal entry to dispose of the overapplied or underapplied overhead?

PB10. LO 4.6 The actual overhead for a company is $73,175. Overhead was based on 4,500 machine hours and was $3,325 overapplied for the year.

A. What is the overhead application rate per direct labor hour?
B. What is the journal entry to dispose of the underapplied overhead?

PB11. LO 4.6 When setting its predetermined overhead application rate, Tasty Turtle estimated its overhead would be $75,000 and manufacturing would require 25,000 machine hours in the next year. At the end of the year, it found that actual overhead was $74,000 and manufacturing required 24,000 machine hours.

A. Determine the predetermined overhead rate.
B. What is the overhead applied during the year?
C. Prepare the journal entry to eliminate the under- or overapplied overhead.

PB12. LO 4.7 The following data summarize the operations during the year. Prepare a journal entry for each transaction.

A. Purchase of raw materials on account: $1,500
B. Raw materials used by Job 1: $400
C. Raw materials used as indirect materials: $50
D. Direct labor for Job 1: $200
E. Indirect labor incurred for Job 1: $30
F. Factory utilities incurred on account: $500
G. Adjusting entry for factory depreciation: $200
H. Manufacturing overhead applied as percent of direct labor: 100%
I. Job 1 is transferred to finished goods
J. Job 1 is sold: $1,000
K. Manufacturing overhead is underapplied: $100

PB13. LO 4.7 The following events occurred during March for Ajax Company. Prepare a journal entry for each transaction.

A. Materials were purchased on account for $5,429.
B. Materials were requisitioned to begin work on Job C15 in the amount of $2,500.
C. Direct labor expense for Job C15 was $4,250.
D. Actual overhead was incurred on account for $5,385.
E. Factory overhead was charged to Job C15 at the rate of 200% direct labor.
F. Job C15 was transferred to finished goods at $15,250.
G. Job C15 was sold on account for $28,000.

PB14. LO 4.8 A leather repair shop incurred the following expenses while repairing luggage for a major airline.

A. Time cards showing direct labor: $750
B. Time cards showing indirect labor: $100
C. Purchased repair supplies on account: $1,500
D. Issued indirect supplies: $350
E. Utilities expense on account: $24,000
F. Overhead applied: 100% of direct labor costs

Journalize the listed transactions.

Thought Provokers

TP1. LO 4.1 Can a company use both job order costing and process costing? Why or why not?

TP2. LO 4.4 If a job order cost system tracks the direct materials and direct labor, why doesn't it track the actual overhead used for a specific job?

TP3. LO 4.5 What are the similarities in calculating the cost of materials used in production, the cost of goods manufactured, and the cost of goods sold?

TP4. LO 4.6 If a company bases its predetermined overhead rate on 100,000 machine hours, and it actually has 100,000 machine hours, would there be an underapplied or overapplied overhead?

TP5. LO 4.7 How do the job cost sheets act as a subsidiary ledger for the work in process inventory if journal entries are not made to the job cost sheets?

TP6. LO 4.8 How is a job order cost system used in a service industry?

5

Process Costing

Figure 5.1 David and William's Family Cookie Venture. (credit: modification of "Big Giant cookies" by Sayuri Miss/Flickr, CC BY 2.0)

Chapter Outline

LO **5.1** Compare and Contrast Job Order Costing and Process Costing

LO **5.2** Explain and Identify Conversion Costs

LO **5.3** Explain and Compute Equivalent Units and Total Cost of Production in an Initial Processing Stage

LO **5.4** Explain and Compute Equivalent Units and Total Cost of Production in a Subsequent Processing Stage

LO **5.5** Prepare Journal Entries for a Process Costing System

Why It Matters

David and William's family has used a secret family recipe for generations to make amazing chocolate chip cookies. While in college, they helped their grandmother, who used only locally sourced products, make and sell the cookies to a local restaurant. They helped her become more efficient, discovered how to retain the quality taste while making larger batches, and developed a plate-sized version that could be decorated similar to a birthday cake. After creating an equally successful peanut butter cookie recipe, David and William decided to expand the business and sell to high-end grocers as well as to a second restaurant. They found it was optimal in terms of cost, efficiency, and quality to produce 100 cookies per batch for each regular-sized cookie and 5 cookies per batch for the large cookies. They surveyed restaurants and grocery stores and determined that each flavor should be offered in four different package sizes. They also analyzed the marketability at various sale prices. David and William now know they need to use their information to identify the costs associated with making the cookies. They need to know the cost to produce one unit of their product in order to price their cookies correctly, determine the optimal product mix, manage efficiency and process improvement, and make other management decisions.

5.1 Compare and Contrast Job Order Costing and Process Costing

As you've learned, job order costing is the optimal accounting method when costs and production specifications are not identical for each product or customer but the direct material and direct labor costs can easily be traced to the final product. Job order costing is often a more complex system and is appropriate when the level of detail is necessary, as discussed in Job Order Costing. Examples of products manufactured using the job order costing method include tax returns or audits conducted by a public accounting firm, custom furniture, or, in a comprehensive example, semitrucks. At the Peterbilt factory in Denton, Texas, the company can build over 100,000 unique versions of their semitrucks without making the same truck twice.

Process costing is the optimal costing system when a standardized process is used to manufacture identical products and the direct material, direct labor, and manufacturing overhead cannot be easily or economically traced to a specific unit. Process costing is used most often when manufacturing a product in batches. Each department or production process or batch process tracks its direct material and direct labor costs as well as the number of units in production. The actual cost to produce each unit through a process costing system varies, but the average result is an adequate determination of the cost for each manufactured unit. Examples of items produced and accounted for using a form of the process costing method could be soft drinks, petroleum products, or even furniture such as chairs, assuming that the company makes batches of the same chair, instead of customizing final products for individual customers.

For example, small companies, such as David and William's, and large companies, such as Nabisco, use similar cost-determination processes. In order to understand how much each product costs—for example, Oreo cookies—Nabisco uses process costing to track the direct materials, direct labor, and manufacturing overhead used in the manufacturing of its products. Oreo production has six distinct steps or departments: (1) make the cookie dough, (2) press the cookie dough into a molding machine, (3) bake the cookies, (4) make the filling and apply it to the cookies, (5) put the cookies together into a sandwich, and (6) and place the cookies into plastic trays and packages. Each department keeps track of its direct materials used and direct labor incurred, and manufacturing overhead applied to facilitate determining the cost of a batch of Oreo cookies.

As previously mentioned, process costing is used when similar items are produced in large quantities. As such, many individuals immediately associate process costing with assembly line production. Process costing works best when products cannot be distinguished from each other and, in addition to obvious production line products like ice cream or paint, also works for more complex manufacturing of similar products like small engines. Conversely, products in a job order cost system are manufactured in small quantities and include custom jobs such as custom manufacturing products. They can also be legal or accounting tasks, movie production, or major projects such as construction activities.

The difference between process costing and job order costing relates to how the costs are assigned to the products. In either costing system, the ability to obtain and analyze cost data is needed. This results in the costing system selected being the one that best matches the manufacturing process.

A job order cost system is often more expensive to maintain than a basic process costing system, since there is a cost associated with assigning the individual material and labor to the product. Thus, a job order cost system is used for custom jobs when it is easy to determine the cost of materials and labor used for each job. A process cost system is often less expensive to maintain and works best when items are identical and it is difficult to trace the exact cost of materials and labor to the final product. For example, assume that your company uses three production processes to make jigsaw puzzles. The first process glues the picture on the cardboard backing, the second process cuts the puzzle into pieces, and the final process loads the pieces into

the boxes and seals them. Tracing the complete costs for the batch of similar puzzles would likely entail three steps, with three separate costing system components. In this environment, it would be difficult and not economically feasible to trace the exact materials and the exact labor to each individual puzzle; rather, it would be more efficient to trace the costs per batch of puzzles.

The costing system used typically depends on whether the company can most efficiently and economically trace the costs to the job (favoring job order costing system) or to the production department or batch (favoring a process costing system).

While the costing systems are different from each other, management uses the information provided to make similar managerial decisions, such as setting the sales price. For example, in a job order cost system, each job is unique, which allows management to establish individual prices for individual projects. Management also needs to establish a sales price for a product produced with a process costing system, but this system is not designed to stop the production process and individually cost each batch of a product, so management must set a price that will work for many batches of the product.

In addition to setting the sales price, managers need to know the cost of their products in order to determine the value of inventory, plan production, determine labor needs, and make long- and short-term plans. They also need to know the costs to determine when a new product should be added or an old product removed from production.

In this chapter, you will learn when and why process costing is used. You'll also learn the concepts of conversion costs and equivalent units of production and how to use these for calculating the unit and total cost of items produced using a process costing system.

Basic Managerial Accounting Terms Used in Job Order Costing and Process Costing

Regardless of the costing system used, manufacturing costs consist of direct material, direct labor, and manufacturing overhead. Figure 5.2 shows a partial organizational chart for Rock City Percussion, a drumstick manufacturer. In this example, two groups—administrative and manufacturing—report directly to the chief financial officer (CFO). Each group has a vice president responsible for several departments. The organizational chart also shows the departments that report to the production department, illustrating the production arrangement. The material storage unit stores the types of wood used (hickory, maple, and birch), the tips (nylon and felt), and packaging materials.

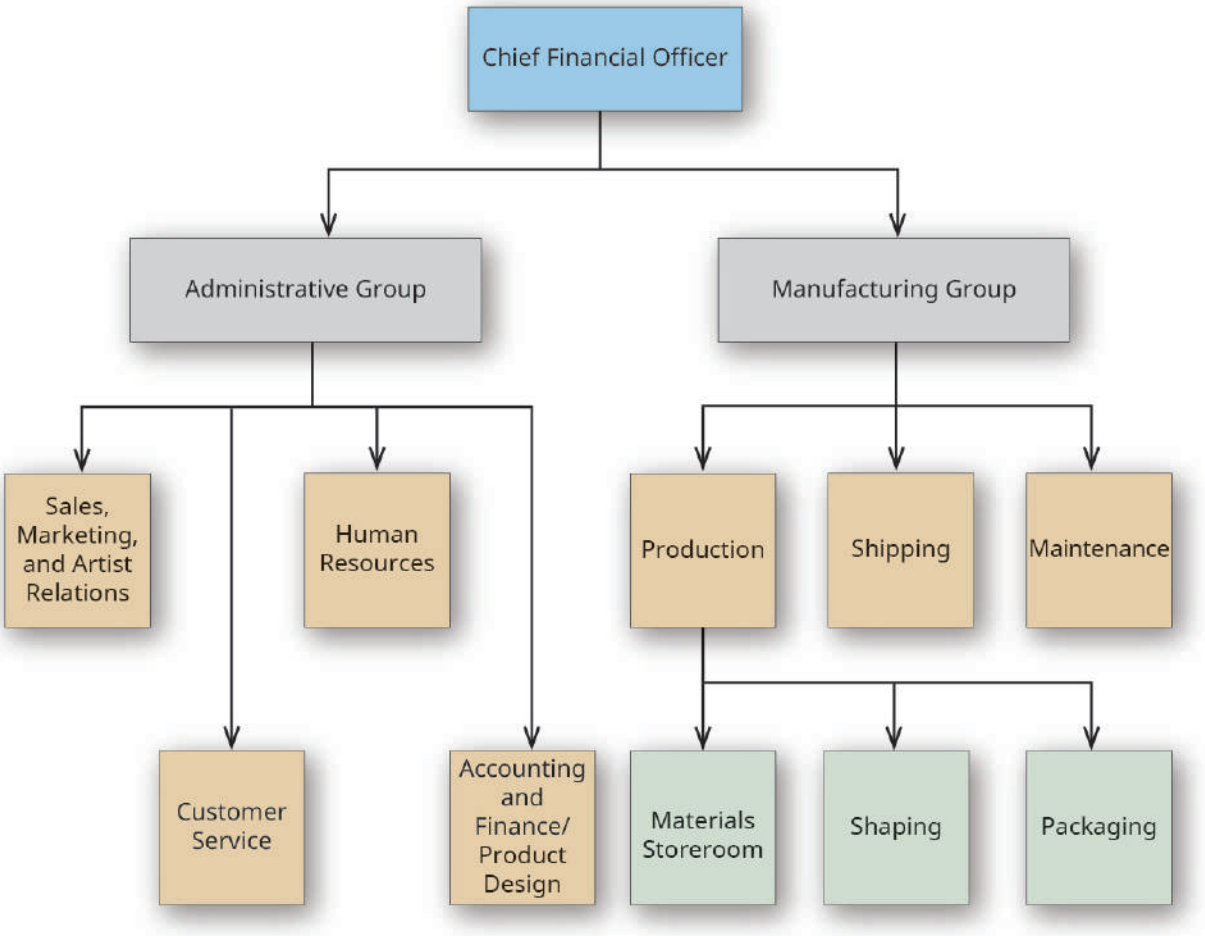


Figure 5.2 The Organizational Chart for Rock City Percussion. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Understanding the company's organization is an important first step in any costing system. Next is understanding the production process. The most basic drumstick is made of hickory and has a wooden tip. When the popular size 5A stick is manufactured, the hickory stored in the materials storeroom is delivered to the shaping department where the wood is cut into pieces, shaped into dowels, and shaped into the size 5A shape while under a stream of water. The sticks are dried, and then sent to the packaging department, where the sticks are embossed with the Rock City Percussion logo, inspected, paired, packaged, and shipped to retail outlets such as Guitar Center. The manufacturing process is described in Figure 5.3.

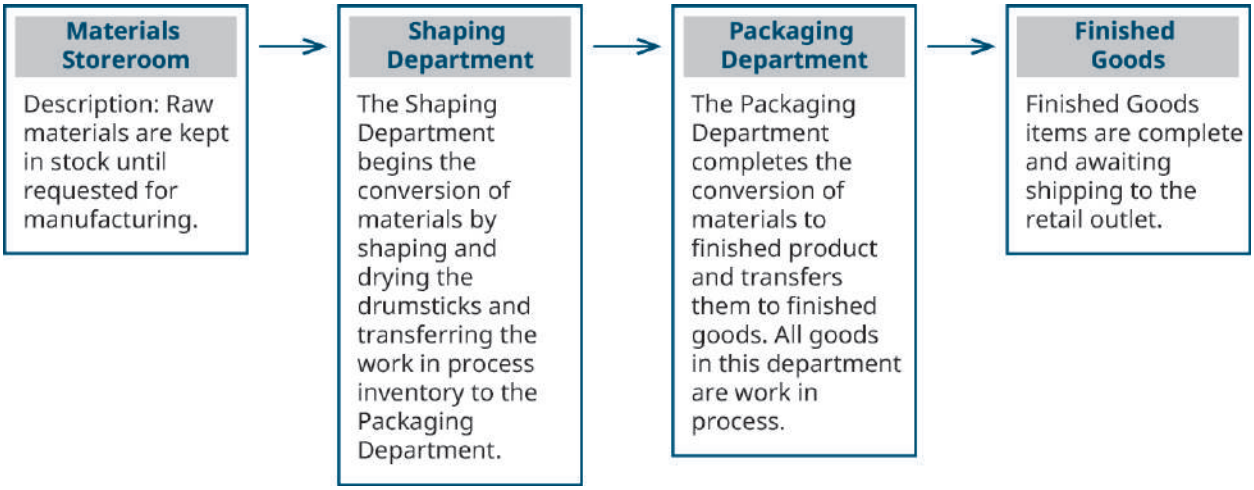


Figure 5.3 Rock City Percussion Manufacturing Process. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

The different units within Rock City Percussion illustrate the two main cost categories of a manufacturing company: manufacturing costs and administrative costs.

LINK TO LEARNING

Understanding the full manufacturing process for a product helps with tracking costs. This video on how drumsticks are made (https://openstax.org/l/50drumsticks) shows the production process for drumsticks at one company, starting with the raw wood and ending with packaging.

Manufacturing Costs

Manufacturing costs or **product costs** include all expenses required to manufacture the product: direct materials, direct labor, and manufacturing overhead. Since process costing assigns the costs to each department, the inventory at the end of the period includes the finished goods inventory, and the work in process inventory for each manufacturing department. For example, using the departments shown in Figure 5.3, raw materials inventory is the cost paid for the materials that remain in the storeroom until requested.

While still in production, the work in process units are moved from one department to the next until they are completed, so the work in process inventory includes all of the units in the shaping and packaging departments. When the units are completed, they are transferred to finished goods inventory and become costs of goods sold when the product is sold.

When assigning costs to departments, it is important to separate the product costs from the **period costs**, which are those that are typically related with a particular time period, instead of attached to the production of an asset. Management often needs additional information to make decisions and needs the product costs further categorized as prime costs or conversion costs (Figure 5.4). **Prime costs** are costs that include the primary (or direct) product costs: direct material and direct labor. **Conversion costs** are the costs necessary to

convert direct materials into a finished product: direct labor and manufacturing overhead, which includes other costs that are not classified as direct materials or direct labor, such as plant insurance, utilities, or property taxes. Also, note that direct labor is considered to be a component of both prime costs and conversion costs.

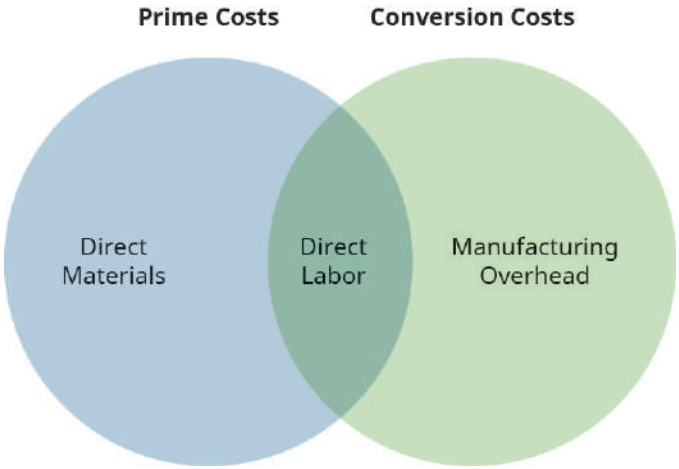


Figure 5.4 Prime Costs and Conversion Costs. Product costs can be categorized as prime costs (direct product costs) or conversion costs (costs incurred while converting the materials into a finished product). Direct labor is accounted for in both categories. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Job order costing tracks prime costs to assign direct material and direct labor to individual products (jobs). Process costing also tracks prime costs to assign direct material and direct labor to each production department (batch). Manufacturing overhead is another cost of production, and it is applied to products (job order) or departments (process) based on an appropriate activity base.

ETHICAL CONSIDERATIONS

The Unethical Bakery Accountant[1],[2]

According to the Federal Bureau of Investigation (FBI), "Sandy Jenkins was a shy, daydreaming accountant at the Collin Street Bakery, the world's most famous fruitcake company. He was tired of feeling invisible, so he started stealing—and got a little carried away." Being unethical netted the accountant ten years in federal prison, and his wife Kay was sentenced to five years' probation and 100 hours of community service, and she was required to write a formal apology to the bakery. According to the FBI, "Jenkins spent over $11 million on a Black American Express card alone—roughly $98,000 per month over the course of the scheme—for a couple that had a legitimate income, through the Bakery, of approximately $50,000 per year."

How did this happen? *Texas Monthly* reports that Sandy found a way to write unapproved checks in the accounting system. He implemented his accounting system and created checks that were "signed" by the owner of the company, Bob McNutt. McNutt was perplexed as to why his bakery was not more

profitable year after year. The accountant was stealing the money while making the stolen checks appear to be paying for material costs or operating costs. According to *Texas Monthly*, "Once Sandy was sure that nobody had noticed the first fraudulent check, he tried it again. And again and again. Each time, Sandy would repeat the scheme, pairing his fraudulent check with one that appeared legitimate. Someone would have to closely examine the checks to see any discrepancies, and that seemed unlikely." The multimillion dollar fraud was exposed when another accountant looked closely at the checks and noticed discrepancies.

Selling and Administrative Expenses

Selling and administrative (S&A) expenses are period costs, which means that they are recorded in the period in which they were incurred. Selling and administrative expenses typically are not directly assigned to the items produced or services provided and include costs of departments not directly associated with manufacturing but necessary to operate the business. The selling costs component of S&A expenses is related to the promotion and sale of the company's products, while administrative expenses are related to the administration of the company. Some examples of S&A expenses include marketing costs; administration building rent; the chief executive officer's salary expense; and the accounting, payroll, and data processing department expenses.

These general rules for S&A expenses, however, have their exceptions. For example, some items that are classified as overhead, such as plant insurance, are period costs but are classified as overhead and are attached to the items produced as product costs.

The **expense recognition principle** is the primary reason to separate the costs of production from the other expenses of the company. This principle requires costs to be recorded in the period in which they are incurred. The costs are expensed when matched to the revenue with which they are associated; this is commonly referred to as *having the expenses follow the revenues*.

Period costs are expensed during the period in which they are incurred; this allows a company to apply the administrative and other expenses shown on the income statement to the same period in which the company earns income. Under generally accepted accounting principles (GAAP), separating the production costs and assigning them to the department results in the costs of the product staying with the work in process inventory for each department. This follows the expense recognition principle because the cost of the product is expensed when revenue from the sale is recognized.

Equivalent Units

In a process cost system, costs are maintained by each department, and the method for determining the cost per individual unit is different than in a job order costing system. Rock City Percussion uses a process cost system because the drumsticks are produced in batches, and it is not economically feasible to trace the direct labor or direct material, like hickory, to a specific drumstick. Therefore, the costs are maintained by each

1 Katy Vine. "Just Desserts." *Texas Monthly*. October 2010. https://features.texasmonthly.com/editorial/just-desserts/

2 Federal Bureau of Investigation (FBI). "Former Collin Street Bakery Executive and Wife Sentenced." September 16, 2015. https://www.fbi.gov/contact-us/field-offices/dallas/news/press-releases/former-collin-street-bakery-executive-and-wife-sentenced

department, rather than by job, as they are in job order costing.

How does an organization determine the cost of each unit in a process costing environment? The costs in each department are allocated to the number of units produced in a given period. This requires determination of the number of units produced, but this is not always an easy process. At the end of the accounting period, there typically are always units still in production, and these units are only partially complete. Think of it this way: At midnight on the last day of the month, all accounting numbers need to be determined in order to process the financial statements for that month, but the production process does not stop at the end of each accounting period. However, the number of units produced must be calculated at the end of the accounting period to determine the number of **equivalent units**, or the number of units that would have been produced if the units were produced sequentially and in their entirety in a particular time period. The number of equivalent units is different from the number of actual units and represents the number of full or whole units that could have been produced given the amount of effort applied. To illustrate, consider this analogy. You have five large pizzas that each contained eight slices. Your friends served themselves, and when they were finished eating, there were several partial pizzas left. In equivalent units, determine how many whole pizzas are left if the remaining slices are divided as shown in Figure 5.5.

- Pie 1 had one slice
- Pie 2 had two slices
- Pie 3 had two slices
- Pie 4 had three slices
- Pie 5 had eight slices

Together, there are sixteen slices left. Since there are eight slices per pizza, the leftover pizza would be considered two full equivalent units of pizzas. The equivalent unit is determined separately for direct materials and for conversion costs as part of the computation of the per-unit cost for both material and conversion costs.

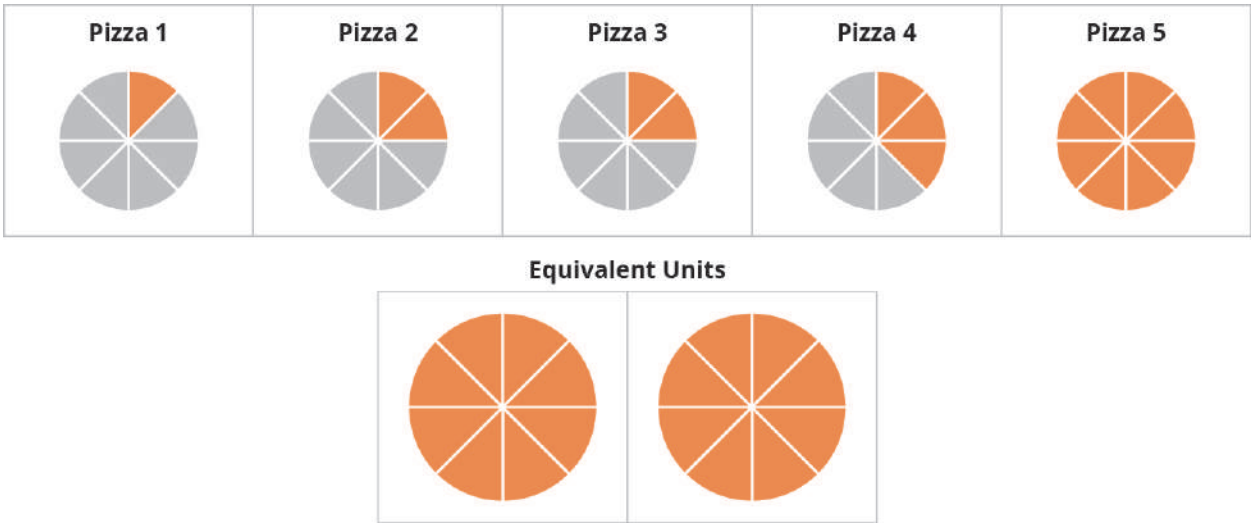


Figure 5.5 Equivalent Units. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Major Characteristics of Process Costing

Process costing is the optimal system for a company to use when the production process results in many similar units. It is used when production is continuous or occurs in large batches and it is difficult to trace a

particular input cost to a specific individual product.

For example, before David and William found ways to make five large cookies per batch, their family always made one large cookie per batch. In order to make five cookies at a time, they had to gather the ingredients and baking materials, including five bowls and five cookie sheets. The exact amount of ingredients for one large cookie was mixed in each separate bowl and then placed on the cookie sheet. When this method was used, it was easy to establish that exactly one egg, two cups of flour, three-quarter cup of chocolate chips, three-quarter cup of sugar, one-quarter teaspoon salt, and so forth, were in each cookie. This made it easy to determine the exact cost of each cookie. But if David and William used one bowl instead of five bowls, measured the ingredients into it and then divided the dough into five large cookies, they could not know for certain that each cookie has exactly two cups of flour. One cookie may have 1 7/8 cups and another may have 1 15/16 cups, and one cookie may have a few more chocolate chips than another. It is also impossible to trace the chocolate chips from each bag to each cookie because the chips were mixed together. These variations do not affect the taste and are not important in this type of accounting. Process costing is optimal when the products are relatively homogenous or indistinguishable from one another, such as bottles of vegetable oil or boxes of cereal.

Often, process costing makes sense if the individual costs or values of each unit are not significant. For example, it would not be cost effective for a restaurant to make each cup of iced tea separately or to track the direct material and direct labor used to make each eight-ounce glass of iced tea served to a customer. In this scenario, job order costing is a less efficient accounting method because it costs more to track the costs per eight ounces of iced tea than the cost of a batch of tea. Overall, when it is difficult or not economically feasible to track the costs of a product individually, process costing is typically the best cost system to use.

Process costing can also accommodate increasingly complex business scenarios. While making drumsticks may sound simple, an immense amount of technology is involved. Rock City Percussion makes 8,000 hickory sticks per day, four days each week. The sticks made of maple and birch are manufactured on the fifth day of the week. It is difficult to tell the first drumstick made on Monday from the 32,000th one made on Thursday, so a computer matches the sticks in pairs based on the tone produced.

Process costing measures and assigns the costs to the associated department. The basic 5A hickory stick consists only of hickory as direct material. The rest of the manufacturing process involves direct labor and manufacturing overhead, so the focus is on properly assigning those costs. Thus, process costing works well for simple production processes such as cereal, rubber, and steel, and for more complicated production processes such as the manufacturing of electronics and watches, if there is a degree of similarity in the production process.

In a process cost system, each department accumulates its costs to compute the value of work in process inventory, so there will be a work in process inventory for each manufacturing or production department as well as an inventory cost for finished goods inventory. Manufacturing departments are often organized by the various stages of the production process. For example, blending, baking, and packaging could each be categorized as manufacturing or production departments for the cookie producer, while cutting, assembly, and finishing could be manufacturing or production departments with accompanying costs for a furniture manufacturer. Each department, or process, will have its own work in process inventory account, but there will only be one finished goods inventory account.

There are two methods used to compute the values in the work in process and finished goods inventories. The first method is the weighted-average method, which includes all costs (costs incurred during the current period and costs incurred during the prior period and carried over to the current period). This method is often favored, because in the process cost production method there often is little product left at the end of the

period and most has been transferred out. The second method is the first-in, first-out (FIFO) method, which calculates the unit costs based on the assumption that the first units sold come from the prior period's work in process that was carried over into the current period and completed. After these units are sold, the newer completed units can then be sold. The theory is similar to the FIFO inventory valuation process that you learned about in Inventory (http://cnx.org/content/m67888/latest/) . (Since the FIFO process costing method is more complicated than the weighted-average method, the FIFO method is typically covered in more advanced accounting courses.)

With processing, it is difficult to establish how much of each material, and exactly how much time is in each unit of finished product. This will require the use of the equivalent unit computation, and management selects the method (weighted average or FIFO) that best fits their information system.

Process costing can also be used by service organizations that provide homogeneous services and often do not have inventory to value, such as a hotel reservation system. Although they have no inventory, the hotel might want to know its costs per reservation for a period. They could allocate the total costs incurred by the reservation system based on the number of inquiries they served. For example, assume that in a year they incurred costs of $200,000 and served 50,000 potential guests. They could determine an average cost by dividing costs by number of inquiries, or $200,000/50,000 = $4.00 per potential guest.

In the case of a not-for-profit company, the same process could be used to determine the average costs incurred by a department that performs interviews. The department's costs would be allocated based on the number of cases processed. For example, assume a not-for-profit pet adoption organization has an annual budget of $180,000 and typically matches 900 shelter animals with new owners each year. The average cost would be $200 per match.

Similarities between Process Costing and Job Order Costing

Both process costing and job order costing maintain the costs of direct material, direct labor, and manufacturing overhead. The process of production does not change because of the costing method. The costing method is chosen based on the production process.

In job order cost production, the costs can be directly traced to the job, and the job cost sheet contains the total expenses for that job. Process costing is optimal when the costs cannot be traced directly to the job. For example, it would be impossible for David and William to trace the exact amount of eggs in each chocolate chip cookie. It is also impossible to trace the exact amount of hickory in a drumstick. Even two sticks made sequentially may have different weights because the wood varies in density. These types of manufacturing are optimal for the process cost system.

The similarities between job order cost systems and process cost systems are the product costs of materials, labor, and overhead, which are used determine the cost per unit, and the inventory values. The differences between the two systems are shown in Table 5.1.

Differences between Job Order Costing and Process Costing

Job Order Costing	Process Costing
Product costs are traced to the product and recorded on each job's individual job cost sheet.	Product costs are traced to departments or processes.
Each department tracks its expenses and adds them to the job cost sheet. As jobs move from one department to another, the job cost sheet moves to the next department as well.	Each department tracks its expenses, the number of units started or transferred in, and the number of units transferred to the next department.
Unit costs are computed using the job cost sheet.	Unit costs are computed using the departmental costs and the equivalent units produced.
Finished goods inventory includes the products completed but not sold, and all incomplete jobs are work in process inventory.	Finished goods inventory is the number of units completed at the per unit cost. Work in process inventory is the cost per unit and the equivalent units remaining to be completed.

Table 5.1

CONCEPTS IN PRACTICE

Choosing Between Process Costing and Job Order Costing

Process costing and job order costing are both acceptable methods for tracking costs and production levels. Some companies use a single method, while some companies use both, which creates a hybrid costing system. The system a company uses depends on the nature of the product the company manufactures.

Companies that mass produce a product allocate the costs to each department and use process costing. For example, General Mills uses process costing for its cereal, pasta, baking products, and pet foods. Job order systems are custom orders because the cost of the direct material and direct labor are traced directly to the job being produced. For example, Boeing uses job order costing to manufacture planes.

When a company mass produces parts but allows customization on the final product, both systems are used; this is common in auto manufacturing. Each part of the vehicle is mass produced, and its cost is calculated with process costing. However, specific cars have custom options, so each individual car costs the sum of the specific parts used.

THINK IT THROUGH

Direct or Indirect Material

Around Again is a wooden frame manufacturer. Wood and fastener metals are typically added at the beginning of the process and are easily tracked as direct material. Sometimes, after inspection, the product needs to be reworked and additional pieces are added. Because the frames have already been through each department, the additional work is typically minor and often entails simply adding an additional fastener to keep the back of the frame intact. Other times, all the frame needs is additional glue for a corner piece.

How does a company differentiate between direct and indirect material? Many direct material costs, as the wood in the frame, are easy to identify as direct costs because the material is identifiable in the final product. But not all readily identifiable material is a direct material cost.

Technology makes it easy to track costs as small as one fastener or ounce of glue. However, if each fastener had to be requisitioned and each ounce of glue recorded, the product would take longer to make and the direct labor cost would be higher. So, while it is possible to track the cost of each individual product, the additional information may not be worth the additional expense. Managerial accountants work with management to decide which products should be accounted for as direct material and tracked individually, versus which should be considered indirect material and allocated to the departments through overhead application.

Should Around Again consider the fasteners or glue added after inspection as direct material or indirect material?

5.2 Explain and Identify Conversion Costs

In a processing environment, there are two concepts important to determining the cost of products produced. These are the concepts of equivalent units and conversion costs. As you have learned, equivalent units are the number of units that would have been produced if one unit was completed before starting a second unit. For example, four units that are one-fourth finished would equal one equivalent unit. Conversion costs are the labor and overhead expenses that “convert” raw materials into a completed unit. Each department tracks its conversion costs in order to determine the quantity and cost per unit (see TBD; we discuss this concept in more detail later). Management often uses the cost information generated to set the sales price; to set

standard usage data and price for material, labor, and overhead; and to allow management to evaluate the efficiency of production and plan for the future.

Definition of Conversion Costs

Conversion costs are the total of direct labor and factory overhead costs. They are combined because it is the labor and overhead together that convert the raw material into the finished product. Remember that factory, manufacturing, or organizational overhead (you might see all three terms in practice) is composed of three sources: indirect materials, indirect labor, and all other overhead costs that are not indirect materials or indirect labor. Materials are often added in stages at discrete points of production, such as at the beginning, middle, or end of a process, but conversion is usually applied equally throughout the process. For example, in the opening example, David and William do not add direct material (ingredients) evenly throughout the cookie-making process. They are all added at the beginning of the production process, so they begin with the direct materials but add labor and overhead throughout the rest of the process.

Conversion costs can be explained through the process of making Just Born's Peeps. Just Born makes 5.5 million Peeps per day using three ingredients and the following process:[3]

1. Use machines to add and mix the sugar, corn syrup, and gelatin into a mixture called a slurry. Send slurry through a whipper to give the marshmallow its fluffy texture.
2. Color the sugar.
3. Deposit marshmallows on sugar-coated belts in the Peep shape. Send Peeps on belts through a wind tunnel that stirs up the sugar to coat the entire shape.
4. Add eyes, and inspect.
5. Move the Peeps via belt into their appropriate tray, and wrap with cellophane.

In the Peep-making process, the direct materials of sugar, corn syrup, gelatin, color, and packaging materials are added at the beginning of steps 1, 2, and 5. While the fully automated production does not need direct labor, it does need indirect labor in each step to ensure the machines are operating properly and to perform inspections (step 4).

Mechanics of Applying Conversion Costs

Let's return to our drumstick example to learn how to work with conversion costs. Rock City Percussion has two departments critical to manufacturing drumsticks: the shaping and packaging departments.

The shaping department uses only wood as its direct material and water as its indirect material. In the shaping department, the material is added first. Then, machines cut the wood underwater into dowels, separate them, and move them to machines that shape the dowels into drumsticks. These machines need electricity to operate and personnel to monitor and adjust the processes and to maintain the equipment. When the shaping is finished, a conveyer belt transfers the sticks to the finishing department.

Since the drumsticks are made by performing one process on one batch at a time, instead of producing one stick at a time from start to finish, it is difficult to determine the exact materials, labor, and overhead for a single pair of drumsticks. It is easier to track the materials and conversion costs for one batch and have those costs follow the batch to the next process.

Therefore, once the batch of sticks gets to the second process—the packaging department—it already has

3 Just Born. "Marshmallow Peeps Factory Tour." n.d. http://www.justborn.com/resource/corporate/popups/virtualTour.cfm

costs attached to it. In other words, the packaging department receives both the drumsticks and their related costs from the shaping department. For the basic size 5A stick, the packaging department adds material at the beginning of the process. The 5A uses only packaging sleeves as its direct material, while other types may also include nylon, felt, and/or the ingredients for the proprietary handgrip. Direct labor and manufacturing overhead are used to test, weigh, and sound-match the drumsticks into pairs.

Thus, at the end of the accounting period, there are two work in process inventories: one in the shaping department and one in the packaging department.

Direct materials are added at the beginning of shaping and packaging departments, so the work in process inventory for those departments is 100% complete with regard to materials, but it is not complete with regard to conversion costs. If they were 100% complete with regard to conversion costs, then they would have been transferred to the next department.

LINK TO LEARNING

Management needs to understand its costs in order to set prices, budget for the upcoming year, and evaluate performance. Sometimes individuals become managers due to their knowledge of the production process but not necessarily the costs. Managers can view this information on the importance of identifying prime and conversion costs (https://openstax.org/l/50PrimeConvCost) from Investopedia, a resource for managers.

5.3 Explain and Compute Equivalent Units and Total Cost of Production in an Initial Processing Stage

As described previously, process costing can have more than one work in process account. Determining the value of the work in process inventory accounts is challenging because each product is at varying stages of completion and the computation needs to be done for each department. Trying to determine the value of those partial stages of completion requires application of the equivalent unit computation. The equivalent unit computation determines the number of units if each is manufactured in its entirety before manufacturing the next unit. For example, forty units that are 25% complete would be ten (40 × 25%) units that are totally complete.

Direct material is added in stages, such as the beginning, middle, or end of the process, while conversion costs are expensed evenly over the process. Often there is a different percentage of completion for materials than there is for labor. For example, if material is added at the beginning of the process, the forty units that are 100% complete with respect to material and 25% complete with respect to conversion costs would be the same as forty units of material and ten units (40 × 25%) completed with conversion costs.

For example, during the month of July, Rock City Percussion purchased raw material inventory of $25,000 for the shaping department. Although each department tracks the direct material it uses in its own department, all material is held in the material storeroom. The inventory will be requisitioned for each department as needed.

During the month, Rock City Percussion's shaping department requested $10,179 in direct material and started into production 8,700 hickory drumsticks of size 5A. There was no beginning inventory in the shaping

department, and 7,500 drumsticks were completed in that department and transferred to the finishing department. Wood is the only direct material in the shaping department, and it is added at the beginning of the process, so the work in process (WIP) is considered to be 100% complete with respect to direct materials. At the end of the month, the drumsticks still in the shaping department were estimated to be 35% complete with respect to conversion costs. All materials are added at the beginning of the shaping process. While beginning the size 5A drumsticks, the shaping department incurred these costs in July:

Direct materials	$10,179
Direct labor	15,176
Applied overhead	7,000
Total cost	$32,355

These costs are then used to calculate the equivalent units and total production costs in a four-step process.

Step One: Determining the Units to Which Costs Will Be Assigned

In addition to the equivalent units, it is necessary to track the units completed as well as the units remaining in ending inventory. A similar process is used to account for the costs completed and transferred. Reconciling the number of units and the costs is part of the process costing system. The reconciliation involves the total of beginning inventory and units started into production. This total is called "units to account for," while the total of beginning inventory costs and costs added to production is called "costs to be accounted for." Knowing the total units or costs to account for is helpful since it also equals the units or costs transferred out plus the amount remaining in ending inventory.

When the new batch of hickory sticks was started on July 1, Rock City Percussion did not have any beginning inventory and started 8,700 units, so the total number of units to account for in the reconciliation is 8,700:

Units to Account For	Units
Beginning work in process	0
Units started into production	8,700
Total units to account for	8,700

The shaping department completed 7,500 units and transferred them to the testing and sorting department. No units were lost to **spoilage**, which consists of any units that are not fit for sale due to breakage or other imperfections. Since the maximum number of units that could possibly be completed is 8,700, the number of units in the shaping department's ending inventory must be 1,200. The total of the 7,500 units completed and transferred out and the 1,200 units in ending inventory equal the 8,700 possible units in the shaping department.

Units Accounted For	Units
Completed and transferred out	7,500
Ending work in process	1,200
Total units to account for	8,700

Step Two: Computing the Equivalent Units of Production

All of the materials have been added to the shaping department, but all of the conversion elements have not; the numbers of equivalent units for material costs and for conversion costs remaining in ending inventory are different. All of the units transferred to the next department must be 100% complete with regard to that

department's cost or they would not be transferred. So the number of units transferred is the same for material units and for conversion units. The process cost system must calculate the equivalent units of production for units completed (with respect to materials and conversion) and for ending work in process with respect to materials and conversion.

For the shaping department, the materials are 100% complete with regard to materials costs and 35% complete with regard to conversion costs. The 7,500 units completed and transferred out to the finishing department must be 100% complete with regard to materials and conversion, so they make up 7,500 (7,500 × 100%) units. The 1,200 ending work in process units are 100% complete with regard to material and have 1,200 (1,200 × 100%) equivalent units for material. The 1,200 ending work in process units are only 35% complete with regard to conversion costs and represent 420 (1,200 × 35%) equivalent units.

Work in Process Completion %		**100%**	**35%**
Units accounted for	**Total Units**	**Material Units**	**Conversion Units**
Completed and transferred out	7,500	7,500	7,500
Ending work in process	1,200	1,200	420
Total equivalent units for shaping	8,700	8,700	7,920

Step Three: Determining the Cost per Equivalent Unit

Once the equivalent units for materials and conversion are known, the cost per equivalent unit is computed in a similar manner as the units accounted for. The costs for material and conversion need to reconcile with the total beginning inventory and the costs incurred for the department during that month.

Costs to Account For	**Materials**	**Conversion**	**Total**
Beginning work in process	$ 0	$ 0	$ 0
Incurred during the period	$10,179	$22,176	$32,355
Total costs to account for	$10,179	$22,176	$32,355
Equivalent units	8,700	7,920	
Cost per equivalent unit	$ 1.17	$ 2.80	$ 3.97

The total materials costs for the period (including any beginning inventory costs) is computed and divided by the equivalent units for materials. The same process is then completed for the total conversion costs. The total of the cost per unit for material ($1.17) and for conversion costs ($2.80) is the total cost of each unit transferred to the finishing department ($3.97).

Step Four: Allocating the Costs to the Units Transferred Out and Partially Completed in the Shaping Department

Now you can determine the cost of the units transferred out and the cost of the units still in process in the shaping department. To calculate the goods transferred out, simply take the units transferred out times the sum of the two equivalent unit costs (materials and conversion) because all items transferred to the next department are complete with respect to materials and conversion, so each unit brings all its costs. But the ending WIP value is determined by taking the product of the work in process material units and the cost per equivalent unit for materials plus the product of the work in process conversion units and the cost per equivalent unit for conversion.

Transferred out costs	(7,500 units × $1.17) + (7,500 units × $2.80) = $29,775
Ending work in process: materials	(1,200 × $1.17) = $1,404
Ending work in process: conversion	(420 × $2.80) = $1,176
Ending work in process: total	$1,404 + $1,176 = $2,580

This information is accumulated in a **production cost report**. This report shows the costs used in the preparation of a product, including the cost per unit for materials and conversion costs, and the amount of work in process and finished goods inventory. A complete production cost report for the shaping department is illustrated in Figure 5.6.

Units to account for	Units		
Beginning work in process	—		
Units started into production	8,700		
Total units to account for	8,700		
Work in process completion %	100%	35%	
Units accounted for	**Materials Units**	**Conversion Units**	**Total**
Completed and transferred out	7,500	7,500	7,500
Ending work in process	1,200	420	1,200
Total units to account for	8,700	7,920	8,700
Costs to account for	**Materials**	**Conversion**	**Total**
Beginning work in process	$ 0	$ 0	$ 0
Incurred during the period	$10,179	$22,176	$32,355
Total costs to account for	$10,179	$22,176	$32,355
Equivalent units	8,700	7,920	
Cost per equivalent unit	$ 1.17	$ 2.80	$ 3.97
	Materials	**Conversion**	**Total**
Value of ending work in process	$ 1,404	$ 1,176	$ 2,580
Completed and transferred	8,775	21,000	29,775
Total costs	$10,179	$22,176	$32,355

Figure 5.6 Production Cost Report for the Shaping Department. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

YOUR TURN

Calculating Inventory Transferred and Work in Process Costs

Kyler Industries started a new batch of paint on October 1. The new batch consists of 8,700 cans of paint, of which 7,500 was completed and transferred to finished goods. During October, the manufacturing process recorded the following expenses: direct materials of $10,353; direct labor of $17,970; and applied overhead of $9,000. The inventory still in process is 100% complete with respect to materials and 30% complete with respect to conversion. What is the cost of inventory transferred out and work in process? Assume that there is no beginning work in process inventory.

Solution

Units to account for	Units		
Beginning work in process	0		
Units started into production	8,700		
Total units to be account for	8,700		
	Materials	**Conversion**	**Total**
Work in process completion %	100%	30%	
Units accounted for			
Completed and transferred out	7,500	7,500	7,500
Ending work in process	1,200	360	1,200
Total units to account for	8,700	7,860	8,700
Costs to account for	**Materials**	**Conversion**	**Total**
Beginning work in process	0	0	0
Incurred during the period	$10,353	$26,970	$37,323
Total costs to account for	$10,353	$26,970	$37,323
Equivalent units	8,700	7,860	
Cost per equivalent unit	$ 1.19	$ 3.43	$ 4.62

5.4 Explain and Compute Equivalent Units and Total Cost of Production in a Subsequent Processing Stage

In many production departments, units are typically transferred from the initial stage to the next stage in the process. When the units are transferred, the accumulated cost per unit is transferred along with them. Since the unit being produced includes work from all of the prior departments, the transferred-in cost is the cost of the work performed in all earlier departments.

When the hickory size 5A drumsticks have completed the shaping process, they are transferred to the packaging department along with the inventory costs of $29,775. The inventory costs of $29,775 were $8,775 for materials and $21,000 for conversion costs and were calculated in Figure 5.6. During the month of July, Rock City Percussion purchased raw material inventory of $2,000 for the packaging department. As with the shaping department, the packaging department tracks its costs and requisitions the raw material from the material storeroom. The packaging department has computed direct material costs of $2,000, direct labor costs of $13,000, and applied overhead of $9,100, for a total of $22,100 in conversion costs. Equivalent units are computed for this department, and a new cost per unit is computed.

	Materials	**Conversion**	**Total**
Beginning work in process	$ 1,600	$ 6,580	$ 8,180
Transferred in	8,775	21,000	29,775
Added this month	2,000	22,100	24,100
Total	$12,375	$49,680	$62,055

As with calculating the equivalent units and total cost of production in the initial processing stage, there are four steps for calculating these costs in a subsequent processing stage.

Step One: Determining the Stage 2 Units to Which Costs Will Be Assigned

In the initial manufacturing department, there is beginning inventory, and units are started in production. In subsequent stages, instead of starting new units, units are transferred in from the prior department, but the accounting process is the same. Returning to the example, Rock City Percussion had a beginning inventory of 750 units in the packaging department. When the 7,500 sticks are transferred into the packaging department from the shaping department, the total number of units to account for in the reconciliation is 8,250, which is the total of the beginning WIP and the units transferred in:

Units to Account For	Units
Beginning work in process	750
Units transferred in	7,500
Total units to account for	8,250

The reconciliation of units to account for are the same for each department. The units that were completed and transferred out plus the ending inventory equal the total units to account for. The packaging department for Rock City Percussion completed 6,500 units and transferred them into finished goods inventory. Since the maximum number of units to possibly be completed is 8,250 and no units were lost to spoilage, the number of units in the packaging department's ending inventory must be 1,750. The total of the 6,500 units completed and transferred out and the 1,750 units in ending inventory equal the 8,250 possible units in the packaging department.

Units Accounted For	Units
Completed and transferred out	6,500
Ending work in process	1,750
Total units to account for	8,250

Step Two: Computing the Stage 2 Equivalent Units of Production

The only direct material added in the packaging department for the 5A sticks is packaging. The packaging materials are added at the beginning of the process, so all the materials have been added before the units are transferred out, but all of the conversion elements have not. As a result, the number of equivalent units for material costs and for conversion costs remaining in ending inventory is different for the testing and sorting department. As you've learned, all of the units transferred to the next department must be 100% complete with regard to that department's cost, or they would not be transferred. The process cost system must calculate the equivalent units of production for units completed (with respect to materials and conversion) and for ending WIP with respect to materials and conversion.

For the packaging department, the materials are 100% complete with regard to materials costs and 40% complete with regard to conversion costs. The 6,500 units completed and transferred out to the finishing department must be 100% complete with regard to materials and conversion, so they make up 6,500 (6,500 × 100%) units. The 1,750 ending WIP units are 100% complete with regard to material and have 1,750 (1,750 × 100%) equivalent units for material. The 1,750 ending WIP units are only 40% complete with regard to conversion costs and represent 700 (1,750 × 40%) equivalent units.

Work in process completion %		100%	40%
Units accounted for	Total Units	Material Units	Conversion Units
Completed and transferred out	6,500	6,500	6,500
Ending work in process	1,750	1,750	700
Total equivalent units for packaging	8,250	8,250	7,200

Step Three: Determining the Stage 2 Cost per Equivalent Unit

Once the equivalent units for materials and conversion are known for the packaging department, the cost per equivalent unit is computed in a manner similar to the calculation for the units accounted for. The costs for material and conversion need to reconcile with the department's beginning inventory and the costs incurred for the department during that month.

Costs to account for	Materials	Conversion	Total
Beginning work in process	$ 1,600	$ 6,580	$ 8,180
Incurred during the period	$10,775	$43,100	$53,875
Total costs to account for	$12,375	$49,680	$62,055
Equivalent units	8,250	7,200	15,450
Cost per equivalent unit	$ 1.50	$ 6.90	$ 8.40

The total materials costs for the period (including any beginning inventory costs) are computed and divided by the equivalent units for materials. The same process is then completed for the total conversion costs. The total of the cost per unit for materials ($1.50) and for conversion costs ($6.90) is the total cost of each unit transferred to the testing and sorting department.

Step Four: Allocating the Costs to the Units in the Finishing Department

Now you can determine the cost of the units transferred out and the cost of the units still in process in the finishing department. For the goods transferred out, simply take the units transferred out times the sum of the two equivalent unit costs (materials and conversion) because all items transferred to the next department are complete with respect to materials and conversion, so each unit brings all its costs. But the ending WIP value is determined by taking the product of the work in process materials units and the cost per equivalent unit for materials plus the product of the work in process conversion units and the cost per equivalent unit for conversion.

Transferred out costs	(6,500 units × $1.50) + (6,500 units × $6.90) = $54,600
Ending work in process: materials	(1,750 × $1.50) = $2,625
Ending work in process: conversion	(700 × $6.90) = $4,830
Ending work in process: total	$2,625 + $4,830 = $7,455

LINK TO LEARNING

Knowing the cost to produce a unit is critical to management's decisions. Sometimes that knowledge leads to management's decision to stop production, but sometimes that decision isn't as simple as it seems. The cost to produce a penny is more than one cent, and yet, the United States still makes

pennies. See this article from Forbes that explains the difference among cost, worth, and value (https://openstax.org/l/50CostValWorth) to learn more.

5.5 Prepare Journal Entries for a Process Costing System

Calculating the costs associated with the various processes within a process costing system is only a part of the accounting process. Journal entries are used to record and report the financial information relating to the transactions. The example that follows illustrates how the journal entries reflect the process costing system by recording the flow of goods and costs through the process costing environment.

Purchased Materials for Multiple Departments

Each department within Rock City Percussion has a separate work in process inventory account. Raw materials totaling $33,500 were ordered prior to being requisitioned by each department: $25,000 for the shaping department and $8,500 for the packaging department. The July 1 journal entry to record the purchases on account is:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
July 1	Raw Materials Inventory	33,500	
	Accounts Payable		33,500
	To record purchase of raw materials		

Direct Materials Requisitioned by the Shaping and Packaging Departments and Indirect Material Used

During July, the shaping department requisitioned $10,179 in direct material. Similar to job order costing, indirect material costs are accumulated in the manufacturing overhead account. The overhead costs are applied to each department based on a predetermined overhead rate. In the example, assume that there was an indirect material cost for water of $400 in July that will be recorded as manufacturing overhead. The journal entry to record the requisition and usage of direct materials and overhead is:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
July 1	Work in Process Inventory: Shaping Department	10,179	
	Manufacturing Overhead	400	
	Materials Inventory		10,579
	To record direct and indirect material cost for July in the Shaping Department		

During July, the packaging department requisitioned $2,000 in direct material and overhead costs for indirect material totaled $300 for the month of July. The journal entry to record the requisition and usage of materials is:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
July 1	Work in Process Inventory: Packaging Department Manufacturing Overhead Materials Inventory *To record direct and indirect material cost for July in the Packaging Department*	2,000 300	 2,300

Direct Labor Paid by All Production Departments

During July, the shaping department incurred $15,000 in direct labor costs and $600 in indirect labor. The journal entry to record the labor costs is:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
July 1	Work in Process Inventory: Shaping Department Manufacturing Overhead Wages Payable *To record direct and indirect labor for July in the Shaping Department*	15,000 600	 15,600

During July, the packaging department incurred $13,000 of direct labor costs and indirect labor of $1,000. The journal entry to record the labor costs is:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
July 1	Work in Process Inventory: Packaging Department Manufacturing Overhead Wages Payable *To record direct and indirect labor for July in the Packaging Department*	13,000 1,000	 14,000

Applied Manufacturing Overhead to All Production Departments

Manufacturing overhead includes indirect material, indirect labor, and other types of manufacturing overhead. It is difficult, if not impossible, to trace manufacturing overhead to a specific product, and yet, the total cost per unit needs to include overhead in order to make management decisions.

Overhead costs are accumulated in a manufacturing overhead account and applied to each department on the basis of a predetermined overhead rate. Properly allocating overhead to each department depends on finding an activity that provides a fair basis for the allocation. It needs to be an activity common to each department and influential in driving the cost of manufacturing overhead. In traditional costing systems, the most common activities used are machine hours, direct labor in dollars, or direct labor in hours. If the number of machine hours can be related to the manufacturing overhead, the overhead can be applied to each department based on the machine hours. The formula for overhead allocation is:

$$\text{Overhead Allocation} = \frac{\text{Estimated Overhead Costs (\$)}}{\text{Expected Annual Activity (machine hours)}}$$

Rock City Percussion determined that machine hours is the appropriate base to use when allocating overhead.

The estimated annual overhead cost is $340,000 per year. It was also estimated that the total machine hours will be 34,000 hours, so the allocation rate is computed as:

$$\frac{\text{Estimated Overhead Costs (\$340,000)}}{\text{Expected Annual Activity (34,000)}} = \text{\$10 per machine hour}$$

The shaping department used 700 machine hours, and with an overhead application rate of $10 per direct labor hour, the journal entry to record the overhead allocation is:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
July 1	Work in Process Inventory: Shaping Department	7,000	
	Manufacturing Overhead		7,000
	To record overhead applied to the Shaping Department		

The finishing department used 910 machine hours, and with an overhead application rate of $10 per direct labor hour, the journal entry to record the overhead allocation is:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
July 1	Work in Process Inventory: Finishing Department	9,100	
	Manufacturing Overhead		9,100
	To record overhead applied to the Finishing Department		

Transferred Costs of Finished Goods from the Shaping Department to the Packaging Department

When the units are transferred from the shaping department to the packaging department, they are transferred at $3.97 per unit, as calculated previously. The amount transferred from the shaping department is the same amount listed on the production cost report in Figure 5.6. The journal entry is:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
July 1	Work in Process Inventory: Finishing Department	29,775	
	Work in Process Inventory: Shaping Department		29,775
	To record the weighted-average method of the cost of goods transferred from the Shaping Department to the Packaging Department		

Transferred Goods from the Packaging Department to Finished Goods

The computation of inventory for the packaging department is shown in Figure 5.7.

Costs to Account For		Units to Account For	
Beginning work in process	$ 8,180	Beginning WIP	750
Direct material	2,000	Units started into production	7,500
Direct labor	13,000	Total units to account for:	8,250
Applied overhead	9,100		
Transferred in	29,775		
Total costs to account for	$62,055		

Step 1: Units to Assign Costs

Completed and transferred out	6,500
Ending work in process	1,750
Total units to account for	8,250

Step 2: Computing Equivalent Units of Production

Work in process completion %		40%	
	Material Units	**Conversion Units**	**Total**
Completed and transferred out	6,500	6,500	6,500
Ending work in process	1,750	700	1,750
Total units to account for	8,250	7,200	8,250

Step 3: Determining Cost per Equivalent Unit

Costs to account for	**Materials**	**Conversion**	**Total**
Beginning work in process	$ 1,600	$ 6,580	$ 8,180
Incurred during the period	$10,775	$43,100	$53,875
Total costs to account for	$12,375	$49,680	$62,055
Equivalent units	8,250	7,200	
Cost per equivalent unit for department	$ 1.50	$ 6.90	$ 8.40

Step 4: Allocating the Costs to Units Transferred to Finished Goods and Partially Completed Units

Transferred-out costs	(6,500 units × $1.50) + (6,500 units × $8.40) =	$54,600
End work in process: materials	(1,750 × $1.50) = $2,625	
End work in process: conversion	(700 × $6.90) = $4,830	
End work in process: total	$2,625 + $4,830 =	7,455
Total Costs Accounted For		$62,055

Figure 5.7 Inventory Computation for Packaging Department. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

The value of the inventory transferred to finished goods in the production cost report is the same as in the journal entry:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
July 1	Finished Goods Inventory	54,600	
	Work in Process Inventory: Packaging Department		54,600
	To transfer completed goods into Finished Goods		

Recording the Cost of Goods Sold Out of the Finished Goods Inventory

Each unit is a package of two drumsticks that cost $8.40 to make and sells for $24.99. There are two transactions when recording a sale. One entry is to transfer the inventory from finished goods inventory to

cost of goods sold and is at the cost of the product. The second transaction is to record the sale at the sales price. The compound entry to record both transactions for the sale of 500 units on account is:

JOURNAL			
Date	**Account**	**Debit**	**Credit**
July 1	Cost of Goods Sold Finished Goods Inventory *To record the manufacturing costs of items sold*	4,200	4,200
July 1	Accounts Receivable Sales *To record the sale of 500 units*	12,495	12,495

LINK TO LEARNING

The importance of properly recording the production process is illustrated in this report on work in process inventory (https://openstax.org/l/50WorkInProcess) from InventoryOps.com.

Key Terms

conversion cost total of labor and overhead for a product; the costs that "convert" the direct material into the finished product

equivalent units number of units that would have been produced if the units were produced sequentially and in their entirety in a particular time period

expense recognition principle (also, matching principle) matches expenses with associated revenues in the period in which the revenues were generated

manufacturing costs (also, product costs) total of all costs expended in the manufacturing process; generally consists of direct material, direct labor, and manufacturing overhead

period costs typically related to a particular time period instead of attached to the production of an asset; treated as an expense in the period incurred (examples include many sales and administrative expenses)

prime costs direct material expenses and direct labor costs

process costing costing system used when a standardized process is used to manufacture identical products and the direct material, direct labor, and manufacturing overhead cannot be traced to a specific unit

product costs all expenses required to manufacture the product: direct materials, direct labor, and manufacturing overhead

production cost report shows the costs used in the preparation of a product, including the cost per unit for materials and conversion costs and the amount of work in process and finished goods inventory

selling and administrative (S&A) expenses period costs not directly assigned to the items produced or services provided; include costs of departments not directly associated with manufacturing but necessary to operate the business

spoilage any units that are not fit for sale due to breakage or other imperfections

Summary

5.1 Compare and Contrast Job Order Costing and Process Costing

- The three categories of costs incurred in producing an item are direct material, direct labor, and manufacturing overhead.
- Process costing is the system of accumulating costs within each department for large-volume, mass-produced units.
- Process costing often groups direct labor and manufacturing overhead as conversion costs.
- Costs under GAAP are categorized as period costs when they are not related to production and instead cover a time period.
- Selling and administrative costs are period costs related to the sales of products and management of the company and are not directly tied to a specific product.
- Process costing determines the cost per unit through the use of equivalent units, or the number of units that would have been produced if production was sequential instead of in batches.

5.2 Explain and Identify Conversion Costs

- Conversion costs are the costs of direct labor and manufacturing overhead used to convert raw materials into a finished product.
- Materials are added during various stages of the manufacturing process, such as the beginning or end, while conversion of the product from raw material into finished goods is considered to occur uniformly through the process. Thus, it is possible for a product to have all of its materials and not be complete.

- Equivalent units for direct materials can be different than the equivalent units for conversion costs because materials are added in steps through the manufacturing process, while conversion costs are incurred evenly throughout the process.

5.3 Explain and Compute Equivalent Units and Total Cost of Production in an Initial Processing Stage

- Process costing has a work in process inventory account for each department.
- Equivalent units of production for materials may differ from the equivalent units for conversion costs.
- The total units to account for is the number of units in the beginning work in process inventory plus the number of units started into production; this total also represents the sum of the number of units completed and the number of units in the ending work in process inventory.
- The cost per equivalent unit for materials is the total of the material costs for the beginning work in process inventory and the total of material costs incurred during the period.
- The cost per equivalent unit for conversion costs is the total of the conversion costs for the beginning work in process inventory and the total of conversion costs incurred during the period.
- The cost of units transferred to the next department is the number of units transferred times the total of the cost per equivalent unit of material plus the cost per equivalent unit for conversion costs.

5.4 Explain and Compute Equivalent Units and Total Cost of Production in a Subsequent Processing Stage

- The total units to account for is the number of units in the beginning work in process inventory plus the number of units transferred from the prior department; this total also represents the number of units completed plus the number of units in the ending work in process inventory.
- The cost per equivalent units for materials is the total of the material costs for the beginning work in process inventory plus the cost of material transferred in to the department plus the total of material costs incurred during the period.
- The cost per equivalent unit for conversion costs is the total of the conversion costs for the beginning work in process inventory plus the conversion costs transferred in plus the total of conversion costs incurred during the period.

5.5 Prepare Journal Entries for a Process Costing System

- Traditional journal entries show the purchase of material and the incurring of overhead costs.
- Each department records the transfer of material from the storeroom into production, its direct labor costs, the application of overhead, and the transfer of goods to the next department or finished goods.
- The value of the inventory transferred to the next department or to finished goods equals the amount listed as transferred on the production cost report.

Multiple Choice

1. LO 5.1 Which of the following production characteristics is better suited for process costing and *not* job order costing?

A. Each product batch is distinguishable from the prior batch.
B. The costs are easily traced to a specific product.
C. Costs are accumulated by department.
D. The value of work in process is the direct material used, the direct labor incurred, and the overhead applied to the job in process.

2. LO 5.1 A process costing system is most likely used by which of the following?
- A. airplane manufacturing
- B. a paper manufacturing company
- C. an accounting firm specializing in tax returns
- D. a hospital

3. LO 5.1 Which of the following is a prime cost?
- A. direct labor
- B. work in process inventory
- C. administrative labor
- D. factory maintenance expenses

4. LO 5.1 Which of the following is a conversion cost?
- A. raw materials
- B. direct labor
- C. sales commissions
- D. direct material used

5. LO 5.1 During production, how are the costs in process costing accumulated?
- A. to cost of goods sold
- B. to each individual product
- C. to manufacturing overhead
- D. to each individual department

6. LO 5.2 Which is *not* needed to compute equivalent units of production?
- A. the percentage of completion for inventory still in process
- B. the number of units transferred out
- C. the number of units started and completed
- D. the material cost per unit

7. LO 5.2 What is the cost of direct labor if the conversion costs are $330,000 and manufacturing overhead is $275,000?
- A. $55,000
- B. $275,000
- C. $330,000
- D. $605,000

8. LO 5.2 What is the conversion cost to manufacture insulated travel cups if the costs are: direct materials, $17,000; direct labor, $33,000; and manufacturing overhead, $70,000?
- A. $16,000
- B. $50,000
- C. $103,000
- D. $120,000

9. LO 5.2 Which of the following lists contains only conversion costs for an inflatable raft manufacturing corporation?
- A. vinyl for raft, machine operator, electricity, insurance
- B. machine operator, electricity, depreciation, plastic for air valves
- C. machine operator, electricity, depreciation, insurance
- D. vinyl for raft, electricity, insurance, plastic for air valves

10. LO 5.3 Direct material costs $3 per unit, direct labor costs $5 per unit, and overhead is applied at the rate of 100% of the direct labor cost. What is the value of the inventory transferred to the next department if beginning inventory was 2,000 units; 9,000 units were started; and 1,000 units were in ending inventory?

A. $1,000
B. $13,000
C. $130,000
D. $20,000

11. LO 5.3 Beginning inventory and direct material cost added during the month total $55,000. What is the value of the ending work in process inventory if beginning inventory was 2,000 units; 9,000 units were started; and 1,000 units were in ending inventory?

A. $1,000
B. $5,000
C. $50,000
D. $55,000

12. LO 5.3 The initial processing department had a beginning inventory of 750 units and an ending inventory of 1,350 units, and it started 9,500 units into production. How many were transferred out to the next department?

A. 750
B. 1,350
C. 8,900
D. 10,250

13. LO 5.3 There were 1,000 units in ending inventory after transferring 16,000 units to finished goods inventory. If the beginning inventory was 2,000 units, how many units were started in process?

A. 1,000
B. 2,000
C. 15,000
D. 17,000

14. LO 5.4 The costs to be accounted for consist of which of the following?

A. costs added during the period
B. costs of the units in ending inventory
C. costs started and transferred during the period
D. costs in the beginning inventory and costs added during the period

15. LO 5.4 Which of the following is the step in which materials, labor, and overhead are detailed?

A. determining the units to which costs are assigned
B. determining the equivalent units of production
C. determining the cost per equivalent units
D. allocating the costs to the units transferred out and the units partially completed

16. LO 5.5 The journal entry to record the $500 of work in process ending inventory that consists of $300 of direct materials, $50 of manufacturing overhead, and $150 od direct labor is which of the following?

A.

Work in Process Inventory	500	
Accounts Payable		500

(When added to the process)

B.

Work in Process Inventory	500	
Materials Inventory		300
Wages Payable		150
Manufacturing Overhead		50

(As incurred or applied)

C.

Cost of Goods Sold	500	
Work in Process Inventory		500

(When transferred)

D.

Accounts Payable	500	
Work in Process Inventory		500

(When added to the process)

17. LO 5.5 Assigning indirect costs to departments is completed by _____.

A. applying the predetermined overhead rate
B. debiting the manufacturing costs incurred
C. applying the costs to manufacturing overhead
D. applying the costs to work in process inventory

18. LO 5.5 In a process costing system, which account shows the overhead assigned to the department?

A. cost of goods sold
B. finished goods inventory
C. raw material inventory
D. work in process inventory

19. LO 5.5 In a process cost system, factory depreciation expense incurred is debited to _____.

A. finished goods inventory
B. work in process inventory
C. manufacturing overhead
D. cost of goods sold

Questions

1. LO 5.1 Explain how process costing differs from job order costing.

2. LO 5.1 Would a pharmaceutical manufacturer use process or job order costing? Why?

3. LO 5.1 Which costs are assigned using the weighted-average method?

4. LO 5.1 What is the primary purpose of process costing?

5. LO 5.2 What is the difference between prime costs and conversion costs?

6. LO 5.2 Explain conversion costs using an example.

7. LO 5.2 Why are there conversion costs in both job order costing and process costing?

8. LO 5.2 What are equivalent units of production, and how are they used in process costing?

9. LO 5.2 How can there be a different number of equivalent units for materials as compared to conversion costs?

10. LO 5.2 Why is the number of equivalent units for materials only sometimes equal to the equivalent units for conversion?

11. LO 5.3 What are the four steps involved in determining the cost of inventory transferred from one department to the next and the cost of work in process inventory?

12. LO 5.3 What is the weighted-average method for computing the equivalent units of production?

13. LO 5.4 How does process costing treat the costs transferred in from another department?

14. LO 5.4 Why does each department have its own work in process inventory?

15. LO 5.5 Match each term with its description.

A. conversion costs	i. total of direct material costs and direct labor costs
B. cost of goods sold	ii. manufacturing costs of the items sold
C. cost of production report	iii. number of units produced if each unit was produced sequentially
D. cost per equivalent unit	iv. total of direct labor costs, indirect labor costs, indirect material costs, and manufacturing overhead
E. equivalent units of production	v. where costs in a process cost system are reported before being applied to the product
F. manufacturing department	vi. detailed listing of the total costs of the product including the value of work in process
G. prime costs	vii. cost of materials or conversion for a specific department during production
H. transferred out costs	viii. product of the total cost per unit and the number of units completed and transferred during the time period

16. LO 5.5 How is manufacturing overhead handled in a process cost system?

17. LO 5.5 How are predetermined overhead rates used in process costing?

Exercise Set A

EA1. LO 5.1 How many units were started into production in a period if there were zero units of beginning work in process inventory, 1,100 units in ending work in process inventory, and 21,500 completed and transferred out units?

EA2. LO 5.1 A company started a new product, and in the first month started 100,000 units. The ending work in process inventory was 20,000 units that were 100% complete with materials and 75% complete with conversion costs. There were 100,000 units to account for, and the equivalent units for materials was $6 per unit while the equivalent units for conversion was $8 per unit. What is the value of the inventory transferred out, using the weighted-average inventory method?

EA3. LO 5.3 Given the following information, determine the equivalent units of ending work in process for materials and conversion under the weighted-average method:

- beginning inventory of 2,500 units is 100% complete with regard to materials and 60% complete with regard to conversion
- 18,000 units were started during the period
- 17,500 units were completed and transferred
- ending inventory is 100% complete with materials and 65% complete with conversion

EA4. LO 5.3 There were 1,700 units in beginning inventory that were 40% complete with regard to conversion. During the month, 8,550 units were started and 9,000 were transferred to finished goods. The ending work in process was 60% complete with regard to conversion costs, and materials are added at the beginning of the process. What is the total amount of equivalent units for materials and conversion at the end of the month using the weighted-average method?

EA5. LO 5.3 A company has 1,500 units in ending work in process that are 30% complete after transferring out 10,000 units. All materials are added at the beginning of the process. If the cost per unit is $4 for materials and $7 for conversion, what is the cost of units transferred out and in ending work in process inventory using the weighted-average method?

EA6. LO 5.3 There were 2,400 units in ending work in process inventory that were 100% complete with regard to material and 25% complete with regard to conversion costs. Ending work in process inventory had a cost of $9,000 and a per-unit material cost of $2. What was the conversion cost per unit using the weighted-average method?

EA7. LO 5.3 How many units must be in ending inventory if beginning inventory was 15,000 units, 55,000 units were started, and 57,000 units were completed and transferred out?

EA8. LO 5.3 How many units must have been completed and transferred if beginning inventory was 75,000 units, ending inventory was 72,000 units, and 290,000 units were started?

EA9. LO 5.3 Using the weighted-average method, compute the equivalent units of production if the beginning inventory consisted of 20,000 units; 55,000 units were started in production; and 57,000 units were completed and transferred to finished goods inventory. For this process, materials are added at the beginning of the process, and the units are 35% complete with respect to conversion.

EA10. LO 5.3 Using the weighted-average method, compute the equivalent units of production for a new company that started 85,000 units into production and transferred 67,000 to the second department. Assume that beginning inventory was 0. Conversion is considered to occur evenly throughout the process, while materials are added at the beginning of the process. The ending inventory for Equivalent Units: Conversion is 9,000 units.

EA11. LO 5.3 Mazomanie Farm completed 20,000 units during the quarter and has 2,500 units still in process. The units are 100% complete with regard to materials and 55% complete with regard to conversion costs. What are the equivalent units for materials and conversion?

EA12. LO 5.3 What are the total costs to account for if a company's beginning inventory had $231,432 in materials, $186,450 in conversion costs, and added direct material costs ($4,231,392), direct labor ($2,313,392), and manufacturing overhead ($1,156,696)?

EA13. LO 5.3 A company started the month with 8,329 units in work in process inventory. It started 23,142 units and had an ending inventory of 9,321. The units were 100% complete to materials and 67% complete with conversion. How many units were transferred out during the period?

EA14. LO 5.4 A production department within a company received materials of $10,000 and conversion costs of $10,000 from the prior department. It added material of $27,200 and conversion costs of $53,000. The equivalent units are 20,000 for material and 18,000 for conversion. What is the unit cost for materials and conversion?

EA15. LO 5.4 Production data show 35,920 units were transferred out of a stage of production and 6,150 units remained in ending WIP inventory that was 100% complete to material and 35% complete to conversion. The unit material cost is $5 for material and $8 for conversion. What is the amount of inventory transferred out and remaining in ending work in process inventory?

EA16. LO 5.5 Overhead is assigned to the manufacturing department at the rate of $10 per machine hour. There were 3,500 machine hours during October in the shaping department and 2,500 in the packaging department. Prepare the journal entry to apply overhead to the manufacturing departments.

EA17. LO 5.5 Prepare the journal entry to record the factory wages of $28,000 incurred for a single production department assuming payment will be made in the next pay period.

EA18. LO 5.5 Prepare the journal entry to record the transfer of 3,000 units from the packaging department to finished goods if the material cost per unit is $4 and the conversion cost per unit is $5.50.

EA19. LO 5.5 Prepare the journal entry to record the sale of 2,000 units that cost $8 per unit and sold for $15 per unit.

Exercise Set B

EB1. LO 5.3 Given the following information, determine the equivalent units of ending work in process for materials and conversion using the weighted-average method:

- Beginning inventory of 750 units is 100% complete with regard to materials and 30% complete with regard to conversion.
- 9,500 units were started during the period.
- 8,900 units were completed and transferred.
- Ending inventory is 100% complete with regard to materials and 68% complete with regard to conversion.

EB2. LO 5.3 There were 2,000 units in beginning inventory that were 70% complete with regard to conversion. During the month, 15,000 units were started, and 16,000 were transferred to finished goods. The ending work in process was 55% complete with regard to conversion costs, and materials are added at the beginning of the process. What is the total amount of equivalent units for materials and conversion at the end of the month using the weighted-average method?

EB3. LO 5.3 A company has 100 units in ending work in process that are 40% complete after transferring out 750 units. If the cost per unit is $5 for materials and $2.50 for conversion, what is the cost of units transferred out and in ending work in process inventory using the weighted-average method?

EB4. LO 5.3 There were 1,500 units in ending work in process inventory that were 100% complete with regard to material and 60% complete with regard to conversion costs. Ending work in process inventory had a cost of $7,200 and a per-unit material cost of $3. What was the conversion cost per unit using the weighted-average method?

EB5. LO 5.3 Using the weighted-average method, compute the equivalent units of production if the beginning inventory consisted of 20,000 units, 55,000 units were started in production, and 57,000 units were completed and transferred to finished goods inventory. For this process, materials are 70% complete and the units are 30% complete with respect to conversion.

EB6. LO 5.3 What are the total costs to account for if a company's beginning inventory had $23,432 in materials and $18,450 in conversion costs, and added direct material costs ($41,392), direct labor ($23,192), and manufacturing overhead ($62,500)?

EB7. LO 5.3 A company started the month with 4,519 units in work in process inventory. It started 15,295 units and had an ending inventory of 4,936. The units were 100% complete to materials and 30% complete with conversion. How many units were transferred out during the period?

EB8. LO 5.4 A production department within a company received materials of $7,000 and conversion costs of $5,000 from the prior department. It added material of $78,400 and conversion costs of $47,000. The equivalent units are 5,000 for material and 4,000 for conversion. What is the unit cost for materials and conversion?

EB9. LO 5.4 Production data show 15,200 units were transferred out of a stage of production and 3,500 units remained in ending WIP inventory that was 100% complete to material and 60% complete to conversion. The unit material cost is $9 for material and $4 for conversion. What is the amount of inventory transferred out and remaining in ending work in process inventory?

EB10. LO 5.5 Overhead is assigned to the manufacturing department at the rate of $5 per machine hour. There were 3,000 machine hours used in the molding department. Prepare the journal entry to apply overhead to the manufacturing department.

EB11. LO 5.5 Prepare the journal entry to record the factory wages of $25,000 incurred in the processing department and $15,000 incurred in the production department assuming payment will be made in the next pay period.

EB12. LO 5.5 Prepare the journal entry to record the transfer of 3,500 units from the separation department to the mash department if the material cost per unit is $2 and the conversion cost per unit is $5.

EB13. LO 5.5 Prepare the journal entry to record the sale of 700 units that cost $5 per unit and sold for $15 per unit.

Problem Set A

PA1. LO 5.1 The following product costs are available for Haworth Company on the production of chairs: direct materials, $15,500; direct labor, $22,000; manufacturing overhead, $16,500; selling expenses, $6,900; and administrative expenses, $15,200.

A. What are the prime costs?
B. What are the conversion costs?
C. What is the total product cost?
D. What is the total period cost?
E. If 7,750 equivalent units are produced, what is the equivalent material cost per unit?
F. If 22,000 equivalent units are produced, what is the equivalent conversion cost per unit?

PA2. LO 5.1 The following product costs are available for Arrez Company on the production of DVD cases: direct materials, $1,450; direct labor, $15.50; manufacturing overhead, applied at 150% of direct labor cost; selling expenses, $1,550; and administrative expenses, $950. The direct labor hours worked for the month are 90 hours.

A. What are the prime costs?
B. What are the conversion costs?
C. What is the total product cost?
D. What is the total period cost?
E. If 1,450 equivalent units are produced, what is the equivalent material cost per unit?
F. What is the equivalent conversion cost per unit?

PA3. LO 5.3 Pant Risers manufactures bands for self-dressing assistive devices for mobility-impaired individuals. Manufacturing is a one-step process where the bands are cut and sewn. This is the information related to this year's production:

Units to Account For	Units	Materials	Conversion
Beginning WIP inventory	500	500	250
Started	20,500		
To account for	21,000		

Ending inventory was 100% complete as to materials and 70% complete as to conversion, and the total materials cost is $57,540 and the total conversion cost is $36,036. Using the weighted-average method, what are the unit costs if the company transferred out 17,000 units? What is the value of the inventory transferred out and the value of the ending WIP inventory?

PA4. LO 5.3 During March, the following costs were charged to the manufacturing department: $14,886 for materials; $14,656 for labor; and $13,820 for manufacturing overhead. The records show that 30,680 units were completed and transferred, while 2,400 remained in ending inventory. There were 33,080 equivalent units of material and 31,640 of conversion costs. Using the weighted-average method, what is the cost of inventory transferred and the balance in work in process inventory?

PA5. LO 5.3 Materials are added at the beginning of a production process, and ending work in process inventory is 30% complete with respect to conversion costs. Use the information provided to complete a production cost report using the weighted-average method.

Costs to Account For	
Beginning inventory: materials	$ 10,000
Beginning inventory: conversion	19,000
Direct material	50,000
Direct labor	75,000
Applied overhead	37,248
Total costs to account for	$191,248

Units to Account For	
Beginning work in process	5,000
Units started into production	20,000
Transferred out	19,000

PA6. LO 5.3 Narwhal Swimwear has a beginning work in process inventory of 13,500 units and transferred in 130,000 units before ending the month with 14,000 units that were 100% complete with regard to materials and 30% complete with regard to conversion costs. The cost per unit of material is $5.80 and the cost per unit for conversion is $8.20 per unit. Using the weighted-average method, what is the amount of material and conversion costs assigned to the department for the month?

PA7. LO 5.3 The following data show the units in beginning work in process inventory, the number of units started, the number of units transferred, and the percent completion of the ending work in process for conversion. Given that materials are added at the beginning of the process, what are the equivalent units for material and conversion costs for each quarter using the weighted-average method? Assume that the quarters are independent.

Quarter	Beginning Work in Process	Started	Transferred Out	Conversion (%)
1	—	134,250	133,250	25
2	523	132,593	132,541	24
3	338	133,245	133,443	20
4	489	134,843	134,232	23

PA8. LO 5.4 The finishing department started the month with 700 units in WIP inventory. It received 2,200 units from the molding department and transferred out 2,150 units. How many units were in process at the end of the month?

PA9. LO 5.4 The packaging department began the month with 500 units that were 100% complete with regard to material and 85% complete with regard to conversion. It received 9,500 units from the processing department and ended the month with 750 units that were 100% complete with regard to materials and 30% complete with regard to conversion. With a $5 per unit cost for conversion and a $5 per unit cost for materials, what is the cost of the units transferred out and remaining in ending inventory?

PA10. LO 5.4 Production information shows these costs and units for the smoothing department in August.

	Cost		Units
Work in process			
Beginning balance: materials	$ 1,550	Beginning units	650
Beginning balance: conversion	2,500	Transferred in	1,780
Materials	7,441	Transferred out	1,810
Labor	14,520		
Overhead	7,930		

All materials are added at the beginning of the period. The ending work in process is 30% complete as to conversion. What is the value of the inventory transferred to finished goods and the value of the WIP inventory at the end of the month?

PA11. LO 5.4 Given the following information, prepare a production report with materials added at the beginning and ending work in process inventory being 25% complete with regard to conversion costs.

Costs to Account For	
Beginning inventory: materials	$ 5,000
Beginning inventory: conversion	1,000
Direct material	24,170
Direct labor	44,500
Applied overhead	12,400
Transferred-in materials	8,000
Transferred-in conversion	10,200
Total costs to account for	$105,270

Units to Account For	
Beginning work in process	3,500
Units started into production	85,000
Transferred out	84,000

PA12. LO 5.4 Complete this production cost report:

Beginning inventory	20,000		
Started during the month	75,000		
Total units to account for	?		
Completed and transferred out	70,000		
Ending work in process	?		
Total units accounted for	?		
Work in process completion %	100%	25%	
	Material Units	**Conversion Units**	**Total**
Completed and transferred out	70,000	70,000	70,000
Ending work in process	?	?	?
Total units accounted for	?	?	?
Costs to account for	**Materials**	**Conversion**	**Total**
Beginning work in process	$ 3,500	$16,000	$19,500
Transferred in	0	0	0
Incurred during the period	$25,000	$45,000	$70,000
Total costs to account for	?	?	?
Equivalent units	?	?	
Cost per equivalent unit for department	?	?	
Transferred-out costs		?	
End work in process: materials	?		
End work in process: conversion	?		
End work in process: total		?	
Costs to account for		?	

PA13. LO 5.5 Selected information from Skylar Studios shows the following:

Raw materials purchased	$ 5,000
Direct materials	$ 1,500
Direct labor	$11,000
Factory depreciation	$ 2,000
Total manufacturing overhead incurred	$15,000
Machine hours per month	28,000
Unit cost for material	$ 2
Unit cost of conversion	$ 8
Number units transferred	15,000

Prepare journal entries to record the following:

A. raw material purchased
B. direct labor incurred
C. depreciation expense (hint: this is part of manufacturing overhead)
D. raw materials used
E. overhead applied on the basis of $0.50 per machine hour
F. the transfer from department 1 to department 2

PA14. LO 5.5 Loanstar had 100 units in beginning inventory before starting 950 units and completing 800 units. The beginning work in process inventory consisted of $2,000 in materials and $5,000 in conversion costs before $8,500 of materials and $11,200 of conversion costs were added during the month. The ending WIP inventory was 100% complete with regard to materials and 40% complete with regard to conversion costs. Prepare the journal entry to record the transfer of inventory from the manufacturing department to the finished goods department.

Problem Set B

PB1. LO 5.3 The following product costs are available for Stellis Company on the production of erasers: direct materials, $22,000; direct labor, $35,000; manufacturing overhead, $17,500; selling expenses, $17,600; and administrative expenses; $13,400.

A. What are the prime costs?
B. What are the conversion costs?
C. What is the total product cost?
D. What is the total period cost?
E. If 13,750 equivalent units are produced, what is the equivalent material cost per unit?
F. If 17,500 equivalent units are produced, what is the equivalent conversion cost per unit?

PB2. LO 5.3 The following product costs are available for Kellee Company on the production of eyeglass frames: direct materials, $32,125; direct labor, $23.50; manufacturing overhead, applied at 225% of direct labor cost; selling expenses, $22,225; and administrative expenses, $31,125. The direct labor hours worked for the month are 3,200 hours.

A. What are the prime costs?
B. What are the conversion costs?
C. What is the total product cost?
D. What is the total period cost?
E. If 6,425 equivalent units are produced, what is the equivalent material cost per unit?
F. What is the equivalent conversion cost per unit?

PB3. LO 5.3 Vexar manufactures nails. Manufacturing is a one-step process where the nails are forged. This is the information related to this year's production:

Cost to Account For	
Beginning inventory: conversion	$ 14,300
Direct material	34,950
Direct labor	55,000
Applied overhead	23,940
Total costs to account for	$148,190

Units to Account For	
Units started into production	25,000
Transferred out	26,000

Ending inventory was 100% complete as to materials and 70% complete as to conversion, and the total materials cost is $115,080 and the total conversion cost is $72,072. Using the weighted-average method, what are the unit costs if the company transferred out 34,000 units? Using the weighted-average method, prepare the company's process cost summary for the month.

PB4. LO 5.3 During March, the following costs were charged to the manufacturing department: $22,500 for materials; $45,625 for labor; and $50,000 for manufacturing overhead. The records show that 40,000 units were completed and transferred, while 10,000 remained in ending inventory. There were 45,000 equivalent units of material and 42,500 units of conversion costs. Using the weighted-average method, prepare the company's process cost summary for the month.

PB5. LO 5.3 Ardt-Barger has a beginning work in process inventory of 5,500 units and transferred in 25,000 units before ending the month with 3,000 units that were 100% complete with regard to materials and 80% complete with regard to conversion costs. The cost per unit of material is $5.45, and the cost per unit for conversion is $6.20 per unit. Using the weighted-average method, prepare the company's process cost summary for the month.

PB6. LO 5.3 The following data show the units in beginning work in process inventory, the number of units started, the number of units transferred, and the percent completion of the ending work in process for conversion. Given that materials are added at the beginning of the process, what are the equivalent units for material and conversion costs for each quarter using the weighted-average method? Assume that the quarters are independent.

Quarter	Beginning Work in Process	Started	Transferred Out	Conversion (%)
1	—	134,250	133,250	25
2	523	132,593	132,541	24
3	338	133,245	133,443	20
4	489	134,843	134,232	23

PB7. LO 5.3 The following data show the units in beginning work in process inventory, the number of units started, the number of units transferred, and the percent completion of the ending work in process for conversion. Given that materials are added 50% at the beginning of the process and 50% at the end of the process, what are the equivalent units for material and conversion costs for each quarter using the weighted-average method? Assume that the quarters are independent.

Quarter	Beginning Work in Process	Started	Transferred Out	Conversion (%)
1	—	255,000	235,000	50
2	2,500	275,000	250,000	40
3	3,600	290,000	275,000	45
4	6,500	300,000	280,000	60

PB8. LO 5.3 The following data show the units in beginning work in process inventory, the number of units started, the number of units transferred, and the percent completion of the ending work in process for conversion. Given that materials are added 50% at the beginning of the process and 50% at the end of the process, what are the equivalent units for material and conversion costs for each quarter using the weighted-average method? Assume that the quarters are independent.

Quarter	Beginning Work in Process	Started	Transferred Out	Conversion (%)
1	—	255,000	235,000	50
2	2,500	275,000	250,000	40
3	3,600	290,000	275,000	45
4	6,500	300,000	280,000	60

PB9. LO 5.4 The finishing department started the month with 600 units in WIP inventory. It received 1,500 units from the molding department and ended the month with 550 units still in process. How many units were transferred out?

PB10. LO 5.4 The packaging department began the month with 750 units that were 100% complete with regard to material and 25% complete with regard to conversion. It received 9,500 units from the processing department and ended the month with 500 units that were 100% complete with regard to materials and 75% complete with regard to conversion. With a $7 per unit material cost and a $4 per unit cost for conversion, what is the cost of the units transferred out and remaining in ending inventory?

PB11. LO 5.4 Production information shows these costs and units for the smoothing department in August.

	Cost		Units
Work in process			
Beginning balance: materials	$ 5,213	Beginning units	1,100
Beginning balance: conversion	8,321	Transferred in	24,500
Materials	10,403	Transferred out	1,300
Labor	16,000		
Overhead	$13,475		

What is the value of the inventory transferred out to finished goods and the value of the WIP inventory at the end of the month, assuming conversion costs are 30% complete?

PB12. LO 5.4 Given the following information, prepare a production report with materials added at the beginning and ending work in process inventory being 80% complete with regard to conversion costs.

Costs to Account For	
Beginning inventory: materials	$ 25,000
Beginning inventory: conversion	30,500
Direct material	2,000
Direct labor	45,000
Applied overhead	11,840
Transferred-in materials	12,015
Transferred-in conversion	33,500
Total costs to account for	$159,855

Units to Account For	
Beginning work in process	4,000
Units started into production	9,500
Transferred out	9,600

PB13. LO 5.5 Selected information from Hernandez Corporation shows the following:

Raw materials purchased	$11,000
Direct materials	$25,000
Direct labor	$75,000
Factory depreciation	$13,000
Total manufacturing overhead incurred	$20,000
Machine hours per month	12,000
Predetermined OH rate	$ 1.20
Unit cost for material	$ 9
Units conversion	5
Number units transferred	15,000

Prepare journal entries to record the following:

A. raw material purchased
B. direct labor incurred
C. depreciation expense (hint: this is part of manufacturing overhead)
D. raw materials used
E. overhead applied on the basis of $0.50 per machine hour
F. the transfer from department 1 to department 2

PB14. LO 5.5 Rexar had 1,000 units in beginning inventory before starting 9,500 units and completing 8,000 units. The beginning work in process inventory consisted of $5,000 in materials and $8,500 in conversion costs before $16,000 of materials and $18,500 of conversion costs were added during the month. The ending WIP inventory was 100% complete with regard to materials and 40% complete with regard to conversion costs. Prepare the journal entry to record the transfer of inventory from the manufacturing department to the finished goods department.

Thought Provokers

TP1. LO 5.1 How would process costing exist in a service industry?

TP2. LO 5.2 Why are labor and manufacturing overhead grouped together as conversion costs?

TP3. LO 5.4 How is process costing for a single manufacturing department different from a manufacturing company with multiple departments?

TP4. LO 5.5 What is different between the journal entries for process costing and that of job order costing?

6

Activity-Based, Variable, and Absorption Costing

Figure 6.1 Allocating Time. The number of activities is one way to determine how resources, such as time, are allocated. (credit: modification of work by West Point – The U.S. Military Academy/Flickr, CC BY 2.0; modification of work by United States Government/Flickr, Public Domain; modification of "training" by Cory Zanker/Flickr, CC BY 4.0)

Chapter Outline

Why It Matters

Barry thinks of his education as a job and spends forty hours a week in class or studying. Barry estimates he has about eighty hours per week to allocate between school and other activities and believes everyone should follow his fifty-fifty rule of time allocation. His roommate, Kamil, disagrees with Barry and argues that allocating 50 percent of one's time to class and studying is not a great formula because everyone has different activities and responsibilities. Kamil points out, for example, that he has a job tutoring other students, is involved with student activities, and plays in a band, while Barry spends some of his nonstudy time doing volunteer work and working out.

Kamil plans each week based on how many hours he will need for each activity: classes, studying and coursework, tutoring, and practicing and performing with his band. In essence, he considers the details of each week's needs to budget his time. Kamil explains to Barry that being aware of the activities that consume his limited resources (time, in this example) helps him to better plan his week. He adds that individuals who

have activities with lots of time commitments (class, work, study, exercise, family, friends, and so on) must be efficient with their time or they risk doing poorly in one or more areas. Kamil argues these individuals cannot simply assign a percentage of their time to each activity but should use each specific activity as the basis for allocating their time. Barry insists that assigning a set percentage to everything is easy and the better method. Who is correct?

6.1 Calculate Predetermined Overhead and Total Cost under the Traditional Allocation Method

Both roommates make valid points about allocating limited resources. Ultimately, each must decide which method to use to allocate time, and they can make that decision based on their own analyses. Similarly, businesses and other organizations must create an allocation system for assigning limited resources, such as overhead. Whereas Kamil and Barry are discussing the allocation of hours, the issue of allocating costs raises similar questions. For example, for a manufacturer allocating maintenance costs, which are an overhead cost, is it better to allocate to each production department equally by the number of machines that need to be maintained or by the square footage of space that needs to be maintained?

In the past, overhead costs were typically allocated based on factors such as total direct labor hours, total direct labor costs, or total machine hours. This allocation process, often called the traditional allocation method, works most effectively when direct labor is a dominant component in production. However, many industries have evolved, primarily due to changes in technology, and their production processes have become more complicated, with more steps or components. Many of these industries have significantly reduced their use of direct labor and replaced it with technology, such as robotics or other machinery. For example, a mobile phone production facility in China replaced 90 percent of its workforce with robots.[1]

In these situations, a direct cost (labor) has been replaced by an overhead cost (e.g., depreciation on equipment). Because of this decrease in reliance on labor and/or changes in the types of production complexity and methods, the traditional method of overhead allocation becomes less effective in certain production environments. To account for these changes in technology and production, many organizations today have adopted an overhead allocation method known as activity-based costing (ABC). This chapter will explain the transition to ABC and provide a foundation in its mechanics.

Activity-based costing is an accounting method that recognizes the relationship between product costs and a production activity, such as the number of hours of engineering or design activity, the costs of the set up or preparation for the production of different products, or the costs of packaging different products after the production process is completed. Overhead costs are then allocated to production according to the use of that activity, such as the number of machine setups needed. In contrast, the traditional allocation method commonly uses cost drivers, such as direct labor or machine hours, as the single activity.

Because of the use of multiple activities as cost drivers, ABC costing has advantages over the traditional allocation method, which assigns overhead using a single predetermined overhead rate. Those advantages come at a cost, both in resources and time, since additional information needs to be collected and analyzed. Chrysler, for instance, shifted its overhead allocation to ABC in 1991 and estimates that the benefits of cost savings, product improvement, and elimination of inefficiencies have been ten to twenty times greater than the investment in the program at some sites. It believes other sites experienced savings of fifty to one hundred times the cost to implement the system.[2]

1 June Javelosa and Kristin Houser. "This Company Replaced 90% of Its Workforce with Machines. Here's What Happened." *Futurism / World Economic Forum*. https://www.weforum.org/agenda/2017/02/after-replacing-90-of-employees-with-robots-this-companys-productivity-soared

2 Joseph H. Ness and Thomas G. Cucuzza. "Tapping the Full Potential of ABC." *Harvard Business Review*. July-Aug. 1995. https://hbr.org/1995/07/tapping-the-full-potential-of-abc

As you've learned, understanding the cost needed to manufacture a product is critical to making many management decisions (Figure 6.2). Knowing the total and component costs of the product is necessary for price setting and for measuring the efficiency and effectiveness of the organization. Remember that product costs consist of direct materials, direct labor, and manufacturing overhead. It is relatively simple to understand each product's direct material and direct labor cost, but it is more complicated to determine the overhead component of each product's costs because there are a number of indirect and other costs to consider. A company's **manufacturing overhead costs** are all costs other than direct material, direct labor, or selling and administrative costs. Once a company has determined the overhead, it must establish how to allocate the cost. This allocation can come in the form of the traditional overhead allocation method or activity-based costing..

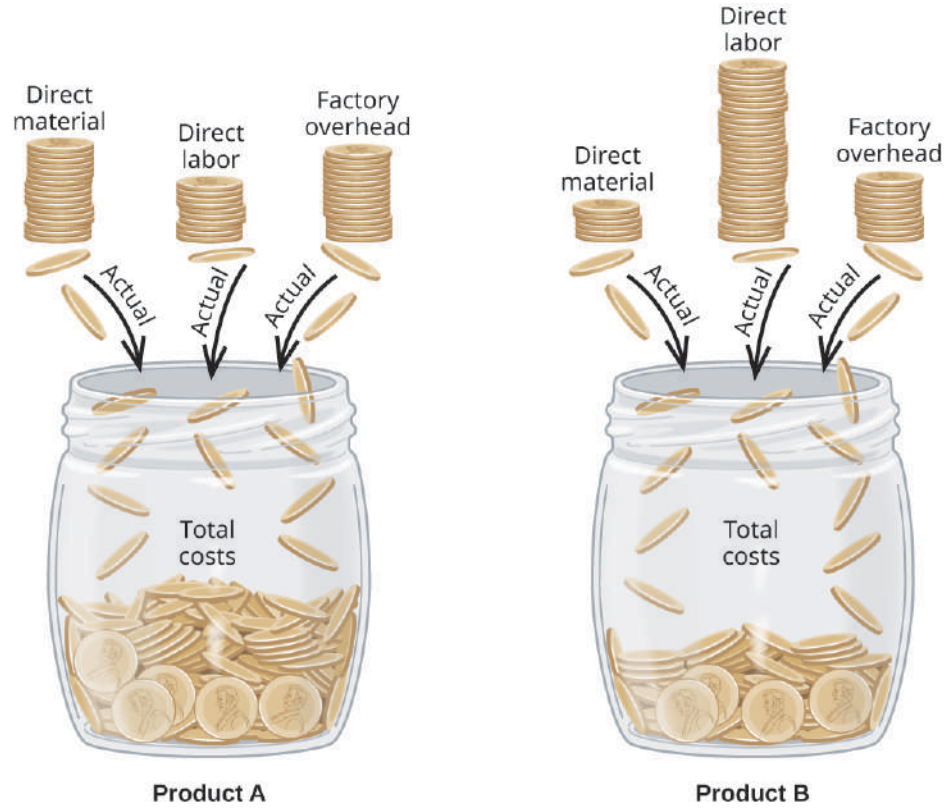


Figure 6.2 Allocating Costs among Products. The total cost of a product is based on direct labor, direct material, and factory overhead costs. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Component Categories under Traditional Allocation

Traditional allocation involves the allocation of factory overhead to products based on the volume of production resources consumed, such as the amount of direct labor hours consumed, direct labor cost, or machine hours used. In order to perform the traditional method, it is also important to understand each of the involved cost components: direct materials, direct labor, and manufacturing overhead. Direct materials and direct labor are cost categories that are relatively easy to trace to a product. **Direct material** comprises the supplies used in manufacturing that can be traced directly to the product. **Direct labor** is the work used in manufacturing that can be directly traced to the product. Although the processes for tracing the costs differ, both job order costing and process costing trace the material and labor through materials requisition requests and time cards or electronic mechanisms for measuring labor input. Job order costing traces the costs directly

to the product, and process costing traces the costs to the manufacturing department.

ETHICAL CONSIDERATIONS

Ethical Cost Modeling

The proper use of management accounting skills to model financial and non-financial data optimizes the organization's evaluation and use of resources and assists in the proper evaluation of costs and revenues in an organization. The IFAC provides guidance on the use of cost models and how to ethically design proper cost models: "Cost models should be designed and maintained to reflect the cause-and-effect interrelationships and the behavioral dynamics of the way the organization functions. The information needs of decision makers at all levels of an organization should be taken into account, by incorporating an organization's business and operational models, strategy, structure, and competitive environment."[3]

Estimated Total Manufacturing Overhead Costs

The more challenging product component to track is manufacturing overhead. Overhead consists of indirect materials, indirect labor, and other costs closely associated with the manufacturing process but not tied to a specific product. Examples of other overhead costs include such items as depreciation on the factory machinery and insurance on the factory building. **Indirect material** comprises the supplies used in production that cannot be traced to an individual product, and **indirect labor** is the work done by employees not directly involved in the manufacturing process, such as the supervisors' salaries or the maintenance staff's wages. Because these costs cannot be traced directly to the product like direct costs are, they have to be allocated among all of the products produced and added, or applied, to the production and product cost.

For example, the recipe for shea butter has easily identifiable quantities of shea nuts and other ingredients. Based on the manufacturing process, it is also easy to determine the direct labor cost. But determining the exact overhead costs is not easy, as the cost of electricity needed to dry, crush, and roast the nuts changes depending on the moisture content of the nuts upon arrival.

Until now, you have learned to apply overhead to production based on a predetermined overhead rate typically using an activity base. An **activity base** is considered to be a primary driver of overhead costs, and traditionally, direct labor hours or machine hours were used for it. For example, a production facility that is fairly labor intensive would likely determine that the more labor hours worked, the higher the overhead will be. As a result, management would likely view labor hours as the activity base when applying overhead costs.

A predetermined overhead rate is calculated at the start of the accounting period by dividing the estimated manufacturing overhead by the estimated activity base. The predetermined overhead rate is then applied to production to facilitate determining a standard cost for a product. This estimated overhead rate will allow a company to determine a cost for the product without having to wait, possibly several months, until all of the actual overhead costs are determined, and to help with issues such as seasonal production or variable overhead costs, such as utilities.

3 International Federation of Accountings (IFAC) PAIB Committee. "Evaluating and Improving Costing in Organizations." *International Good Practice Guidance*. June 30, 2009. https://www.ifac.org/system/files/publications/files/IGPG-Evaluating-and-Improving-Costing-July-2009.pdf

Calculation of Predetermined Overhead and Total Cost under Traditional Allocation

The predetermined overhead rate is set at the beginning of the year and is calculated as the estimated (budgeted) overhead costs for the year divided by the estimated (budgeted) level of activity for the year. This activity base is often direct labor hours, direct labor costs, or machine hours. Once a company determines the overhead rate, it determines the overhead rate per unit and adds the overhead per unit cost to the direct material and direct labor costs for the product to find the total cost.

$$\text{Predetermined Overhead Rate} = \frac{\text{Estimated Overhead Cost (\$)}}{\text{Estimated Activity Base (units or \$)}}$$

To put this method into context, consider this example. Musicality Manufacturing developed a recording device similar to a microphone that allows musicians and music aficionados to record their playing or singing along with any song publicly available. There are three products that vary in features and ability: Solo, Band, and Orchestra. Musicality was started by musicians who majored in math and software engineering while in college. Their main concern was building a quality manufacturing plant, so they used the simpler traditional allocation method. They started by determining their direct costs, which are shown in Figure 6.3.

	Solo	Band	Orchestra
Direct Materials per Unit	$ 3.50	$6.00	$11.70
Direct Labor Cost per Unit	10.00	2.75	4.30

Figure 6.3 Material and Labor Costs for Musicality. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Musicality determines the overhead rate based on direct labor hours. At the beginning of the year, the company estimates total overhead costs to be $2,500,000 and total direct labor hours to be 1,250,000. The predetermined overhead rate is

$$\frac{\$2{,}500{,}000 \text{ overhead}}{1{,}250{,}000 \text{ labor hours}} = \$2.00 \text{ per labor hour}$$

Musicality uses this information to determine the cost of each product. For example, the total direct labor hours estimated for the solo product is 350,000 direct labor hours. With $2.00 of overhead per direct hour, the Solo product is estimated to have $700,000 of overhead applied. When the $700,000 of overhead applied is divided by the estimated production of 140,000 units of the Solo product, the estimated overhead per product for the Solo product is $5.00 per unit. The computation of the overhead cost per unit for all of the products is shown in Figure 6.4.

	Solo	Band	Orchestra	Total
Direct Labor Hours per Product	350,000	400,000	500,000	1,250,000
Overhead Rate per Direct Labor Hour	× $2	× $2	× $2	× $2
Overhead Assign per Product	$700,000	$800,000	$1,000,000	$2,500,000
Number Units	140,000	100,000	250,000	490,000
Overhead per Unit	$ 5	$ 8	$ 4	

Figure 6.4 Musicality's Overhead per Unit Using Traditional Allocation. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

The overhead cost per unit from Figure 6.4 is combined with the direct material and direct labor costs as

shown in Figure 6.3 to compute the total cost per unit as shown in Figure 6.5.

	Solo	Band	Orchestra
Direct Materials per Unit	$ 3.50	$ 6.00	$11.70
Direct Labor per Unit	10.00	2.75	4.30
Overhead per Unit	$ 5.00	$ 8.00	$ 4.00
Cost per Unit	$18.50	$16.75	$20.00

Figure 6.5 Musicality's Product Costs Using Traditional Allocation. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

After reviewing the product cost and consulting with the marketing department, the sales prices were set. The sales price, cost of each product, and resulting gross profit are shown in Figure 6.6.

	Solo	Band	Orchestra
Sales Price	$20.00	$25.00	$30.00
Cost per Unit (traditional)	18.50	16.75	20.00
Gross Profit per Unit	$ 1.50	$ 8.25	$10.00

Figure 6.6 Musicality's Gross Profit per Unit Using Traditional Allocation. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Sales of each product have been strong, and the total gross profit for each product is shown in Figure 6.7. Using the Solo product as an example, 150,000 units are sold at a price of $20 per unit resulting in sales of $3,000,000. The cost of goods sold consists of direct materials of $3.50 per unit, direct labor of $10 per unit, and manufacturing overhead of $5.00 per unit. With 150,000 units, the direct material cost is $525,000; the direct labor cost is $1,500,000; and the manufacturing overhead applied is $750,000 for a total Cost of Goods Sold of $2,775,000. The resulting Gross Profit is $225,000 or $1.50 per unit.

Traditional Costing	Solo	Band	Orchestra	Total
Number of Units Sold	150,000	110,000	200,000	460,000
Sales	$3,000,000	$2,750,000	$6,000,000	$11,750,000
Less Cost of Goods Sold				
Direct Material	525,000	660,000	2,340,000	3,525,000
Direct Labor	1,500,000	302,500	860,000	2,662,500
Manufacturing Overhead	750,000	880,000	800,000	2,430,000
Cost of Goods Sold	2,775,000	1,842,500	4,000,000	8,617,500
Gross Profit	$ 225,000	$ 907,500	$2,000,000	$ 3,132,500

Figure 6.7 Musicality's Gross Profit by Product Line Using Traditional Allocation. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

THINK IT THROUGH

Computing Actual Overhead Costs

As manufacturing technology becomes less expensive and more efficient, the mix between overhead and labor changes so that tasks are more computerized tasks and involve less direct labor; the traditional use of direct labor hours or direct labor dollars changes accordingly. If the predetermined overhead rate is based on direct labor hours and set at the beginning of the year but manufacturing technology leads to a reduction in direct labor during the year, the number of direct labor hours may be less than estimated. This reduces the amount of overhead applied so that the overhead is more likely to be underapplied at the end of the year. Why do companies not wait until the end of the period and compute an actual overhead rate based on actual manufacturing costs and actual units?

6.2 Describe and Identify Cost Drivers

As you've learned, the most common bases for predetermined overhead are direct labor hours, direct labor dollars, or machine hours. Each of these costs is considered a **cost driver** because of the causal relationship between the base and the related costs: As the cost driver's usage increases, the cost of overhead increases as well. Table 6.1 shows various costs and potential cost drivers.

Common Manufacturing Expenses and Potential Cost Drivers

Common Expenses	Potential Cost Drivers
• Customer Service • Cleaning Equipment Costs • Marketing Expenses • Office Supplies • Green Floral Tape (indirect material) • Website Maintenance Expense	• Number of product returns from customers • Number of square feet • Number of customer contacts • Number of employees • Number of customer orders • Number of customer online orders

Table 6.1

The more accurately a company can determine the cost drivers for its products, the more accurate the costing information will be, which in turn allows management to make better use of the cost data in making decisions. As technology changes, however, the mix between materials, labor, and overhead changes. Often, improved technology means less waste of material and fewer direct labor hours, but possibly more overhead. For example, technology has changed the way pharmaceuticals are manufactured. Advancing technology allows for the now smaller labor force to be more productive than a larger labor force from earlier years. While the labor cost has changed, this decrease may only be temporary as a labor force with higher costs and different skills is often needed. Additionally, an increase in technology often raises overhead costs. How accurate, then, is the company's product cost information if it has become more efficient in its production process? Should the company still be using a predetermined overhead application rate based on direct labor hours or machine hours? A detailed analysis of the cost drivers will answer these questions.

Another benefit of looking at cost drivers is that doing so allows a company to analyze all costs. A company can differentiate among costs that drive overhead and have value, those that do not drive overhead but still add value, and those that may or may not drive the overhead but do not add any value. For example, a furniture manufacturer produces and sells wooden tables in various colors. The painting process involves a white base coat, a color coat, and a clear protective top coat. The three coats are applied in a sealed room using a spraying process followed by an ultraviolet drying process. The depreciation on the spraying machines and the ultraviolet bulbs used in the painting process are overhead costs. These costs drive or increase overhead, and they add value to the product by increasing the quality. Costs associated with repainting or fixing any blemishes are overhead costs that are necessary to sell the product but would not be considered value-added costs. The goal is to eliminate as many of the non-value-added costs as possible and subsequently reduce overhead costs.

Cost Drivers and Overhead

In today's production environment, there are many activities within the production process that can contribute to the cost of the product, but determining the cost drivers may be complicated because some of those activities may change over time. Additionally, the appropriate level of assigning cost drivers needs to be determined. In some cases, overhead costs such as inspection increase with each unit inspected, and the costs need to be allocated on a per-unit level. In other cases, the overhead costs, such as machine setup costs, are incurred each time a batch of products is manufactured and need to be allocated at the batch level.

For example, the labor hours for the staff taking, fulfilling, and inspecting orders may increase as the number of orders increases, driving up the overhead. Furthermore, the costs of taking orders or of quality inspections can vary per product and may not be captured properly. Technology improvements, including switching to automated processes for production, may decrease the labor hours of the production staff, driving the labor-related overhead downward but potentially increasing other overhead expenses. These activities—order taking, fulfillment, and quality inspections—are potential cost drivers associated with production, and they each drive the overhead at varying rates.

THINK IT THROUGH

Identifying Cost Drivers

Cost drivers vary widely among companies.

1. After costs are accumulated into cost pools, what information would help management select the appropriate cost driver?
2. Name an appropriate cost driver for each of the following cost pools:
   A. Plant cleaning and maintenance
   B. Factory supervision
   C. Machine maintenance
   D. Machine setups

Identify Cost Drivers

How does a company determine its cost drivers for indirect materials, indirect labor, and other overhead costs? To begin the determination of appropriate cost drivers, an accountant analyzes the activities in the product production process that contribute to the cost of that product. An activity is any action that consumes company resources, such as taking orders for a product, setting up machines to produce the product, inspecting the product, and providing customer support before and through the order process. For example, Musicality's direct costs can be traced to the products, but there are indirect costs associated with using various types of material for each product. While the Orchestra product has more intricate materials and labor, it has fewer costs associated with requisitioning and conveying materials to the production line than the other products have. Additionally, examining the inspection costs indicates the Orchestra product is a simple product to inspect, so random quality inspections are sufficient. But individual inspections for both the Solo and Band products are critical, and the overhead related to inspection costs should be based on the number of inspections.

As you can imagine, the unique aspects of the production process for each product affect the overhead cost of each product. However, these costs may not be allocated to the products appropriately when overhead is applied using a predetermined rate based on one activity. While Solo, Band, and Orchestra might appear to be different only in quality, they are actually very different from each other when it comes to manufacturing overhead costs.

Whether the products produced require significantly different overhead resources or not, the company benefits from understanding what its cost drivers are. The more efficiently each product's activities are tracked, the more actual cost drivers are discovered, and the more accurately overhead can be assigned to each product.

CONCEPTS IN PRACTICE

Cost Drivers for Small Businesses

The value of analyzing cost drivers can be used in budgeting beyond allocating overhead to products. American Express has forums designed to help small businesses be successful. Knowing the cost drivers for your business can help with budgeting. American Express states that all business activities are related to five main cost drivers:[4]

- Employee head count is often the driver for office supply expense.
- Salesperson head count is often the driver for auto and other employee travel expense.
- The number of leads required to reach the target sales goal is often the driver for advertising, public relations, social media, search engine optimization expense, and other expenses associated with generating leads.
- Sales and all related variable expenses are often the driver for commissions, bad debt, insurance expense, and so on.
- Fixed costs, such as postage, web hosting fees, business licenses, and banking fees, are often overlooked as cost drivers.

4 American Express. "5 Cost Drivers to Help You Make Accurate Expense Projections." June 23, 2011. https://www.americanexpress.com/us/small-business/openforum/articles/5-cost-drivers-to-help-you-make-accurate-expense-projections/

6.3 Calculate Activity-Based Product Costs

As technology changes the ratio between direct labor and overhead, more overhead costs are linked to drivers other than direct labor and machine hours. This shift in costs gives companies the opportunity to stop using the traditional single predetermined overhead rate applied to all units of production and instead use an overhead allocation approach based on the actual activities that drive overhead. Making this change allows management to obtain more accurate product cost information, which leads to more informed decisions. **Activity-based costing** (ABC) is the process that assigns overhead to products based on the various activities that drive overhead costs.

Historical Perspective on Determination of Manufacturing Overhead Allocation

All products consist of material, labor, and overhead, and the major cost components have historically been materials and labor. Manufacturing overhead was not a large cost of the product, so an overhead allocation method based on labor or machine hours was logical. For example, as shown in Figure 6.3, Musicality determined the direct costs and direct labor for their three products: Solo, Band, and Orchestra. Under the traditional method of costing, the predetermined overhead rate of $2 per direct labor hour was computed by dividing the estimated overhead by the estimated direct labor hours. Based on the number of direct labor hours and the number of units produced for each product, the overhead per product is shown in Figure 6.4.

As technology costs decreased and production methods became more efficient, overhead costs changed and became a much larger component of product costs. For many companies, and in many cases, overhead costs are now significantly larger than labor costs. For example, in the last few years, many industries have increased technology, and the amount of overhead has doubled.[5] Technology has changed the manufacturing labor force, and therefore, the type and cost of labor associated with those jobs have changed. In addition, technology has made it easier to track the various activities and their related overhead costs.

Many manufacturing companies use MRP (material requirements planning) or ERP (enterprise resource planning) systems. MRP helps management organize the planning, scheduling, and tracking of materials while ERP systems help plan, organize, and track the materials as well as the accounting, marketing, supply chain, and other management functions.

Costs can be gathered on a unit level, batch level, product level, or factory level. The idea behind these various levels is that at each level, there are additional costs that are encountered, so a company must decide at which level or levels it is best for the company to accumulate costs. A **unit-level cost** is incurred each time a unit of product is produced and includes costs such as materials and labor. A **batch-level cost** is incurred every time a batch of items is manufactured, for example, costs associated with purchasing and receiving materials. A **product-level cost** is incurred each time a product is produced and includes costs such as engineering costs, testing costs, or quality control costs. A **factory-level cost** is incurred because products are being produced and includes costs such as the plant supervisor's salary and rent on the factory building. By definition, indirect labor is not traced to individual products. However, it is possible to track some indirect labor to several jobs or batches. A similar amount of information can be derived for indirect material. An example of an indirect material in some manufacturing processes is cleaning solution. For example, one type of cleaning solution is used in the manufacturing of pop sockets. It is not practical to measure every ounce of cleaning solution used in the manufacture of an individual pop socket; rather, it makes sense to allocate to a particular batch of pop

5 Mary Ellen Biery. "A Sure-Fire Way to Boost the Bottom Line." *Forbes*. January 12, 2014. https://www.forbes.com/sites/sageworks/2014/01/12/control-overhead-compare-industry-data/#47a9ea69d068

sockets the cost of the cleaning solution needed to make that batch. Likewise, a manufacturer of frozen french fries uses a different type of solution to clean potatoes prior to making the french fries and would allocate the cost of the solution based on how much is used to make each batch of fries.

Establishing an Activity-Based Costing System

ABC is a five-stage process that allocates overhead more precisely than traditional allocation does by applying it to the products that use those activities. ABC works best in complex processes where the expenses are not driven by a single cost driver. Instead, several cost drivers are used as the overhead costs are analyzed and grouped into activities, and each activity is allocated based on each group's cost driver. The five stages of the ABC process are:

1. Identify the activities performed in the organization
2. Determine activity cost pools
3. Calculate activity rates for each cost pool
4. Allocate activity rates to products (or services)
5. Calculate unit product costs

The first step is to identify activities needed for production. An activity is an action or process involved in the production of inventory. There can be many activities that consume resources, and management will need to narrow down the activities to those that have the biggest impact on overhead costs. Examples of these activities include:

- Taking orders
- Setting up machines
- Purchasing material
- Assembling products
- Inspecting products
- Providing customer service

The second step is assigning overhead costs to the identified activities. In this step, overhead costs are assigned to each of the activities to become a cost pool. A **cost pool** is a list of costs incurred when related activities are performed. Table 6.2 illustrates the various cost pools along with their activities and related costs.

Cost Pools and Their Activities and Related Costs

Cost Pool	Activities and Related Costs
Production	• Indirect labor setting up machines • Indirect labor cost of accepting and verifying orders • Machine maintenance costs • Costs to operate the machine: utilities, insurance, etc.
Purchasing material	• Preparing purchase requisitions for the material • Cost to move material from receiving department into production • Depreciation of equipment used to move material
Inspect products	• Inspection supervisor costs • Cost to move product to and from the inspection area

Table 6.2

Cost Pools and Their Activities and Related Costs

Cost Pool	Activities and Related Costs
Assemble products	• Cost of assembly machine • Cost of label machine • Cost of labels
Technological production	• Website maintenance • Depreciation of computers

Table 6.2

For example, the production cost pool consists of costs such as indirect labor for those accepting the order, verifying the customer has credit to pay for the order, maintenance and depreciation on the machines used to produce the orders, and utilities and rent for operating the machines. Figure 6.8 illustrates how the costs in each pool are allocated to each product in a different proportion.

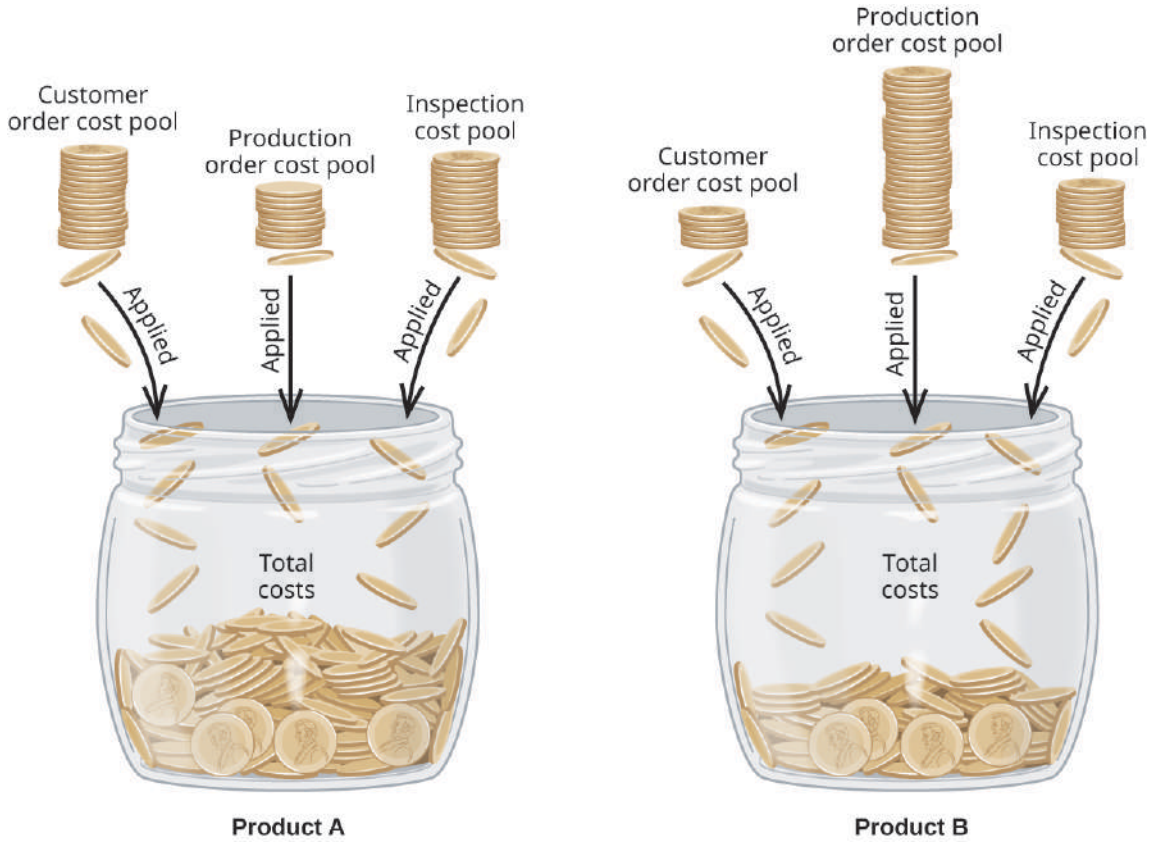


Figure 6.8 Allocating Overhead by Cost Pool. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Once the costs are grouped into similar cost pools, the activities in each pool are analyzed to determine which activity "drives" the costs in that pool, leading to the third step of ABC: identify the cost driver for each cost pool and estimate an annual level of activity for each cost driver. As you've learned, the cost driver is the

specific activity that drives the costs in the cost pools. Table 6.3 shows some activities and cost drivers for those activities.

Activities and Their Common Cost Drivers

Cost Pool	Cost Driver
Customer order	Number of orders
Production	Machine setups
Purchasing materials	Purchase requisitions
Assembling products	Direct labor hours
Inspecting products	Inspection hours
Customer service	Number of contacts with customer

Table 6.3

The fourth step is to compute the predetermined overhead rate for each of the cost drivers. This portion of the process is similar to finding the traditional predetermined overhead rate, where the overhead rate is divided by direct labor dollars, direct labor hours, or machine hours. Each cost driver will have its own overhead rate, which is why ABC is a more accurate method of allocating overhead.

Finally, step five is to allocate the overhead costs to each product. The predetermined overhead rate found in step four is applied to the actual level of the cost driver used by each product. As with the traditional overhead allocation method, the actual overhead costs are accumulated in an account called manufacturing overhead and then applied to each of the products in this step.

Notice that steps one through three represent the process of allocating overhead costs to activities, and steps four and five represent the process of allocating the overhead costs that have been assigned to activities to the products to which they pertain. Thus, the five steps of ABC involve two major processes: first, allocating overhead costs to the various activities to get a cost per activity, and then allocating the cost per activity to each product based on that product's usage of the activities.

Now that the steps involved have been detailed, let's demonstrate the calculations using the Musicality example.

YOUR TURN

Comparing Estimates to Actual Costs

A company has determined that its estimated 500,000 machine hours is the optimal driver for its estimated $1,000,000 machine overhead cost pool. The $750,000 in the material overhead cost pool should be allocated using the estimated 15,000 material requisition requests. How much is over- or underapplied if there were actually 490,000 machine hours and 15,500 material requisitions that resulted

in $950,000 in the machine overhead cost pool, and $780,000 in the material cost pool? What does this difference indicate?

Solution

The predetermined overhead rate is $2 per machine hour ($1,000,000/500,000 machine hours) and $50 per material requisition ($750,000/15,000 requisitions). The actual and applied overhead can then be calculated to determine whether it is over- or underapplied:

	Rate	Actual	Applied	Difference	Overapplied or Underapplied?
Machine Overhead	$ 2*	490,000*	$980,000	$30,000	Overapplied
Material Overhead	$50**	15,500**	$775,000	$(5,000)	Underapplied

* machine hours
**requisitions

The difference is a combination of factors. There were fewer machine hours than estimated, but there was also less overhead than estimated. There were more requisitions than estimated, and there was also more overhead.

The Calculation of Product Costs Using the Activity-Based Costing Allocation Method

Musicality is considering switching to an activity-based costing approach for determining overhead and has collected data to help them decide which overhead allocation method they should use. Performing the analysis requires these steps:

1. Identify cost pools necessary to complete the product. Musicality determined its cost pools are:
   - Setting up machines
   - Purchasing material
   - Inspecting products
   - Assembling products
   - Technological production
2. Assign overhead cost to the cost pools. Musicality has estimated the overhead for each cost pool to be:

Activity	Estimated Overhead Costs
Setting Up Machines	$ 200,000
Purchasing Material	500,000
Inspecting Products	300,000
Assembling Products	600,000
Technological Production	900,000
Total	$2,500,000

3. Identify the cost driver for each activity, and estimate an annual activity for each driver. Musicality determined the driver and estimated activity for each product to be the following:

Cost Driver	Expected Cost Driver Activities			Total
	Solo	Band	Orchestra	
Machine Setups	2,000	1,500	1,500	5,000
Number of Purchase Requisitions	5,000	4,000	1,000	10,000
Inspection Hours	10,000	9,000	1,000	20,000
Number of Parts Requiring Labor	15,000	3,000	12,000	30,000
Machine Hours	80,000	60,000	10,000	150,000

4. Compute the predetermined overhead for each cost driver. Musicality determined this predetermined overhead rate for each driver:

Activity	Cost Driver	Estimated Overhead Costs	Total Activity	ABC Rate per Activity
Setting Up Machines	Machine setups	$ 200,000	5,000	$40
Purchasing Material	Number of purchase requisitions	500,000	10,000	50
Inspecting Products	Inspection hours	300,000	20,000	15
Assembling Products	Number of parts requiring labor	600,000	30,000	20
Technological Production	Machine hours	900,000	150,000	6
Total		$ 2,500,000		

5. Allocate overhead costs to products. Assuming Musicality's activities were as estimated, the amount allocated to each product is:

Activity	Expected Cost Driver Activities			Total
	Solo	Band	Orchestra	
Machine Setups	$ 80,000	$ 60,000	$ 60,000	$ 200,000
Number of Purchase Requisitions	250,000	200,000	50,000	500,000
Inspection Hours	150,000	135,000	15,000	300,000
Number of Parts Requiring Labor	300,000	60,000	240,000	600,000
Machine Hours	480,000	360,000	60,000	900,000
Total Overhead	$1,260,000	$815,000	$425,000	$2,500,000

Now that Musicality has applied overhead to each product, they can calculate the cost per unit. Management can review its sales price and make necessary decisions regarding its products. The overhead cost per unit is the overhead for each product divided by the number of units of each product:

Activity	Solo	Band	Orchestra	Total
Total Overhead	$1,260,000	$815,000	$425,000	$2,500,000
Number Units	140,000	100,000	250,000	490,000
Overhead per Unit	$ 9.00	$ 8.15	$ 1.70	

The overhead per unit can be added to the unit cost for direct material and direct labor to compute the total product cost per unit:

	Solo	Band	Orchestra
Direct Materials per Unit	$ 3.50	$ 6.00	$11.70
Direct Labor per Unit	10.00	2.75	4.30
Overhead per Unit	9.00	8.15	1.70
Cost per Unit via ABC	$22.50	$16.90	$17.70

The sales price was set after management reviewed the product cost with traditional allocation along with other factors such as competition and product demand. The current sales price, cost of each product using ABC, and the resulting gross profit are shown in Figure 6.9.

	Solo	Band	Orchestra
Sales Price	$20.00	$25.00	$30.00
Cost per Unit (ABC)	22.50	16.90	17.70
Gross Profit (loss) per Unit	$(2.50)	$ 8.10	$12.30

Figure 6.9 Solo's Sales Price, ABC Costing, and Gross Profit. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

The loss on each sale of the Solo product was not discovered until the company did the calculations for the ABC method, because the sales of the other products were strong enough for the company to retain a total gross profit.

Additionally, the more accurate gross profit for each product calculated using ABC is shown in Figure 6.10:

	Solo	Band	Orchestra	Total
Number of Units Sold	150,000	110,000	200,000	460,000
ABC Costing				
Sales	$3,000,000	$2,750,000	$6,000,000	$11,750,000
Cost of Goods Sold	3,375,000	1,859,000	3,540,000	8,774,000
Gross Profit (loss)	$ (375,000)	$ 891,000	$2,460,000	$ 2,976,000

Figure 6.10 Solo's Gross Profit by Product. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

The calculations Musicality did in order to switch to ABC revealed that the Solo product was generating a loss for every unit sold. Knowing this information will allow Musicality to consider whether they should make changes to generate a profit from the Solo product, such as increase the selling price or carefully analyze the costs to identify potential cost reductions. Musicality could also decide to continue selling Solo at a loss, because the other products are generating enough profit for the company to absorb the Solo product loss and still be profitable. Why would a company continue to sell a product that is generating a loss? Sometimes these products are ones for which the company is well known or that draw customers into the store. For example, companies will sometimes offer extreme sales, such as on Black Friday, to attract customers in the hope that the customers will purchase other products. This information shows how valuable ABC can be in many situations for providing a more accurate picture than traditional allocation.

The Service Industries and Their Use of the Activity-Based Costing Allocation Method

ABC costing was developed to help management understand manufacturing costs and how they can be better managed. However, the service industry can apply the same principles to improve its cost management. Direct material and direct labor costs range from nonexistent to minimal in the service industry, which makes the overhead application even more important. The number and types of cost pools may be completely different in the service industry as compared to the manufacturing industry. For example, the health-care industry may have different overhead costs and cost drivers for the treatment of illnesses than they have for injuries. Some of the overhead related to monitoring a patient's health status may overlap, but most of the overhead related to diagnosis and treatment differ from each other.

LINK TO LEARNING

Activity-based costing is not restricted to manufacturing. Service industries also have cost drivers and can benefit from analyzing what drives their costs. See this report on activity-based costing at UPS (https://openstax.org/l/50ABC) for an example.

6.4 Compare and Contrast Traditional and Activity-Based Costing Systems

Calculating an accurate manufacturing cost for each product is a vital piece of information for a company's decision-making. For example, knowing the cost to produce a unit of product affects not only how a business budgets to manufacture that product, but it is often the starting point in determining the sales price.

An important component in determining the total production costs of a product or job is the proper allocation of overhead. For some companies, the often less-complicated traditional method does an excellent job of allocating overhead. However, for many products, the allocation of overhead is a more complex issue, and an activity-based costing (ABC) system is more appropriate.

Another factor to consider in determining which of the two major overhead allocation methods to use is the cost associated with collecting and analyzing information. When making their decision regarding which method to use, the company must consider these costs, both in time and money. Table 6.4 compares overhead in the two systems. In many cases, the ABC method is more expensive in terms of time and other costs.

The difference between the traditional method (using one cost driver) and the ABC method (using multiple cost drivers) is more complex than simply the number of cost drivers. When direct labor is a large portion of the product cost, the overhead costs tend to be consistently driven by one cost driver, which is typically direct labor or machine hours; the traditional method appropriately allocates those costs. When technology is a large portion of the product cost, the overhead costs tend to be driven by multiple drivers, so using multiple cost drivers in the ABC method allows for a more precise allocation of overhead.

Overhead in Traditional versus ABC Costing

	Traditional	ABC
Overhead assigned	Single cost driver	Multiple cost drivers
Optimal usage	When direct labor is a large portion of the product cost	When technology is a large portion of the product cost
Orientation	Cost driven	Process driven

Table 6.4

As shown with Musicality's products, not only are there different costs for each product when comparing traditional allocation with an activity-based costing, but ABC showed that the Solo product creates a loss for the company. Activity-based costing is a more accurate method, because it assigns overhead based on the activities that drive the overhead costs. It can be concluded, then, that the cost and subsequent gross loss for each unit's sales provide a more accurate picture than the overall cost and gross profit under the traditional method. image compares the cost per unit using the different cost systems and shows how different the costs can be depending on the method used.

	Solo	Band	Orchestra
Cost per Unit via ABC	$22.50	$16.90	$17.70
Cost per Unit via Traditional	18.50	16.75	20.00
Difference	$ 4.00	$ 0.15	$(2.30)

Advantages and Disadvantages of the Traditional Method of Calculating Overhead

The traditional allocation system assigns manufacturing overhead based on a single cost driver, such as direct labor hours, direct labor dollars, or machine hours, and is optimal when there is a relationship between the activity base and overhead. This most often occurs when direct labor is a large part of the product cost. The theory supporting the single cost driver is that the cost driver selected increases as overhead increases, and further analysis is more costly than it is valuable. Each method has its advantages and disadvantages. These are advantages of the traditional method:

- All manufacturing costs are classified as material, labor, or overhead and assigned to products regardless of whether they drive or are driven by production.
- All manufacturing costs are considered to be part of the product cost, whereas nonmanufacturing costs are not considered to be production costs and are not assigned to products, regardless of whether the costs are based on the products. For example, the machines used to receive and process customer orders are necessary because product orders must be taken, but their costs are not allocated to particular products.
- There is only one overhead cost pool and a single measure of activity, such as direct labor hours, which makes the traditional method simple and less costly to maintain. The predetermined overhead rate is based on estimated costs at the budgeted level of activity. Therefore, the overhead rate is consistent across products, but overhead may be over- or underapplied.

Disadvantages of the traditional method include:

- The use of the single cost driver does not allocate overhead as accurately as using multiple cost drivers.
- The use of the single cost driver may overallocate overhead to one product and underallocate overhead to another product, resulting in erroneous total costs and potentially setting an incorrect sales price.
- Traditional allocation assigns costs as period or product costs, and all product costs are included in the cost of inventory, which makes this method acceptable for generally accepted accounting principles (GAAP).

THINK IT THROUGH

ABC Method and Financial Statements

There are pros and cons to both the traditional and the ABC system. One advantage of the ABC system is that it provides more accurate information on the costs to manufacture products, but it does not show up on the financial statements. Explain how this costing information has value if it does not appear on the financial statements.

Advantages and Disadvantages of Creating an Activity-Based Costing System for Allocating Overhead

While ABC systems more accurately allocate the costs based on the various resources used to make the product, they cost more to use and, therefore, are not always the best method. Management needs to consider each system and how it will work within its own organization. Some advantages of activity-based costing include:

- There are multiple overhead cost pools, and each has its own unique measure of activity. This provides more accurate rates for applying overhead, but it takes more time to implement and results in a higher cost.
- The allocation bases (i.e., measures of activity) often differ from those used in traditional allocation. Multiple cost pools allow management to group costs being influenced by similar drivers and to consider cost drivers beyond the typical labor or machine hour. This results in a more accurate overhead application rate.
- The activity rates may consider the level of activity at capacity instead of the budgeted level of activity.
- Both nonmanufacturing costs and manufacturing costs may be assigned to products. The main rationale in assigning costs is the relationship between the cost and the product. If the cost increases as the volume of the product increases, it is considered part of overhead.

There are disadvantages to using ABC costing that management needs to consider when determining which method to use. Those disadvantages include:

- Some manufacturing costs may be excluded from product costs. For example, the cost to heat the factory may be excluded as a product cost because, while it is necessary for production, it does not fit into one of the activity-driven cost pools.
- It is more expensive, as there is a cost to collect and analyze cost driver information as well as to allocate overhead on the basis of multiple cost drivers.
- An ABC system takes much more to implement and operate, as information on cost drivers must be

collected in an objective manner.

The advantages and disadvantages of both methods are as previously listed, but what is the practical impact on the product cost? There are several items to consider at the product costs level:

- Adopting an ABC overhead allocation system can allow a company to shift manufacturing overhead costs between products based on their volume.
- Using an ABC method to better assign unit-level, batch-level, product-level, and factory-level costs can increase the per-unit costs of the low-volume products and decrease the per-unit costs of the high-volume products.
- The effects are not symmetrical; there is usually a larger change in the per-unit costs of the low-volume products.
- The cost of the products may include some period costs but not some of the product costs, so it is not considered GAAP compliant. The information is supplemental and very helpful to management, but the company still needs to compute the product's cost under the traditional method for financial reporting.

LINK TO LEARNING

Changing from the traditional allocation method to ABC costing is not as simple as having management dictate that employees follow the new system. There are often challenges that begin with convincing employees that it will provide benefits and that they should buy into the new system. See this 1995 article, Tapping the Full Potential of ABC, illustrating some of Chrysler's challenges (https://openstax.org/l/50Chrysler) to learn more.

6.5 Compare and Contrast Variable and Absorption Costing

ABC costing assigns a proportion of overhead costs on the basis of the activities under the presumption that the activities drive the overhead costs. As such, ABC costing converts the indirect costs into product costs. There are also cost systems with a different approach. Instead of focusing on the overhead costs incurred by the product unit, these methods focus on assigning the fixed overhead costs to inventory.

There are two major methods in manufacturing firms for valuing work in process and finished goods inventory for financial accounting purposes: variable costing and absorption costing. **Variable costing**, also called *direct costing* or *marginal costing*, is a method in which all variable costs (direct material, direct labor, and variable overhead) are assigned to a product and fixed overhead costs are expensed in the period incurred. Under variable costing, fixed overhead is not included in the value of inventory. In contrast, **absorption costing**, also called *full costing*, is a method that applies all direct costs, fixed overhead, and variable manufacturing overhead to the cost of the product. The value of inventory under absorption costing includes direct material, direct labor, and all overhead.

The difference in the methods is that management will prefer one method over the other for internal decision-making purposes. The other main difference is that only the absorption method is in accordance with GAAP.

Variable Costing Versus Absorption Costing Methods

The difference between the absorption and variable costing methods centers on the treatment of fixed manufacturing overhead costs. Absorption costing "absorbs" all of the costs used in manufacturing and includes fixed manufacturing overhead as product costs. Absorption costing is in accordance with GAAP, because the product cost includes fixed overhead. Variable costing considers the variable overhead costs and does not consider fixed overhead as part of a product's cost. It is not in accordance with GAAP, because fixed overhead is treated as a period cost and is not included in the cost of the product.

CONCEPTS IN PRACTICE

Absorbing Costs through Overproduction

While companies use absorption costing for their financial statements, many also use variable costing for decision-making. The Big Three auto companies made decisions based on absorption costing, and the result was the manufacturing of more vehicles than the market demanded. Why? With absorption costing, the fixed overhead costs, such as marketing, were allocated to inventory, and the larger the inventory, the lower was the unit cost of that overhead. For example, if a fixed cost of $1,000 is allocated to 500 units, the cost is $2 per unit. But if there are 2,000 units, the per-unit cost is $0.50. While this was not the only reason for manufacturing too many cars, it kept the period costs hidden among the manufacturing costs. Using variable costing would have kept the costs separate and led to different decisions.

Deferred Costs

Absorption costing considers all fixed overhead as part of a product's cost and assigns it to the product. This treatment means that as inventories increase and are possibly carried over from the year of production to actual sales of the units in the next year, the company allocates a portion of the fixed manufacturing overhead costs from the current period to future periods.

Carrying over inventories and overhead costs is reflected in the ending inventory balances at the end of the production period, which become the beginning inventory balances at the start of the next period. It is anticipated that the units that were carried over will be sold in the next period. If the units are not sold, the costs will continue to be included in the costs of producing the units until they are sold. Finally, at the point of sale, whenever it happens, these deferred production costs, such as fixed overhead, become part of the costs of goods sold and flow through to the income statement in the period of the sale. This treatment is based on the **expense recognition principle**, which is one of the cornerstones of accrual accounting and is why the absorption method follows GAAP. The principle states that expenses should be recognized in the period in which revenues are incurred. Including fixed overhead as a cost of the product ensures the fixed overhead is expensed (as part of cost of goods sold) when the sale is reported.

For example, assume a new company has fixed overhead of $12,000 and manufactures 10,000 units. Direct materials cost is $3 per unit, direct labor is $15 per unit, and the variable manufacturing overhead is $7 per unit. Under absorption costing, the amount of fixed overhead in each unit is $1.20 ($12,000/10,000 units); variable costing does not include any fixed overhead as part of the cost of the product. Figure 6.11 shows the

cost to produce the 10,000 units using absorption and variable costing.

	Absorption	Variable
Materials ($3 per unit)	$ 30,000	$ 30,000
Labor ($15 per unit)	150,000	150,000
Variable Overhead ($7 per unit)	70,000	70,000
Fixed Overhead ($1.20 per unit)	12,000	
Total Finished Goods Inventory	$262,000	$250,000

Figure 6.11 Finished Goods Inventory under Absorption and Variable Costing. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Assume each unit is sold for $33 each, so sales are $330,000 for the year. If the entire finished goods inventory is sold, the income is the same for both the absorption and variable cost methods. The difference is that the absorption cost method includes fixed overhead as part of the cost of goods sold, while the variable cost method includes it as an administrative cost, as shown in Figure 6.12. When the entire inventory is sold, the total fixed cost is expensed as the cost of goods sold under the absorption method or it is expensed as an administrative cost under the variable method; net income is the same under both methods.

	Absorption	Variable
Sales	$330,000	$330,000
Cost of Goods Sold	262,000	250,000
Gross Profit	68,000	80,000
– Fixed Overhead	0	12,000
Net Income	$162,400	$160,000

Figure 6.12 Income Statement When the Entire Inventory Is Sold. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Now assume that 8,000 units are sold and 2,000 are still in finished goods inventory at the end of the year. The cost of the fixed overhead expensed on the income statement as cost of goods sold is $9,600 ($1.20/unit × 8,000 units), and the fixed overhead cost remaining in finished goods inventory is $2,400 ($1.20/unit × 2,000 units). The amount of the fixed overhead paid by the company is not totally expensed, because the number of units in ending inventory has increased. Eventually, the fixed overhead cost will be expensed when the inventory is sold in the next period. Figure 6.13 shows the cost to produce the 8,000 units of inventory that became cost of goods sold and the 2,000 units that remain in ending inventory.

	Absorption	Variable
Cost of Goods Sold		
Materials	$ 24,000	$ 24,000
Labor	120,000	120,000
Variable Overhead	56,000	14,000
Fixed Overhead	9,600	
Cost of Goods Sold	$209,600	$200,000
Ending Inventory		
Materials	$ 6,000	$ 6,000
Labor	30,000	30,000
Variable Overhead	14,000	14,000
Fixed Overhead	2,400	
Ending Inventory	$ 52,400	$ 50,000

Figure 6.13 Cost of Goods Sold and Ending Inventory with the Absorption and Variable Costing Methods. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

If the 8,000 units are sold for $33 each, the difference between absorption costing and variable costing is a timing difference. Under absorption costing, the 2,000 units in ending inventory include the $1.20 per unit share, or $2,400 of fixed cost. That cost will be expensed when the inventory is sold and accounts for the difference in net income under absorption and variable costing, as shown in Figure 6.14.

	Absorption	Variable
Sales	$264,000	$264,000
Cost of Goods Sold	209,600	200,000
Gross Profit	54,400	64,000
– Fixed Overhead	0	12,000
Net Income	$ 54,400	$ 52,000

Figure 6.14 Net Income under Absorption and Variable Costing When Ending Inventory Remains. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Under variable costing, the fixed overhead is not considered a product cost and would not be assigned to ending inventory. The fixed overhead would have been expensed on the income statement as a period cost.

Inventory Differences

Because absorption costing defers costs, the ending inventory figure differs from that calculated using the variable costing method. As shown in Figure 6.13, the inventory figure under absorption costing considers both variable and fixed manufacturing costs, whereas under variable costing, it only includes the variable manufacturing costs.

Suitability for Cost-Volume-Profit Analysis

Using the absorption costing method on the income statement does not easily provide data for cost-volume-profit (CVP) computations. In the previous example, the fixed overhead cost per unit is $1.20 based on an activity of 10,000 units. If the company estimated 12,000 units, the fixed overhead cost per unit would decrease to $1 per unit. This calculation is possible, but it must be done multiple times each time the volume of activity

changes in order to provide accurate data, as CVP analysis makes no distinction between variable costing and absorption costing income statements.

YOUR TURN

Comparing Variable and Absorption Methods

A company expects to manufacture 7,000 units. Its direct material costs are $10 per unit, direct labor is $9 per unit, and variable overhead is $3 per unit. The fixed overhead is estimated at $49,000. How much would each unit cost under both the variable method and the absorption method?

Solution

The variable cost per unit is $22 (the total of direct material, direct labor, and variable overhead). The absorption cost per unit is the variable cost ($22) plus the per-unit cost of $7 ($49,000/7,000 units) for the fixed overhead, for a total of $29.

Advantages and Disadvantages of the Variable Costing Method

Variable costing only includes the product costs that vary with output, which typically include direct material, direct labor, and variable manufacturing overhead. Fixed overhead is not considered a product cost under variable costing. Fixed manufacturing overhead is still expensed on the income statement, but it is treated as a period cost charged against revenue for each period. It does not include a portion of fixed overhead costs that remains in inventory and is not expensed, as in absorption costing.

If absorption costing is the method acceptable for financial reporting under GAAP, why would management prefer variable costing? Advocates of variable costing argue that the definition of fixed costs holds, and fixed manufacturing overhead costs will be incurred regardless of whether anything is actually produced. They also argue that fixed manufacturing overhead costs are true period expenses and have no future service potential, since incurring them now has no effect on whether these costs will have to be incurred again in the future.

Advantages of the variable approach are:

- **More useful for CVP analysis**. Variable costing statements provide data that are immediately useful for CVP analysis because fixed and variable overhead are separate items. Computations from financial statements prepared with absorption costing need computations to break out the fixed and variable costs from the product costs.
- **Income is not affected by changes in production volume**. Fixed overhead is treated as a period cost and does not vary as the volume of inventory changes. This results in income increasing in proportion to sales, which may not happen under absorption costing. Under absorption costing, the fixed overhead assigned to a cost changes as the volume changes. Therefore, the reported net income changes with production, since fixed costs are spread across the changing number of units. This can distort the income picture and may even result in income moving in an opposite direction from sales.
- **Understandability**. Managers may find it easier to understand variable costing reports because overhead changes with the cost driver.

- **Fixed costs are more visible**. Variable costing emphasizes the impact fixed costs have on income. The total amount of fixed costs for the period is reported after gross profit. This emphasizes the direct impact fixed costs have on net income, whereas in absorption costing, fixed costs are included as product costs and thus are part of cost of goods sold, which is a determinant of gross profit.
- **Margins are less distorted**. Gross margins are not distorted by the allocation of common fixed costs. This facilitates appraisal of the profitability of products, customers, and business segments. **Common fixed costs**, sometimes called allocated fixed costs, are costs of the organization that are shared by the various revenue-generating components of the business, such as divisions. Examples of these costs include the chief executive officer (CEO) salary and corporate headquarter costs, such as rent and insurance. These overhead costs are typically allocated to various components of the organization, such as divisions or production facilities. This is necessary, because these costs are needed for doing business but are generated by a part of the company that does not directly generate revenues to offset these costs. The company's revenues are generated by the goods that are produced and sold by the various divisions of the company.
- **Control is facilitated**. Variable costing considers only variable production costs and facilitates the use of control mechanisms such as flexible budgets that are based on differing levels of production and therefore designed around variable costs, since fixed costs do not change within a relevant range of production.
- **Incremental analysis is more straightforward**. Variable cost corresponds closely with the current out-of-pocket expenditure necessary to manufacture goods and can therefore be used more readily in incremental analysis.

While the variable cost method helps management make decisions, especially when the number of units in ending inventory fluctuates, there are some disadvantages:

- **Financial reporting**. The variable cost method is not acceptable for financial reporting under GAAP. GAAP requires expenses to be recognized in the same period as the related revenue, and the variable method expenses fixed overhead as a period cost regardless of how much inventory remains.
- **Tax reporting**. Tax laws in the United States and many other countries do not allow variable costing and require absorption costing.

Advantages and Disadvantages of the Absorption Costing Method

Under the absorption costing method, all costs of production, whether fixed or variable, are considered product costs. This means that absorption costing allocates a portion of fixed manufacturing overhead to each product.

Advocates of absorption costing argue that fixed manufacturing overhead costs are essential to the production process and are an actual cost of the product. They further argue that costs should be categorized by function rather than by behavior, and these costs must be included as a product cost regardless of whether the cost is fixed or variable.

The advantages of absorption costing include:

- **Product cost**. Absorption costing includes fixed overhead as part of the inventory cost, and it is expensed as cost of goods sold when inventory is sold. This represents a more complete list of costs involved in producing a product.
- **Financial reporting**. Absorption costing is the acceptable reporting method under GAAP.
- **Tax reporting**. Absorption costing is the method required for tax preparation in the United States and

many other countries.

While financial and tax reporting are the main advantages of absorption costing, there is one distinct disadvantage:

- **Difficulty in understanding**. The absorption costing method does not list the incremental fixed overhead costs and is more difficult to understand and analyze as compared to variable costing.

ETHICAL CONSIDERATIONS

Cost Accounting for Ethical Business Managers

An ethical and evenhanded approach to providing clear and informative financial information regarding costing is the goal of the ethical accountant. Ethical business managers understand the benefits of using the appropriate costing systems and methods. The accountant's entire business organization needs to understand that the costing system is created to provide efficiency in assisting in making business decisions. Determining the appropriate costing system and the type of information to be provided to management goes beyond providing just accounting information. The costing system should provide the organization's management with factual and true financial information regarding the organization's operations and the performance of the organization. Unethical business managers can game the costing system by unfairly or unscrupulously influencing the outcome of the costing system's reports.

Comparing the Operating Income Statements for Both Methods Assuming No Ending Inventory in the First Year, and the Existence of Ending Inventory in the Second Year

In order to understand how to prepare income statements using both methods, consider a scenario in which a company has no ending inventory in the first year but does have ending inventory in the second year. Outdoor Nation, a manufacturer of residential, tabletop propane heaters, wants to determine whether absorption costing or variable costing is better for internal decision-making. It manufactures 5,000 units annually and sells them for $15 per unit. The total of direct material, direct labor, and variable overhead is $5 per unit with an additional $1 in variable sales cost paid when the units are sold. Additionally, fixed overhead is $15,000 per year, and fixed sales and administrative expenses are $21,000 per year.

Production is estimated to hold steady at 5,000 units per year, while sales estimates are projected to be 5,000 units in year 1; 4,000 units in year 2; and 6,000 in year 3.

Under absorption costing, the ending inventory costs include all manufacturing costs, including overhead. If fixed overhead is $15,000 per year and 5,000 units are manufactured each year, the fixed overhead per unit is $3:

$$\frac{\$15{,}000}{5{,}000 \text{ units}} = \$3 \text{ per unit}$$

The projected income statement using absorption costing is shown in Figure 6.15:

	Year 1	Year 2	Year 3
Sales	$75,000	$60,000	$90,000
Cost of Goods Sold			
Beginning Inventory	0	0	8,000
+ Cost of Goods Manufactured			
Direct Material, Labor, and Overhead			
(5,000 units × $5 per unit)	25,000	25,000	25,000
Fixed Manufacturing Overhead	15,000	15,000	15,000
Cost of Goods Available for Sale	40,000	40,000	48,000
− Ending Inventory	0	8,000	0
Cost of Goods Sold	40,000	32,000	48,000
Gross Margin	35,000	28,000	42,000
− Sales and Administrative Expenses			
Fixed Sales and Administration Expenses	21,000	21,000	21,000
Variable Sales and Administration Expenses	5,000	4,000	6,000
Net Income	$ 9,000	$ 3,000	$15,000

Figure 6.15 Outdoor Nation's Income Statement Using Absorption Costing. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

In variable costing, the fixed overhead is not included in the cost of goods sold even if it relates to manufacturing. As a result, the net income under variable costing differs from absorption costing by the same amount as inventory differential. The projected income under variable costing is shown in Figure 6.16:

	Year 1	Year 2	Year 3
Sales	$75,000	$60,000	$90,000
− Variable Expenses			
Beginning Inventory	0	0	5,000
+ Variable Manufacturing Overhead	25,000	25,000	25,000
Cost of Goods Available for Sale	25,000	25,000	30,000
− Ending Inventory	0	5,000	0
Variable Cost to Manufacturing	25,000	20,000	30,000
Variable Selling and Administrative Expenses	5,000	4,000	6,000
Cost of Goods Sold	30,000	24,000	36,000
Contribution Margin	45,000	36,000	54,000
− Fixed Expenses			
Fixed Overhead Expenses	15,000	15,000	15,000
Fixed Sales and Administration Expenses	21,000	21,000	21,000
Net Income	$ 9,000	$ 0	$18,000

Figure 6.16 Outdoor Nation's Income Statement Using Variable Costing. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

The difference between the methods is attributable to the fixed overhead. Therefore, the methods can be reconciled with each other, as shown in Figure 6.17.

Reconciliation	Year 1	Year 2	Year 3
Income under Variable Costing	$9,000	$ 0	$18,000
+ Fixed Manufacturing Overhead in Ending Inventory	0	3,000	0
− Fixed Manufacturing Overhead in Beginning Inventory	0	0	3,000
Income under Absorption	$9,000	$3,000	$15,000

Figure 6.17 Outdoor Nation's Reconciliation of Net Incomes. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Each method results in different amounts for net income when the inventory amounts change. More specifically, the effects on income are:

- **Sales and Production equal.** When a company sells the same quantity of products produced during the period, the resulting net income will be identical whether absorption costing or variable costing is used. When sales equals production, all manufacturing costs are accounted for in net income, and none of the costs are waiting in finished goods inventory to be recognized in a future period. Remember, with absorption costing, all manufacturing costs are added to the cost of the product during the work in process phase; thus, as the goods are sold, all costs have been accounted for. With variable costing, only the variable costs or production are added to the cost of the product during the work in process phase, and the fixed costs are expensed in the period in which they are incurred. Thus, in the example where sales and production are equal, all costs have been accounted for since all of the produced inventory has moved through cost of goods sold. This means that net income under absorption costing would be the same as net income under variable costing.
- **Sales less than Production**. When a company produces more than it sells, net income will be less under variable costing than under absorption costing. In this scenario, there will be a buildup, or an increase, in inventory from the beginning of the period to the end of the period. Under variable costing, fixed manufacturing costs are still in the finished goods inventory account. But under absorption costing, those fixed costs have been expensed during the current production period and thus have reduced net income.
- **Sales greater than Production.** When a company sells more than it produces during the current period, this indicates it is selling goods produced in a prior period. This will result in net income under variable costing being greater than under absorption costing. With absorption costing, all manufacturing costs are captured in the finished goods inventory account, and as those goods are sold, those costs become expenses. Selling items that were produced in a prior period defers the recognition of the costs of those products until the future period in which they are sold. Variable costing results in all of the variable costs associated with the sold products being in the current period net income, but only the current period fixed expenses would be included in the current period net income. The fixed expenses associated with the items produced in a prior period were recognized in the period in which they were incurred, not the period in which the products are sold. This results in fewer expenses and therefore greater income with the variable cost method.
- **Effect of differences in Sales and Production Long Term.** The differences between net income generated under absorption costing and variable costing will be almost zero over the long run, as all costs associated with the production of goods will eventually be recognized in net income. The use of absorption versus variable costing creates more of a timing issue for the recognition of fixed expenses, and this is why net income would vary from period to period under the two methods but in the long run would not. In addition, absorption costing does allow for manipulation of income by managers through

overproduction. Increasing production at year-end results in a higher net income than if the additional goods had not been produced, since increasing the number of units decreases the fixed cost per unit. Under absorption costing, these fixed costs follow the units produced and do not become a part of cost of goods sold until they are sold. Instead, a portion of the fixed costs is in the inventory accounts. Why would a manager want to manipulate income by overproducing? If the manager's annual bonus or other compensation is linked to net income, then the manager may be motivated to overproduce in order to increase the potential for or the amount of a bonus. If the level of sales remain constant while manipulating the production level, such an action would increase the company's expenses (including the amount of bonus) while not increasing its revenue. Barring any other justification for the increase in production, such an action by the manager would typically be considered an ethical violation, since the manager's actions would be in the manager's best interests, but contrary to the best interests of the company.

LINK TO LEARNING

Absorption costing is not as well understood as variable costing because of its financial statement limitations. But understanding how it can help management make decisions is very important. See the Strategic CFO forum on Absorption Cost Accounting that helps managers understand its uses (https://openstax.org/l/50Absorption) to learn more.

Key Terms

absorption costing (also, full costing) system of accounting where all costs are treated as product costs regardless of whether they are variable or fixed

activity base activity that has been considered to be a primary driver of overhead costs and for which, traditionally, direct labor hours or machine hours were used

activity-based costing process of assigning overhead to products based on the cost driver for each activity cost pool

batch-level cost one that is incurred when a group (or batch) of items is produced

common fixed costs expenses that are shared among all divisions or production units and include such costs as the CEO salary and corporate headquarter costs

cost driver activity that is the reason for the increase or decrease of another cost; examples include labor hours incurred, labor costs paid, amounts of materials used in production, units produced, or any other activity that has a cause-and-effect relationship with incurred costs

cost pool accumulation of costs that are incurred during the production of the activities included in the activity cost pool

direct labor labor directly related to the manufacturing of the product or the production of a service

direct materials materials used in the manufacturing process that can be traced directly to the product

expense recognition principle (also, matching principle) matches expenses with associated revenues in the period in which the revenues were generated

factory-level cost one that is incurred when production occurs, such as production supervisor salary

indirect labor labor not directly involved in the active conversion of materials into finished products or the provision of services

indirect materials materials used in production but not efficiently traceable to a specific unit of production

manufacturing overhead costs all manufacturing costs excluding direct material and direct labor

product-level cost one that occurs as support of the product, such as engineering

traditional allocation allocation of factory overhead to products based on the volume of production resources consumed

unit-level cost one that is incurred for each unit produced

variable costing (also, *direct costing* or *marginal costing*) system of accounting where only variable costs are treated as product costs

Summary

6.1 Calculate Predetermined Overhead and Total Cost under the Traditional Allocation Method

- Manufacturing overhead is estimated for the upcoming period.
- An activity base is selected to allocate overhead. This is traditionally direct labor hours, direct labor cost, or machine hours.
- A predetermined overhead rate is calculated by dividing the estimated overhead by the allocation base.
- Overhead is allocated to each product based on the estimated predetermined overhead rate and the number of units in the selected activity base.

6.2 Describe and Identify Cost Drivers

- Overhead costs are analyzed and grouped based on similar activity bases. A cost driver, such as inspections, machine setups, or order taking, is selected for each cost grouping.

- Analysis of cost drivers allows for better selection of true overhead cost drivers and more appropriate allocation of overhead.

6.3 Calculate Activity-Based Product Costs

- Costs can be traced to the unit level or batch level.
- There are five steps in the ABC process:
  - identify activities needed for production
  - assign overhead expenses
  - assign a cost driver for each expense
  - determine a predetermined overhead rate
  - allocate overhead to each product

6.4 Compare and Contrast Traditional and Activity-Based Costing Systems

- Traditional allocation assigns overhead based on a single overhead rate, while ABC assigns overhead based on several cost pools and the activities that drive costs.
- Traditional allocation is optimal when the manufacturing process is labor driven and overhead increases based on traditional activity bases, such as direct labor hours, direct labor dollars, or machine hours.
- ABC costing is optimal when the manufacturing process is technology driven and overhead increases based on various activities that differ for each product.

6.5 Compare and Contrast Variable and Absorption Costing

- Absorption costing assigns all manufacturing costs to products, whereas variable costing only assigns variable costs to the products.
- Income statements from both methods can be reconciled by starting with the net income or loss using variable costing and adding the amount of fixed costs included in ending inventory and subtracting the fixed costs included in beginning inventory.
- Variable costing is not considered GAAP compliant but lends itself to cost-volume-profit analysis.

Multiple Choice

1. LO 6.1 Active Frame, Inc., manufactures clear and tinted sport glasses. The manufacturing of clear glasses takes 45,000 direct labor hours and involves 1,700 parts and 115 inspections. The manufacturing of tinted glasses takes 115,000 direct labor hours and involves 1,400 parts and 450 inspections. The traditional method applies $560,000 of overhead on the basis of direct labor hours. What is the amount of overhead per direct labor hour applied to the clear glass products?

A. $933.33
B. $157,500
C. $322.500
D. $402,500

2. LO 6.1 TyeDye Lights makes two products: Party and Holiday. It takes 80,900 direct labor hours to manufacture the Party Line and 93,500 direct labor hours to manufacture the Holiday Line. Overhead consists of $225,000 in the machine setup cost pool and $149,960 in the packaging cost pool. The machine setup pool has 52,000 setups for the Party product and 98,000 setups for the Holiday product. The packaging cost pool has 26,000 parts in the Party product and 39,200 parts for the Holiday product. Using the traditional cost method of direct labor hours, what is the predetermined overhead rate?

A. $1.50 per direct labor hour
B. $2.15 per direct labor hour
C. $2.30 per direct labor hour
D. $3.80 per direct labor hour

3. LO 6.2 Which is *not* a step in analyzing the cost driver for manufacturing overhead?

A. identify the cost
B. identify non-value-added costs
C. analyze the effect on manufacturing overhead
D. identify the correlation between the potential driver and manufacturing overhead

4. LO 6.2 Overhead costs are assigned to each product based on _____.

A. the proportion of that product's use of the cost driver
B. a predetermined overhead rate for a single cost driver
C. price of the product
D. machine hours per product

5. LO 6.3 Which of the following is a reason a company would implement activity-based costing?

A. The cost of record keeping is high.
B. The additional data obtained through traditional allocation are not worth the cost.
C. They want to improve the data on which decisions are made.
D. A company only has one cost driver.

6. LO 6.3 Which is the correct formula for computing the overhead rate?

A. estimated use of the cost driver for production/estimated overhead for the activity
B. estimated overhead for the product/estimated use of the cost driver for the activity
C. estimated use of the cost driver for production/estimated overhead for the activity
D. estimated overhead for the activity/estimated use of the cost driver for the activity

7. LO 6.3 A company anticipates the cost to heat the building will be $21,000. Product A takes up 500 square feet of space, while Product B takes up 200 square feet. The activity rate per product using activity-based costing would be which of the following?

A. $30/square foot
B. $4.20/square foot
C. $11/square foot
D. $15.20/square foot

8. LO 6.3 A company calculated the predetermined overhead based on an estimated overhead of $70,000, and the activity for the cost driver was estimated as 2,500 hours. If product A utilized 1,350 hours and product B utilized 1,100 hours, what was the total amount of overhead assigned to the products?

A. $35,000
B. $30,800
C. $37,800
D. $68,600

9. LO 6.3 Which is *not* a step in activity-based costing?

A. identify the activities performed by the organization
B. identify the cost driver(s) associated with each activity
C. compute a cost rate per production
D. assign costs to products by multiplying the cost driver rate by the volume of the cost driver units consumed by the product

10. LO 6.3 What is the proper order of tasks in an ABC system?

A. identify the cost drivers, assign the costs to the products, calculate the overhead application rate for each cost pool, identify the cost pools
B. assign the costs to the products, identify the cost drivers, calculate the overhead application rate for each cost pool, identify the cost pools
C. identify the cost drivers, identify the cost pools, calculate the overhead application rate for each cost pool, assign the costs to the products
D. identify the cost pools, identify the cost drivers, calculate the overhead application rate for each cost pool, assign the costs to the products

11. LO 6.3 Which is not a task typically associated with ABC systems?

A. calculating the overhead application rate for each cost pool
B. applying a single cost rate
C. identifying a cost driver
D. more correctly allocating overhead costs

12. LO 6.4 Which statement is correct?

A. Activity-based cost systems are less costly than traditional cost systems.
B. Activity-based cost systems are easier to implement than traditional cost systems.
C. Activity-based cost systems are more accurate than traditional cost systems.
D. Activity-based cost systems provide the same data as traditional cost systems.

13. LO 6.4 Activity-based costing systems:

A. use a single predetermined overhead rate based on machine hours instead of on direct labor
B. frequently increase the overhead allocation to at least one product while decreasing the overhead allocation to at least one other product
C. limit the number of cost pools
D. always result in an increase of at least one product's selling price

14. LO 6.4 Activity-based costing is preferable in a system:

A. when multiple products have similar product volumes and costs
B. with a large direct labor cost as a percentage of the total product cost
C. with multiple, diverse products
D. where management needs to support an increase in sales price

15. LO 6.5 Absorption costing is also referred to as:

A. direct costing
B. marginal costing
C. full costing
D. variable costing

16. LO 6.5 Under variable costing, a unit of product includes which costs?
- A. direct material, direct labor, and manufacturing overhead
- B. direct material, direct labor, and variable manufacturing overhead
- C. direct material, direct labor, and fixed manufacturing overhead
- D. direct material, direct labor, and all variable manufacturing overhead

17. LO 6.5 Under absorption costing, a unit of product includes which costs?
- A. direct material, direct labor, and manufacturing overhead
- B. direct material, direct labor, and variable manufacturing overhead
- C. direct material, direct labor, and fixed manufacturing overhead
- D. direct material, direct labor, and all variable manufacturing overhead

18. LO 6.5 A downside to absorption costing is:
- A. not including fixed manufacturing overhead in the cost of the product
- B. that it is not really useful for managerial decisions
- C. that it is not allowable under GAAP
- D. that it is not well designed for cost-volume-profit analysis

19. LO 6.5 When the number of units in ending inventory increases through the year, which of the following is true?
- A. Net income is the same for variable and absorption costing.
- B. Net income is higher for variable costing than for absorption costing.
- C. Net income is higher for absorption costing than for variable costing.
- D. There is no relationship between net income and the costing method.

20. LO 6.5 Product costs under variable costing are typically:
- A. higher than under absorption costing
- B. lower than under absorption costing
- C. the same as with absorption costing
- D. higher than absorption costing when inventory increases

Questions

1. LO 6.1 What is the predetermined overhead rate, and when is it typically estimated?

2. LO 6.1 LO 6.3 When is an activity-based costing system better than a traditional allocation system?

3. LO 6.2 What is the advantage of labeling activities as value added or nonvalue added?

4. LO 6.2 What conditions are necessary to designate an activity as a cost driver?

5. LO 6.2 For each cost pool, identify an appropriate cost driver.
- A. order department
- B. accounts receivable processing
- C. catering
- D. raw material inventory

6. LO 6.3 How is the primary focus of activity-based costing different from that of traditional allocation?

7. LO 6.3 What are the primary differences between traditional and activity-based costing?

8. LO 6.3 How are service companies similar or different from manufacturing companies in using ABC costing?

9. LO 6.3 How are costs allocated in an ABC system?

10. LO 6.4 In production, what has changed to allow ABC costing to become valuable?

11. LO 6.4 Why is it important to know the true cost for a product or service?

12. LO 6.5 What is the primary difference between variable costing and absorption costing?

13. LO 6.5 Why would managers prefer variable costing over absorption costing?

14. LO 6.5 Why is absorption costing the method allowable for GAAP?

15. LO 6.5 Can a company gather information for both variable and absorption costing systems?

Exercise Set A

EA1. LO 6.1 Steeler Towel Company estimates its overhead to be $250,000. It expects to have 100,000 direct labor hours costing $2,500,000 in labor and utilizing 12,500 machine hours. Calculate the predetermined overhead rate using:

A. Direct labor hours
B. Direct labor dollars
C. Machine hours

EA2. LO 6.1 Crystal Pools estimates overhead will utilize 250,000 machine hours and cost $750,000. It takes 2 machine hours per unit, direct material cost of $14 per unit, and direct labor of $20 per unit. What is the cost of each unit produced?

EA3. LO 6.1 A company estimated 100,000 direct labor hours and $800,000 in overhead. The actual overhead was $805,100, and there were 99,900 direct labor hours. What is the predetermined overhead rate, and how much was applied during the year?

EA4. LO 6.1 Cozy, Inc., manufactures small and large blankets. It estimates $350,000 in overhead during the manufacturing of 75,000 small blankets and 25,000 large blankets. What is the predetermined overhead rate if a small blanket takes 1 machine hour and a large blanket takes 2 machine hours?

EA5. LO 6.2 Identify appropriate cost drivers for these cost pools:

A. setup cost pools
B. assembly cost pool
C. supervising cost pool
D. testing cost pool

EA6. LO 6.2 Match the activity with the most appropriate cost driver.

Activities and Cost Drivers

Activity	Cost Driver
Fringe benefits	Square feet
Electricity	Direct labor hours
Depreciation	Machine hours
Machine maintenance	
Heat and air conditioning	

Table 6.5

EA7. LO 6.3 Rex Industries has two products. They manufactured 12,539 units of product A and 8,254 units of product B. The data are:

Activity in Cost Pool	Estimated Overhead	Product A	Product B
1	$45,900	1,000	500
2	67,300	200	800
3	25,200	600	5,400

What is the activity rate for each cost pool?

EA8. LO 6.3 Rex Industries has identified three different activities as cost drivers: machine setups, machine hours, and inspections. The overhead and estimated usage are:

Activity	Overhead per Activity	Annual Usage
Machine setups	$155,000	4,000
Machine hours	352,800	14,112
Inspections	120,750	3,500

Compute the overhead rate for each activity.

EA9. LO 6.3 Custom's makes two types of hats: polyester (poly) and silk. There are two cost pools: setup, with an estimated $100,000 in overhead, and inspection, with $25,000 in overhead. Poly is estimated to have 750,000 setups and 170,000 inspections, while silk has 250,000 setups and 80,000 inspections. How much overhead is applied to each product?

EA10. LO 6.3 Custom's has three cost pools and an associated cost driver to allocate the costs to the product. The cost pools, cost driver, estimated overhead, and estimated activity for the cost pool are:

Cost Pool	Cost Driver	Estimated Activity per Driver	Estimated Overhead
Material	Material requisitions	14,000	$ 52,500
Machining	Machine hours	186,400	363,500
Inspection	Number of inspections	10,000	75,000

What is the predetermined overhead rate for each activity?

EA11. LO 6.3 Potterii sells its products to large box stores and recently added a retail line of products to sell directly to consumers. These estimates are to be used in determining the overhead allocation rate for ABC:

Cost Pool	Cost Driver	Estimated Overhead	Wholesale	Retail
Ordering	Number of orders	$120,000	180,000	60,000
Machine setups	Number of setups	85,000	200,000	140,000
Inspection	Number of inspections	75,000	60,000	15,000

What would be the predetermined rate for each cost pool?

EA12. LO 6.3 Assign each of the following expenses to either the machine setup cost pool or the factory cost pool:

A. indirect materials
B. inspections
C. factory insurance
D. machine depreciation
E. machine setup (indirect labor)
F. machine setup (indirect material)

EA13. LO 6.4 Tri-bikes manufactures two different levels of bicycles: the Standard and the Extreme. The total overhead of $300,000 has traditionally been allocated by direct labor hours, with 150,000 hours for the Standard and 50,000 hours for the Extreme. After analyzing and assigning costs to two cost pools, it was determined that machine hours is estimated to have $200,000 of overhead, with 4,000 hours used on the Standard product and 1,000 hours used on the Extreme product. It was also estimated that the setup cost pool would have $100,000 of overhead, with 1,000 hours for the Standard and 1,500 hours for the Extreme. What is the overhead rate per product, under traditional and under ABC costing?

EA14. LO 6.5 Cool Pool has these costs associated with production of 20,000 units of accessory products: direct materials, $70; direct labor, $110; variable manufacturing overhead, $45; total fixed manufacturing overhead, $800,000. What is the cost per unit under both the variable and absorption methods?

EA15. LO 6.5 Using this information from Planters, Inc., what is the cost per unit under both variable and absorption costing?

Production	10,000
Direct materials	$ 240
Direct labor	280
Variable manufacturing overhead	100
Fixed manufacturing overhead	1,200,000

Exercise Set B

EB1. LO 6.1 Green Bay Cheese Company estimates its overhead to be $375,000. It expects to have 125,000 direct labor hours costing $1,500,000 in labor and utilizing 15,000 machine hours. Calculate the predetermined overhead rate using:

A. Direct labor hours
B. Direct labor dollars
C. Machine hours

EB2. LO 6.1 Boarders estimates overhead will utilize 160,000 machine hours and cost $80,000. It takes 4 machine hours per unit, direct material cost of $5 per unit, and direct labor of $5 per unit. What is the cost of each unit produced?

EB3. LO 6.1 A company estimated 50,000 direct labor hours and $450,000 in overhead. The actual overhead was $445,000, and there were 50,500 direct labor hours. What is the predetermined overhead rate, and how much was applied during the year?

EB4. LO 6.1 Cozy, Inc., manufactures small and large blankets. It estimates $950,000 in overhead during the manufacturing of 360,000 small blankets and 120,000 large blankets. What is the predetermined overhead rate if a small blanket takes 2 hours of direct labor and a large blanket takes 3 hours of direct labor?

EB5. LO 6.2 Identify appropriate cost drivers for these cost pools:

A. material cost pool
B. machine cost pool
C. painting cost pool
D. maintenance cost pool

EB6. LO 6.2 Match the activity with the most appropriate cost driver.

Activities and Cost Drivers

Activity	Cost Driver
Factory maintenance	Number of setups
Payroll tax	Number of employees
Rent	Square feet
Machine setups	Direct labor hours
Factory supervision	

Table 6.6

EB7. LO 6.3 Rocks Industries has two products. They manufactured 12,539 units of product A and 8,254 units of product B. The data are:

Cost Pool	Estimated Overhead	Product A	Product B
1	$32,400	1,500	3,000
2	54,900	1,700	1,300
3	51,385	1,390	1,000

What is the activity rate for each cost pool?

EB8. LO 6.3 Rocks Industries has identified three different activities as cost drivers: machine setups, machine hours, and inspections. The overhead and estimated usage are:

Activity	Overhead per Activity	Annual Usage
Machine setups	$75,000	6,000
Machine hours	$85,002	5,484
Inspections	70,000	20,000

Compute the overhead rate for each activity.

EB9. LO 6.3 Frenchy's makes two types of scarves: polyester (poly) and silk. There are two cost pools: setup, with an estimated $120,000 in overhead, and inspection, with $30,000 in overhead. Poly is estimated to have 800,000 setups and 450,000 inspections, while silk has 400,000 setups and 150,000 inspections. How much overhead is applied to each product?

EB10. LO 6.3 Frenchy's has three cost pools and an associated cost driver to allocate the costs to the product. The cost pools, cost driver, estimated overhead, and estimated activity for the cost pool are:

Cost Pool	Cost Driver	Estimated Activity per Driver	Estimated Overhead
Material	Material requisitions	250,000	$105,000
Machining	Machine hours	360,750	432,900
Inspection	Number of inspections	25,000	15,750

What is the predetermined overhead rate for each activity?

EB11. LO 6.3 Carboni recently added a carbon line in addition to its aluminum line. The following are estimates to be used in determining the overhead allocation rate for ABC.

Cost Pool	Cost Driver	Estimated Overhead	Carbon	Aluminum
Material handling	Material requisitions	$45,000	120,000	60,000
Machine setups	Number of setups	55,000	80,000	30,000
Assembly	Number of parts	25,000	35,000	15,000

What would be the predetermined rate for each cost pool?

EB12. LO 6.3 Assign each of the following expenses to either the machine cost pool or the factory cost pool:

A. property taxes
B. heat and air-conditioning
C. electricity, machines
D. plant depreciation
E. electricity, plant
F. machine maintenance wages

EB13. LO 6.4 Stacks manufactures two different levels of hockey sticks: the Standard and the Slap Shot. The total overhead of $600,000 has traditionally been allocated by direct labor hours, with 400,000 hours for the Standard and 200,000 hours for the Slap Shot. After analyzing and assigning costs to two cost pools, it was determined that machine hours is estimated to have $450,000 of overhead, with 30,000 hours used on the Standard product and 15,000 hours used on the Slap Shot product. It was also estimated that the inspection cost pool would have $150,000 of overhead, with 25,000 hours for the Standard and 5,000 hours for the Slap Shot. What is the overhead rate per product, under traditional and under ABC costing?

EB14. LO 6.5 Crafts 4 All has these costs associated with production of 12,000 units of accessory products: direct materials, $19; direct labor, $30; variable manufacturing overhead, $15; total fixed manufacturing overhead, $450,000. What is the cost per unit under both the variable and absorption methods?

EB15. LO 6.5 Using this information from Outdoor Grills, what is the cost per unit under both variable and absorption costing?

Production	90,000
Direct materials	$ 110
Direct labor	150
Variable manufacturing overhead	75
Fixed manufacturing overhead	2,700,000

Problem Set A

PA1. LO 6.1 Colonels uses a traditional cost system and estimates next year's overhead will be $480,000, with the estimated cost driver of 240,000 direct labor hours. It manufactures three products and estimates these costs:

	Small	Medium	Large
Units	32,000	12,000	4,000
Direct Material Cost	$ 5	$ 8	$ 9
Direct Labor Hours per Unit	4	6	10

If the labor rate is $25 per hour, what is the per-unit cost of each product?

PA2. LO 6.1 Five Card Draw manufactures and sells 24,000 units of Diamonds, which retails for $180, and 27,000 units of Clubs, which retails for $190. The direct materials cost is $25 per unit of Diamonds and $30 per unit of Clubs. The labor rate is $25 per hour, and Five Card Draw estimated 180,000 direct labor hours. It takes 3 direct labor hours to manufacture Diamonds and 4 hours for Clubs. The total estimated overhead is $720,000. Five Card Draw uses the traditional allocation method based on direct labor hours.

A. What is the gross profit per unit for Diamonds and Clubs?
B. What is the total gross profit for the year?

PA3. LO 6.2 A local picnic table manufacturer has budgeted these overhead costs:

Purchasing	$70,000
Handling materials	33,333
Machine setups	70,500
Inspections	25,500
Utilities	45,000

They are considering adapting ABC costing and have estimated the cost drivers for each pool as shown:

Cost Driver	Activity
Orders	700
Material moves	1,334
Machine setups	15,000
Number of inspections	5,000
Square feet	180,000

Recent success has yielded an order for 1,000 tables. Assume direct labor costs per hour of $20. Determine how much the job would cost given the following activities:

	Activity
Order (units)	1,000
Direct materials	112,700
Machine hours	15,200
Direct labor hours	5,300
Number of purchase orders	60
Number of material moves	800
Number of machine setups	100
Number of inspections	450
Number of square feet occupied	8,000

PA4. LO 6.2 Explain how each activity in this list can be associated with the corresponding unit or batch level provided.

A. Assembling products: unit level
B. Issuing raw materials: batch level
C. Machine setup: batch level
D. Inspection: unit level
E. Loading the labeling machine: batch level
F. Equipment maintenance: batch level
G. Printing a banner: unit level
H. Moving material: batch level
I. Ordering a part: batch level

PA5. LO 6.3 Medical Tape makes two products: Generic and Label. It estimates it will produce 423,694 units of Generic and 652,200 of Label, and the overhead for each of its cost pools is as follows:

Cost pool	Estimated Overhead
Material receipts	$ 133,000
Machine setups	300,000
Assembly	700,000
Inspection	250,000
Total	$1,383,000

It has also estimated the activities for each cost driver as follows:

Driver	Generic	Label
Inspections	400	600
Requisitions	450	950
Parts	300	400
Setups	250	350

How much is the overhead allocated to each unit of Generic and Label?

PA6. LO 6.3 Box Springs, Inc., makes two sizes of box springs: twin and double. The direct material for the twin is $25 per unit and $40 is used in direct labor, while the direct material for the double is $40 per unit, and the labor cost is $50 per unit. Box Springs estimates it will make 5,000 twins and 9,000 doubles in the next year. It estimates the overhead for each cost pool and cost driver activities as follows:

Activity Cost Pools	Driver	Estimated Overhead	Use per Twin	Use per Double
Framing	Square feet of pine	210,000	5,000	2,000
Padding	Square feet of quilting	220,000	120,000	100,000
Filling	Square feet of filling	320,000	500,000	300,000
Labeling	Number of boxes	240,000	800,000	400,000
Inspection	Number of inspections	170,000	12,000	5,000

How much does each unit cost to manufacture?

PA7. LO 6.3 Please use the information from this problem for these calculations. After grouping cost pools and estimating overhead and activities, Box Springs determined these rates:

Purchasing (per order)	$55
Utilities (per square foot)	3
Machine setups (per machine hour)	8
Supervision (per direct labor hour)	5

It estimates there will be five orders in the next year, and those jobs will involve:

Orders	5
Square feet	200
Machine hours	50
Direct labor hours	35
Direct materials	1,500
Direct labor rate	$ 25

What is the total cost of the jobs?

PA8. LO 6.4 A company has traditionally allocated its overhead based on machine hours but had collected this information to change to activity-based costing:

	Estimated Activity		
Activity Center	**Product 1**	**Product 2**	**Estimated Cost**
Machine setups	15	45	$ 10,800
Assembly parts	3,000	3,000	144,600
Packaging pieces	500	400	55,350
Machine hour per unit	4	3	
Production volume	750	1,500	

A. How much overhead would be allocated to each unit under the traditional allocation method?
B. How much overhead would be allocated to each unit under activity-based costing?

PA9. LO 6.4 Carlton's Kitchens makes two types of pasta makers: Strands and Shapes. The company expects to manufacture 70,000 units of Strands, which has a per-unit direct material cost of $10 and a per-unit direct labor cost of $60. It also expects to manufacture 30,000 units of Shapes, which has a per-unit material cost of $15 and a per-unit direct labor cost of $40. It is estimated that Strands will use 140,000 machine hours and Shapes will require 60,000 machine hours. Historically, the company has used the traditional allocation method and applied overhead at a rate of $21 per machine hour. It was determined that there were three cost pools, and the overhead for each cost pool is shown:

Machine setups	$ 900,000
Machine processing	4,000,000
Material requisitions	100,000
Total overhead	$4,190,000

The cost driver for each cost pool and its expected activity is shown:

	Strands	**Shapes**	**Total**
Machine setups	100	200	300
Machine hours	140,000	60,000	200,000
Parts requisitions	80	120	200

A. What is the per-unit cost for each product under the traditional allocation method?
B. What is the per-unit cost for each product under ABC costing?

PA10. LO 6.4 Carlton's Kitchen's three cost pools and overhead estimates are as follows:

Activity Cost Pool	**Cost Driver**	**Estimated Overhead**	**Use per Product A**	**Use per Product B**
Machine setups	Setups	$128,000	5,000	3,000
Assembly	Number of parts	105,000	25,000	45,000
Machine maintenance	Machine hours	150,000	12,500	37,500

Compare the overhead allocation using:

A. The traditional allocation method
B. The activity-based costing method

(Hint: the traditional method uses machine hours as the allocation base.)

PA11. LO 6.4 Lampierre makes brass and gold frames. The company computed this information to decide whether to switch from the traditional allocation method to ABC:

	Brass	Gold
Units planned	750	125
Material moves	400	100
Machine setups	400	600
Direct labor hours	700	1,200

The estimated overhead for the material cost pool is estimated as $12,500, and the estimate for the machine setup pool is $35,000. Calculate the allocation rate per unit of brass and per unit of gold using:

A. The traditional allocation method
B. The activity-based costing method

PA12. LO 6.4 Portable Seats makes two chairs: folding and wooden. This information was obtained to review the decision to consider ABC:

	Folding Chairs	Wooden Chairs	Total Cost
Material requisitions	500*	200*	$55,000
Inspections	150	50	25,000
Labor hours	2,600	2,400	

*lbs

Compute the overhead assigned to each product under:

A. The traditional allocation method
B. The activity-based costing method

PA13. LO 6.5 Grainger Company produces only one product and sells that product for $100 per unit. Cost information for the product is:

Direct Material	$15 per Unit
Direct Labor	$25 per Unit
Variable Overhead	$5 per Unit
Fixed Overhead	$34,000

Selling expenses are $4 per unit and are all variable. Administrative expenses of $20,000 are all fixed. Grainger produced 5,000 units; sold 4,000; and had no beginning inventory.

A. Compute net income under
    i. absorption costing
    ii. variable costing
B. Reconcile the difference between the income under absorption and variable costing.

PA14. LO 6.5 Summarized data for Walrus Co. for its first year of operations are:

Sales (100,000 units)	$5,000,000
Production costs (120,000 units)	
Direct material	1,800,000
Direct labor	1,500,000
Manufacturing overhead	
Variable	900,000
Fixed	300,000
Selling and administrative expenses	
Variable	260,000
Fixed	440,000

A. Prepare an income statement under absorption costing
B. Prepare an income statement under variable costing

PA15. LO 6.5 Happy Trails has this information for its manufacturing:

Direct Materials	$15
Direct labor	$15
Variable manufacturing overhead	$ 3
Fixed manufacturing overhead	$25
Units produced	27,000
Units sold	19,000

Its income statement under absorption costing is:

Sales	$1,900,500
Beginning Inventory	0
Cost of Goods Manufactured	1,566,000
Cost of Goods Available for Sale	1,566,000
– Ending Inventory	464,000
Cost of Goods Sold	1,102,000
Gross Profit	798,500
– Sales and Administration Expenses	
Variable	133,000
Fixed	300,000
Total Sales and Administration Expenses	433,000
Net Operating Income	$ 365,500

Prepare an income statement with variable costing and a reconciliation statement between both methods.

PA16. LO 6.5 Appliance Apps has the following costs associated with its production and sale of devices that allow appliances to receive commands from cell phones.

Beginning inventory	0
Units produced	25,000
Units sold	20,000
Selling price per unit	$ 145
Variable sales and administration expenses	$ 5
Fixed sales and administration expenses	$975,000
Direct material cost per unit	$ 25
Direct labor cost per unit	$ 11
Variable manufacturing overhead cost per unit	$ 3
Fixed manufacturing overhead cost per month	$980,000

Prepare an income statement under both the absorption and variable costing methods along with a reconciliation between the two statements.

PA17. LO 6.5 This information was collected for the first year of manufacturing for Appliance Apps:

Direct materials per unit	$ 2.50
Direct labor per unit	$ 1.50
Variable manufacturing overhead per unit	$ 0.25
Variable selling and administration expenses	$ 1.75
Units produced	40,000
Units sold	35,000
Sales price	$ 12
Fixed manufacturing expenses	$140,000
Fixed selling and administration expenses	$ 20,000

Prepare an income statement under variable costing, and prepare a reconciliation to the income under the absorption method.

Problem Set B

PB1. LO 6.1 Bobcat uses a traditional cost system and estimates next year's overhead will be $800,000, as driven by the estimated 25,000 direct labor hours. It manufactures three products and estimates the following costs:

	Bobcat	Jaguar	Tiger
Units	250,000	80,000	12,000
Direct Material Cost	$ 13	$ 22	$ 37
Direct Labor Hours per Unit	2	3	5

If the labor rate is $30 per hour, what is the per-unit cost of each product?

PB2. LO 6.1 Five Card Draw manufactures and sells 10,000 units of Aces, which retails for $200, and 8,000 units of Kings, which retails for $170. The direct materials cost is $20 per unit of Aces and $15 per unit of Kings. The labor rate is $30 per hour, and Five Card Draw estimated 64,000 direct labor hours. It takes 4 direct labor hours to manufacture Aces and 3 hours for Kings. The total estimated overhead is $128,000. Five Card Draw uses the traditional allocation method based on direct labor hours.

A. How much is the gross profit per unit for Aces and Kings?
B. What is the total gross profit for the year?

PB3. LO 6.2 A local picnic table manufacturer has budgeted the following overhead costs:

	Estimated Overhead
Purchasing	$80,000
Handling materials	45,000
Machine setups	55,000
Assembly	60,000
Utilities	90,000

They are considering adapting ABC costing and have estimated the cost drivers for each pool as shown:

Cost Driver	Activity
Orders	10,000
Material moves	1,500
Machine setups	5,000
Number of parts	5,000
Square feet	60,000

Recent success has yielded an order for 1,500 tables. Determine how much the job would cost given the following activities, and assuming an hourly rate for direct labor of $25 per hour:

	Activity
Order (units)	1,500
Direct materials	75,900
Machine hours	3,310
Direct labor hours	4,590
Number of purchase orders	70
Number of material moves	750
Number of machine setups	85
Number of parts	290
Number of square feet occupied	3,000

PB4. LO 6.2 Explain how each activity in this list can be associated with the corresponding unit or batch level provided.

A. Assembling products: batch level
B. Issuing raw materials: unit level
C. Machine setup: unit level
D. Inspection: batch level
E. Loading the labeling machine: unit level
F. Equipment maintenance: unit level
G. Printing a banner: batch level
H. Moving material: unit level
I. Ordering a part: unit level

PB5. LO 6.3 Wrappers Tape makes two products: Simple and Removable. It estimates it will produce 369,991 units of Simple and 146,100 of Removable, and the overhead for each of its cost pools is as follows:

Cost Pool	Estimated Overhead
Material receipts	$ 249,975
Machine setups	150,000
Assembly	450,000
Machine maintenance	175,000
	$1,024,975

It has also estimated the activities for each cost driver as follows:

Driver	Simple	Removable
Machine hours	2,000	1,500
Requisitions	300	450
Parts	100	200
Setups	150	50

How much is the overhead allocated to each unit of Simple and Removable?

PB6. LO 6.3 Box Springs, Inc., makes two sizes of box springs: queen and king. The direct material for the queen is $35 per unit and $55 is used in direct labor, while the direct material for the king is $55 per unit, and the labor cost is $70 per unit. Box Springs estimates it will make 4,300 queens and 3,000 kings in the next year. It estimates the overhead for each cost pool and cost driver activities as follows:

Activity Cost Pools	Driver	Estimated Overhead	Use per Queen	Use per King
Framing	Square feet of pine	$150,000	4,500	3,000
Padding	Square feet of quilting	156,000	80,000	40,000
Filling	Square feet of filling	210,000	150,000	60,000
Labeling	Number of boxes	190,000	38,000	38,000
Inspection	Number of inspections	180,000	120,000	60,000

How much does each unit cost to manufacture?

PB7. LO 6.3 Please use the information from this problem for these calculations. After grouping cost pools and estimating overhead and activities, Box Springs determined these rates:

	ABC Rate
Purchasing	$21
Utilities	15
Machine setups	10
Supervision	3

Box Springs estimates there will be four orders in the next year, and those jobs will involve:

Order	4
Square feet	150
Machine hours	60
Direct labor hours	25
Direct materials	900
Direct labor rate	35

What is the total cost of the jobs?

PB8. LO 6.4 A company has traditionally allocated its overhead based on machine hours but collected this information to change to activity-based costing:

	Estimated Activity		
Activity Center	**Product 1**	**Product 2**	**Estimated Cost**
Machine setups	10	15	$50,000
Assembly parts	1,000	1,500	75,000
Packaging units	500	300	80,000
Machine hours per unit	1	1.5	
Production volume	2,000	2,000	

A. How much overhead would be assigned to each unit under the traditional allocation method?
B. How much overhead would be assigned to each unit under activity-based costing?

PB9. LO 6.4 Casey's Kitchens makes two types of food smokers: Gas and Electric. The company expects to manufacture 20,000 units of Gas smokers, which have a per-unit direct material cost of $15 and a per-unit direct labor cost of $25. It also expects to manufacture 50,000 units of Electric smokers, which have a per-unit material cost of $20 and a per-unit direct labor cost of $45. Historically, it has used the traditional allocation method and applied overhead at a rate of $125 per machine hour. It was determined that there were three cost pools, and the overhead for each cost pool is as follows:

Machine setups	$ 5,000
Machine processing	6,000,000
Material requisitions	25,000
Total overhead	$6,030,000

The cost driver for each cost pool and its expected activity is as follows:

	Gas	**Electric**	**Total**
Machine setups	100	150	250
Machine hours	45,000	105,000	150,000
Parts requisitions	360	140	500

A. What is the per-unit cost for each product under the traditional allocation method?
B. What is the per-unit cost for each product under ABC costing?
C. Compared to ABC costing, was each product's overhead under- or overapplied?
D. How much was overhead under- or overapplied for each product?

PB10. LO 6.4 Casey's Kitchens' three cost pools and overhead estimates are as follows:

Activity Cost Pool	**Cost Driver**	**Estimated Overhead**	**Use per Product A**	**Use per Product B**
Machine setups	Setups	$250,000	7,000	3,000
Assembly	Number of parts	300,000	25,000	35,000
Machine maintenance	Machine hours	500,000	10,000	40,000

Compare the overhead allocation using:

A. The traditional allocation method
B. The activity-based costing method

(Hint: the traditional method uses machine hours as the allocation base.)

PB11. LO 6.4 Lampierre makes silver and gold candlesticks. The company computed this information to decide whether to switch from the traditional allocation method to ABC.

	Silver	Gold
Units planned	500	250
Material moves	250	750
Machine setups	5,600	4,400
Direct labor hours	500	1,500

The estimated overhead for the material cost pool is estimated as $45,000, and the estimate for the machine setup pool is $55,000. Calculate the allocation rate per unit of silver and per unit of gold using:

A. The traditional allocation method
B. The activity-based costing method

PB12. LO 6.4 Portable Seats makes two chairs: folding and wooden. This information was obtained to review the decision to consider ABC:

	Folding Chairs	Wooden Chairs	Total Cost
Material requisitions	450*	250*	$105,000
Inspections	250	150	30,000
Labor hours	1,300	1,700	

*lbs

Compute the overhead assigned to each product under:

A. The traditional allocation method
B. The activity-based costing method

PB13. LO 6.5 Submarine Company produces only one product and sells that product for $150 per unit. Cost information for the product is as follows:

Direct material	$40 per unit
Direct labor	$50 per unit
Variable overhead	$10 per unit
Fixed overhead	$ 40,000

Selling expenses are $2 per unit and are all variable. Administrative expenses of $15,000 are all fixed, Submarine produced 2,000 units and sold 1,800. Grainger had no beginning inventory.

A. Compute net income under
    i. absorption costing
    ii. variable costing
B. Reconcile the difference between the income under absorption and variable costing.

PB14. LO 6.5 Summarized data for Backdraft Co. for its first year of operations are as follows:

Sales (90,000 units)	$3,500,000
Production costs (100,000 units)	
Direct material	1,100,000
Direct labor	400,000
Manufacturing overhead	
Variable	200,000
Fixed	100,000
Selling and administrative expenses	
Variable	80,000
Fixed	50,000

A. Prepare an income statement under absorption costing
B. Prepare an income statement under variable costing

PB15. LO 6.5 Trail Outfitters has this information for its manufacturing:

Direct materials	$ 15
Direct labor	$ 15
Variable manufacturing overhead	$ 3
Fixed manufacturing overhead	$ 25
Units produced	30,000
Units sold	38,000

Its income statement under absorption costing is as follows:

Sales	$3,200,000
Beginning inventory	464,000
Cost of goods manufactured	1,740,000
Cost of goods available for sale	2,204,000
– Ending inventory	0
Cost of goods sold	2,204,000
Gross profit	996,000
– Sales and administration expenses	
Variable	266,000
Fixed	300,000
Total sales and administration expenses	566,000
Net operating income	$ 430,000

Prepare an income statement with variable costing and a reconciliation statement between both methods.

PB16. LO 6.5 Wifi Apps has these costs associated with its production and sale of devices that allow visual communications between cell phones:

Beginning inventory	$ 0
Units produced	33,000
Units sold	23,000
Selling price per unit	$ 170
Variable sales and administration expenses	$ 4
Fixed sales and administration expenses	$895,000
Direct material cost per unit	$ 23
Direct labor cost per unit	$ 15
Variable manufacturing overhead	$ 4
Cost per unit	
Fixed manufacturing overhead	$858,000
Cost per month	

Prepare an income statement under both the absorption and variable costing methods along with a reconciliation between the two statements.

PB17. LO 6.5 This information was collected for the first year of manufacturing for Wifi Apps:

Direct materials per unit	$ 1.75
Direct labor per unit	$ 3.50
Variable manufacturing overhead per unit	$ 0.55
Variable selling and administration expenses	$ 1.25
Units produced	50,000
Units sold	40,000
Sales price	$ 13
Fixed manufacturing expenses	$120,000
Fixed selling and administration expenses	$ 35,000

Prepare an income statement under variable costing and prepare a reconciliation to the income under the absorption method.

Thought Provokers

TP1. LO 6.1 What conditions are optimal for using traditional allocation? Is the allocation more effective when there is high-volume production?

TP2. LO 6.2 College Cases sells cases for electronic devices such as phones, computers, and tablets. These cases have college logos or mascots on them and can be customized by adding such things as the customer's name, initials, sport, or fraternity letters. The company buys the cases in various colors and then uses laser technology to do the customization of the letters and to add school names, logos, mascots, and so on. What are potential activity-based costing pools for College Cases, and what would be appropriate cost drivers?

TP3. LO 6.3 How would a service industry apply activity-based costing?

TP4. LO 6.4 Cape Cod Adventures makes foam noodles with sales of 3,000,000 units per year and retractable boat oars with sales of 50,000 pairs per year. What information would Cape Cod Adventures need in order to change from traditional to ABC costing? What are the limitations to activity-based costing?

TP5. LO 6.5 In designing a bonus structure to reward your production managers, one of the options is to reward the managers based on reaching annual income targets. What are the differences between a reward system for a company that uses absorption costing and one for a company that uses variable costing?

7

Budgeting

Figure 7.1 Budget. Chris and Nikki needed to budget effectively in order to take advantage of sightseeing opportunities while studying abroad. (credit: modification of “Tourists: Here or there?” by “morebyless”/Flickr, CC BY 2.0)

Chapter Outline

Why It Matters

Chris and Nikki are studying abroad next semester. Chris wants to spend her weekends sightseeing, but she does not have a lot of extra money. She creates a budget so she can save money to sightsee. She can reliably predict costs such as tuition, books, travel, and much of the sightseeing costs. She can also predict the amount of resources she will have to meet those costs, including scholarships, some savings, and earnings from her job.

Chris developed a budget from this information and planned for emergencies by including extra working hours and listing expenses that could be eliminated. On her trip, Chris was very careful with expenses and visited all the places she budgeted to visit.

Chris’s roommate, Nikki, on the other hand, did not plan ahead before going abroad. She did not have any travel funds for the last several weeks and lamented that she should not have purchased so many souvenirs.

Chris and Nikki are clear illustrations of why people and companies prepare budgets. Preparing a budget for

future anticipated activities requires a company to look critically at its revenue and expenses. A good budget gives management the ability to evaluate results at the end of the budget cycle. Even well-planned budgets can have emergencies or unplanned financial disruptions, but having a budget provides a company with the information to develop an alternative budget. A good budget can be adjusted to work with changes in income and still produce similar results.

In this chapter, you will learn the basic process companies use to create budgets and the general composition of basic budgets that are summed up in a master budget. You will also learn the importance of the flexible budget and be introduced to the idea of how budgets are used to evaluate company and management performance.

7.1 Describe How and Why Managers Use Budgets

Implementation of a company's strategic plan often begins by determining management's basic expectations about future economic, competitive, and technological conditions, and their effects on anticipated goals, both long-term and short-term. Many firms at this stage conduct a situational analysis that involves examining their *strengths* and *weaknesses* and the external *opportunities* available and the *threats* that they might face from competitors. This common analysis is often labeled as SWOT.

After performing the situational analysis, the organization identifies potential strategies that could enable achievement of its goals. Finally, the company will create, initiate, and monitor both long-term and short-term plans.

An important step in the initiation of the company's strategic plan is the creation of a budget. A good budgeting system will help a company reach its strategic goals by allowing management to plan and to control major categories of activity, such as revenue, expenses, and financing options. As detailed in Accounting as a Tool for Managers, planning involves developing future objectives, whereas controlling involves monitoring the planning objectives that have been put into place.

There are many advantages to budgeting, including:

- Communication
  - Budgeting is a formal method to communicate a company's plans to its internal stakeholders, such as executives, department managers, and others who have an interest in—or responsibility for—monitoring the company's performance.
  - Budgeting requires managers to plan for both revenues and expenses.
- Planning
  - Preparing a budget requires managers to consider and evaluate
    - The assumptions used to prepare the budget.
    - Long-term financial goals.
    - Short-term financial goals.
    - The company's position in the market.
    - How each department supports the strategic plan.
  - Preparing a budget requires departments to work together to
    - Determine realizable sales goals.
    - Compute the manufacturing or other requirements necessary to meet the sales goals.
    - Solve bottlenecks that are predicted by the budget.
    - Allocate resources so they can be used effectively to meet the sales and manufacturing goals.
    - Compare forecasted or flexible budgets with actual results.

- Evaluation
  - When compared to actual results, budgets are early alerts and they forecast:
    - Cash flows for various levels of production.
    - When loans may be required or when loans may be reduced.
  - Budgets show which areas, departments, units, and so forth, are profitable or meet their appropriate goals. Similarly, they also show which components are unprofitable or do not reach their anticipated goals.
  - Budgets set defined benchmarks that may be used for evaluating company and management performance, including raises and bonuses, as well as negative consequences, such as firing.

To understand the benefits of budgeting, consider Big Bad Bikes, a company that manufactures high-end mountain bikes. The company will begin producing and selling trainers this year. Trainers are stands that allow a rider to ride their bike indoors similar to the way bikes are used in spinning classes. Big Bad Bikes has a 5-year plan and has always been successful in managing its budget. Managers participate in developing the budget and are aware that all expenses must be related to the company's strategic plan. They know that managing their departments is much easier when the budget is developed to support the strategic plan.

The plan for Big Bad Bikes is to introduce itself to the trainer market with a sales price of $70 for the first two quarters of the year and then raise the price to $75 per unit. The marketing department estimates that sales will be 1,000 units for the first two quarters, 1,500 for the third quarter, and 2,500 per quarter through the second year. Management will work with each department to communicate goals and build a budget based on the sales plan. The resulting budget can be evaluated by all departments involved.

ETHICAL CONSIDERATIONS

Break-Even Analysis and Profitability

In the long run, proper budget reporting assists management in making good decisions. Management uses budgets to evaluate the performance of employees and their department. They can also use budgets to evaluate and benchmark the performance of a business unit in a large business organization or of the entire performance of a small company. They can also use budgets to evaluate separate projects. In budgeting situations, employees may feel a tension between reporting actual results and reporting results that reach the predetermined goals created by the budget. This creates a situation where managers may choose to act unethically and pressure accountants to report favorable financial results not supported by the operations.

Accountants need to be aware of this circumstance and use ethical standards when assisting the development and creation of budgets. After a proper budget has been created, the reporting of the actual results will assist in creating a realistic and honest picture of the actual operations for the managers reviewing the budget. The budget accountant needs to take steps to ensure that employees are not trying to misreport the budget results; for example, managers might be tempted to set artificially low standards to ensure that targets are hit and significantly exceeded. Such results could lead to what might be considered as excessive bonuses paid to managers.

The Basics of Budgeting

All companies—large and small—have limits on the amount of money or resources they can receive and pay out. How these resources are used to reach their goals and objectives must be planned. The quantitative plan estimating when and how much cash or other resources will be received and when and how the cash or other resources will be used is the **budget**. As you've learned, some of the benefits of budgeting include improved communication, planning, coordination, and evaluation.

All budgets are quantitative plans for the future and will be constructed based on the needs of the organization for which the budget is being created. Depending on the complexity, some budgets can take months or even years to develop. The most common time period covered by a budget is one year, although the time period may vary from strategic, long-term budgets to very detailed, short-term budgets. Generally, the closer the company is to the start of the budget's time period, the more detailed the budget becomes.

Management begins with a vision of the future. The long-term vision sets the direction of the company. The vision develops into goals and strategies that are built into the budget and are directly or indirectly reflected on the master budget.

The master budget has two major categories: the financial budget and the operating budget. The financial budget plans the use of assets and liabilities and results in a projected balance sheet. The operating budget helps plan future revenue and expenses and results in a projected income statement. The operating budget has several subsidiary budgets that all begin with projected sales. For example, management estimates sales for the upcoming few years. It then breaks down estimated sales into quarters, months, and weeks and prepares the sales budget. The sales budget is the foundation for other operating budgets. Management uses the number of units from the sales budget and the company's inventory policy to determine how many units need to be produced. This information in units and in dollars becomes the production budget.

The production budget is then broken up into budgets for materials, labor, and overhead, which use the standard quantity and standard price for raw materials that need to be purchased, the standard direct labor rate and the standard direct labor hours that need to be scheduled, and the standard costs for all other direct and indirect operating expenses. Companies use the historic quantities of the amount of material per unit and the hours of direct labor per unit to compute a standard used to estimate the quantity of materials and labor hours needed for the expected level of production. Current costs are used to develop standard costs for the price of materials, the direct labor rate, as well as an estimate of overhead costs.

The budget development process results in various budgets for various purposes, such as revenue, expenses, or units produced, but they all begin with a plan. To save time and eliminate unnecessary repetition, management often starts with the current year's budget and adjusts it to meet future needs.

There are various strategies companies use in adjusting the budget amounts and planning for the future. For example, budgets can be derived from a top-down approach or from a bottom-up approach. Figure 7.2 shows the general difference between the top-down approach and the bottom-up approach. The top-down approach typically begins with senior management. The goals, assumptions, and predicted revenue and expenses information are passed from the senior manager to middle managers, who further pass the information downward. Each department must then determine how it can allocate its expenses efficiently while still meeting the company goals. The benefit of this approach is that it ties in to the strategic plan and company goals. Another benefit of passing the amount of allowed expenses downward is that the final anticipated costs are reduced by the *vetting* (fact checking and information gathering) process.

In the top-down approach, management must devote attention to efficiently allocating resources to ensure that expenses are not padded to create budgetary slack. The drawback to this approach to budgeting is that

the budget is prepared by individuals who are not familiar with specific operations and expenses to understand each department's nuances.

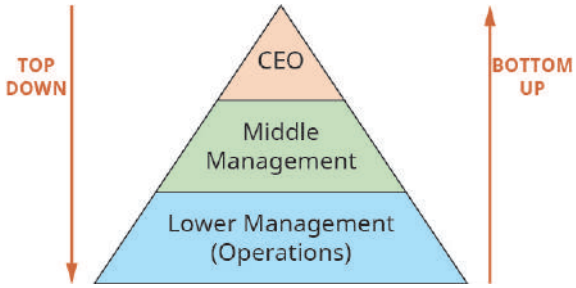


Figure 7.2 Top-Down versus Bottom-Up Approach to Budgeting. The top-down approach to budgeting starts with upper level management, while the bottom-up approach starts with input from lower-level management. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

The bottom-up approach (sometimes also named a self-imposed or participative budget) begins at the lowest level of the company. After senior management has communicated the expected departmental goals, the departments then plans and predicts their sales and estimates the amount of resources needed to reach these goals. This information is communicated to the supervisor, who then passes it on to upper levels of management. The advantages of this approach are that managers feel their work is valued and that knowledgeable individuals develop the budget with realistic numbers. Therefore, the budget is more likely to be attainable. The drawback is that managers may not fully understand or may misunderstand the strategic plan.

Other approaches in addition to the top-down and bottom-up approaches are a combination approach and the zero-based budgeting approach. In the combination approach, guidelines and targets are set at the top while the managers work to develop a budget within the targeted parameters.

Zero-based budgeting begins with zero dollars and then adds to the budget only revenues and expenses that can be supported or justified. Figure 7.3 illustrates the difference between traditional budget preparation and zero-based budgeting in a bottom-up budgeting scenario. The advantage to zero-based budgeting is that unnecessary expenses are eliminated because managers cannot justify them. The drawback is that every expense needs to be justified, including obvious ones, so it takes a lot of time to complete. A compromise tactic is to use a zero-based budgeting approach for certain expenses, like travel, that can be easily justified and linked to the company goals.

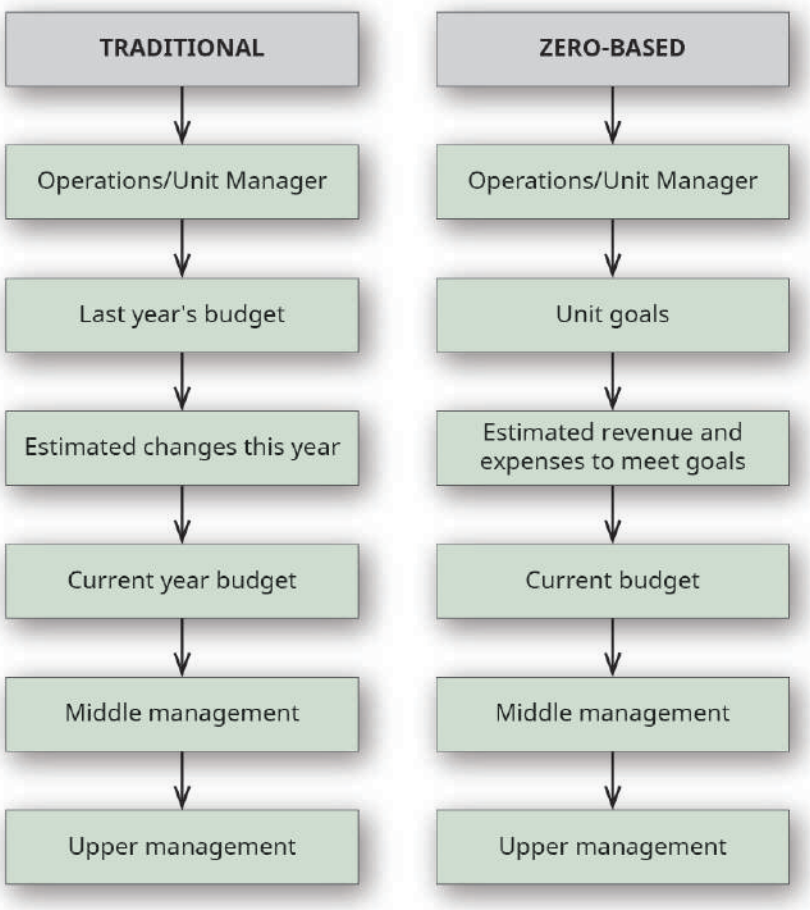


Figure 7.3 Comparison of Traditional Budgeting Process and Zero-Based Budgeting Process. In a bottom-up budgeting environment, the budget process begins with lower level or operational management. Under a traditional budgeting, last year's budget would be the starting point for creating the current budget. Under a zero-based budgeting approach, all budget numbers are derived newly each year or budget cycle. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Often budgets are developed so they can adjust for changes in the volume or activity and help management make decisions. Changes and challenges can affect the budget and have an impact on a company's plans. A flexible budget adjusts the cost of goods produced for varying levels of production and is more useful than a static budget, which remains at one amount regardless of the production level. A flexible budget is created at the end of the accounting period, whereas the static budget is created before the fiscal year begins.

Additionally Figure 7.4 shows a comparison of a static budget and a flexible budget for Bingo's Bags, a company that produces purses and backpacks. In the flexible budget, the budgeted costs are calculated with actual sales, whereas in the static budget, budgeted costs are calculated with budgeted sales. The flexible budget allows management to see what they would expect the budget to look like based on the actual sales and budgeted costs. Flexible budgets are addressed in greater detail in Prepare Flexible Budgets.

	Flexible budget			Static budget			Sales Volume Variance
	Budgeted Cost (A)	Actual Sales Volume (B)	Flexible Budget (A × B)	Budgeted Cost (C)	Budgeted Sales Volume (D)	Static Budget (C × D)	Flexible Budget – Static Budget (A × B) – (C × D)
Direct Materials							
Backpacks	$5.720	71,600	$409,552	$5.720	72,000	$411,840	$ (2,288) F
Purses	7.460	37,000	276,020	7.460	35,000	261,100	14,920 U
Total direct materials cost			**$685,572**			**$672,940**	**$12,632 U**
Direct labor							
Backpacks	$3.450	71,600	$247,020	$3.450	72,000	$248,400	$ (1,380) F
Purses	2.220	37,000	82,140	2.220	35,000	77,700	4,440 U
Total direct labor cost			**$329,160**			**$326,100**	**$ 3,060 U**
Variable Overhead (60% x Direct labor cost)							
Backpacks	$2.130	71,600	$152,508	$2.130	72,000	$153,360	$ (852) F
Purses	1.820	37,000	67,340	1.820	35,000	63,700	3,640 U
Total variable overhead cost			**$219,848**			**$217,060**	**$ 2,788 U**

Figure 7.4 Comparison of a Flexible Budget and a Static Budget. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

In order to handle changes that occur in the future, companies can also use a **rolling budget**, which is one that is continuously updated. While the company's goals may be multi-year, the rolling budget is adjusted monthly, and a new month is added as each month passes. Rolling budgets allow management to respond to changes in estimates or actual occurrences, but it also takes management away from other duties as it requires continual updating. Figure 7.5 shows an example of how a rolling quarterly budget would work. Notice that as one month rolls off (is completed) another month is added to the budget so that four quarters of a year are always presented.

	A	B	C	D	E	F	G	H	I
1	QUARTERLY ROLLING BUDGET								
2		Year 1				Year 2			
3		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
4	INITIAL ANNUAL BUDGET								
5	ROLLING BUDGET Year 1/Q2								
6	ROLLING BUDGET Year 1/Q3								
7	ROLLING BUDGET Year 1/Q4								
8	ROLLING BUDGET Year 2/Q1								

Figure 7.5 Rolling Budget. In a quarterly operating budget, the budget always projects forward for four months, or one quarter. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Because budgets are used to evaluate a manager's performance as well as the company's, managers are responsible for specific expenses within their own budget. Each manager's performance is evaluated by how well he or she manages the revenues and expenses under his or her control. Each individual who exercises control over spending should have a budget specifying limits on that spending.

The Role of the Master Budget

Most organizations will create a master budget—whether that organization is large or small, public or private, or a merchandising, manufacturing, or service company. A **master budget** is one that includes two areas, operational and financial, each of which has its own sub-budgets. The **operating budget** spans several areas that help plan and manage day-to-day business. The **financial budget** depicts the expectations for cash inflows and outflows, including cash payments for planned operations, the purchase or sale of assets, the payment or financing of loans, and changes in equity. Each of the sub-budgets is made up of separate but interrelated budgets, and the number and type of separate budgets will differ depending on the type and size of the organization. For example, the sales budget predicts the sales expected for each quarter. The direct materials budget uses information from the sales budget to compute the number of units necessary for production. This information is used in other budgets, such as the direct materials budget, which plans when materials will be purchased, how much will be purchased, and how much that material should cost. You will review some specific examples of budgeting for direct materials in Prepare Operating Budgets.

Figure 7.6 shows how operating budgets and financial budgets are related within a master budget.

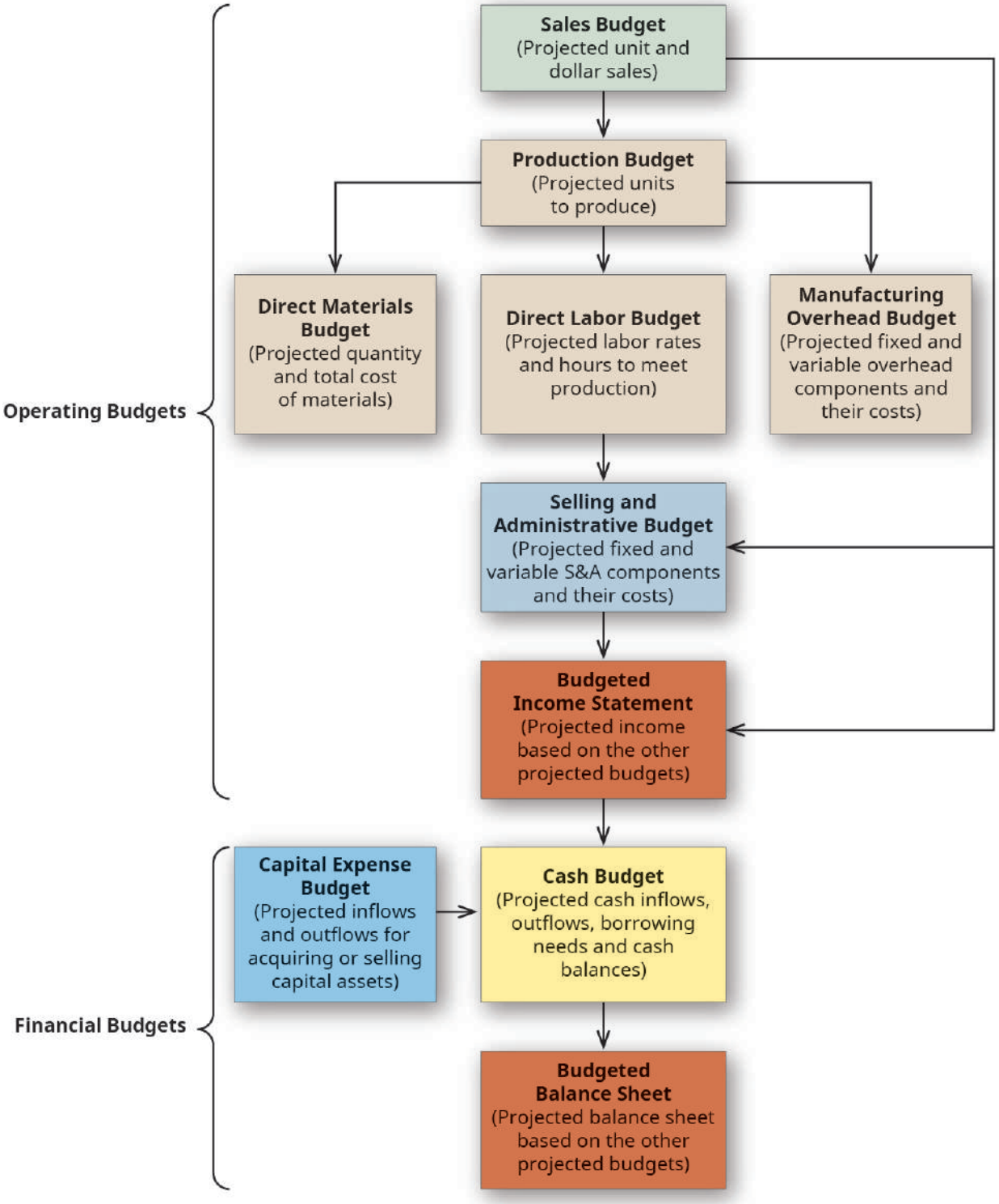


Figure 7.6 Operating Budgets, Financial Budgets, and the Relationship between Budgets. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

The Role of Operating Budgets

An operating budget consists of the sales budget, production budget, direct material budget, direct labor budget, and overhead budget. These budgets serve to assist in planning and monitoring the day-to-day activities of the organization by informing management of how many units need to be produced, how much material needs to be ordered, how many labor hours need to be scheduled, and the amount of overhead expected to be incurred. The individual pieces of the operating budget collectively lead to the creation of the budgeted income statement. For example, Big Bad Bikes estimates it will sell 1,000 trainers for $70 each in the first quarter and prepares a sales budget to show the sales by quarter. Management understands that it needs to have on hand the 1,000 trainers that it estimates will be sold. It also understands that additional inventory needs to be on hand in the event there are additional sales and to prepare for sales in the second quarter. This information is used to develop a production budget. Each trainer requires 3.2 pounds of material that usually costs $1.25 per pound. Knowing how many units are to be produced and how much inventory needs to be on hand is used to develop a direct materials budget.

The direct materials budget lets managers know when and how much raw materials need to be ordered. The same is true for direct labor, as management knows how many units will be manufactured and how many hours of direct labor are needed. The necessary hours of direct labor and the estimated labor rate are used to develop the direct labor budget. While the materials and labor are determined from the production budget, only the variable overhead can be determined from the production budget. Existing information regarding fixed manufacturing costs are combined with variable manufacturing costs to determine the manufacturing overhead budget. The information from the sales budget is used to determine the sales and administrative budget. Finally, the sales, direct materials, direct labor, fixed manufacturing overhead budget, and sales and administrative budgets are used to develop a pro-forma income statement.

The Role of Financial Budgets

A financial budget consists of the cash budget, the budgeted balance sheet, and the budget for capital expenses. Similar to the individual budgets that make up the operating budgets, the financial budgets serve to assist with planning and monitoring the financing requirements of the organization. Management plans its capital asset needs and states them in the capital expense budget. Management addresses its collection and payment policies to determine when it will receive cash from sales and when it will pay the material, labor, and overhead expenses. The capital expense budget and the estimated payment and collection of cash allow management to build a cash budget and determine when it will need financing or have additional funds to pay back loans. These budgets taken together will be part of the budgeted balance sheet. Figure 7.6 shows how these budgets relate.

YOUR TURN

Maintaining a Cash Balance

DaQuan recently began work as a senior accountant at Mad Coffee Company. He learned he would be responsible for monitoring the cash balance because there is a bank loan requirement that a minimum balance of $10,000 be maintained with the bank at all times. DaQuan asked to see the cash budget so he could anticipate when the balance was most likely to go below $10,000. How can DaQuan determine

potential cash balance issues by looking at the budget?

Solution

Budgeting helps plan for those times when cash is in short supply and bills need to be paid. Proper budgeting shows when and for how long a cash shortage may exist. DaQuan can see the months when the cash payments exceed the cash receipts and when the company is in danger of having a cash balance below the minimum requirement of $10,000. Knowing the inflow and outflow of cash will help him plan and manage the shortage through a line of credit, delay in purchasing, delay in hiring, or delay in payment of non-essential items.

LINK TO LEARNING

Budgeting is a task that should be completed by all organizations, not only those limited to manufacturing. Unfortunately, there are many individuals who want to operate a business and know nothing about budgeting. Often, professional organizations or industry trade groups offer information to help their members succeed in business. For example, the real estate profession provides information and suggestions such as this article on preparing a marketing budget (https://openstax.org/l/50RealtorMag) to help professionals.

7.2 Prepare Operating Budgets

Operating budgets are a primary component of the master budget and involve examining the expectations for the primary operations of the business. Assumptions such as sales in units, sales price, manufacturing costs per unit, and direct material needed per unit involve a significant amount of time and input from various parts of the organization. It is important to obtain all of the information, however, because the more accurate the information, the more accurate the resulting budget, and the more likely management is to effectively monitor and achieve its budget goals.

Individual Operating Budgets

In order for an organization to align the budget with the strategic plan, it must budget for the day-to-day operations of the business. This means the company must understand when and how many sales will occur, as well as what expenses are required to generate those sales. In short, each component—sales, production, and other expenses—must be properly budgeted to generate the operating budget components and the resulting pro-forma budgeted income statement.

The budgeting process begins with the estimate of sales. When management has a solid estimate of sales for each quarter, month, week, or other relevant time period, they can determine how many units must be produced. From there, they determine the expenditures, such as direct materials necessary to produce the units. It is critical for the sales estimate to be accurate so that management knows how many units to produce. If the estimate is understated, the company will not have enough inventory to satisfy customers, and they will

not have ordered enough material or scheduled enough direct labor to manufacture more units. Customers may then shop somewhere else to meet their needs. Likewise, if sales are overestimated, management will have purchased more material than necessary and have a larger labor force than needed. This overestimate will cause management to have spent more cash than was necessary.

Sales Budget

The **sales budget** details the expected sales in units and the sales price for the budget period. The information from the sales budget is carried to several places in the master budget. It is used to determine how many units must be produced as well as when and how much cash will be collected from those sales.

For example, Big Bad Bikes used information from competitor sales, its marketing department, and industry trends to estimate the number of units that will be sold in each quarter of the coming year. The number of units is multiplied by the sales price to determine the sales by quarter as shown in Figure 7.7.

BIG BAD BIKES
Sales Budget
For the Year Ended December 31, 2019

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Expected Sales (Units)	1,000	1,000	1,500	2,500	6,000
Sales Price per Unit	$ 70	$ 70	$ 75	$ 75	
Total Sales Revenue	$70,000	$70,000	$112,500	$187,500	$440,000

Figure 7.7 Sales Budget for Big Bad Bikes. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

The sales budget leads into the production budget to determine how many units must be produced each week, month, quarter, or year. It also leads into the cash receipts budget, which will be discussed in Prepare Financial Budgets.

Production Budget

Estimating sales leads to identifying the desired quantity of inventory to meet the demand. Management wants to have enough inventory to meet production, but they do not want too much in the ending inventory to avoid paying for unnecessary storage. Management often uses a formula to estimate how much should remain in ending inventory. Management wants to be flexible with its budgeting, wants to create budgets that can grow or shrink as needed, and needs to have inventory on hand. So the amount of ending inventory often is a percentage of the next week's, month's, or quarter's sales.

In creating the production budget, a major issue is how much inventory should be on hand. Having inventory on hand helps the company avoid losing a customer because the product isn't available. However, there are storage costs associated with holding inventory as well as having a lag time between paying to manufacture a product and receiving cash from selling that product. Management must balance the two issues and determine the amount of inventory that should be available.

When determining the number of units needed to be produced, start with the estimated sales plus the desired ending inventory to derive the maximum number of units that must be available during the period. Since the number of units in beginning inventory are already produced, subtracting the beginning inventory from the

goods available results in the number of units that need to be produced.

After management has estimated how many units will sell and how many units need to be in ending inventory, it develops the **production budget** to compute the number of units that need to be produced during each quarter. The formula is the reverse of the formula for the cost of goods sold.

Cost of Goods Sold	Number of Units Produced
Beginning Inventory	Goods Sold
+ Purchases (or produced)	+ Ending Inventory
Goods available for sale	Goods available for sale
– Ending Inventory	– Beginning Inventory

The number of units expected to be sold plus the desired ending inventory equals the number of units that are available. When the beginning inventory is subtracted from the number of units available, management knows how many units must be produced during that quarter to meet sales.

In a merchandising firm, retailers do not produce their inventory but purchase it. Therefore, stores such as Walmart do not have raw materials and instead substitute the number of units to be purchased in place of the number of units to be produced; the result is the merchandise inventory to be purchased.

To illustrate the steps in developing a production budget, recall that Big Bad Bikes is introducing a new product that the marketing department thinks will have strong sales. For new products, Big Bad Bikes requires a target ending inventory of 30% of the next quarter's sales. Unfortunately, they were unable to manufacture any units before the end of the current year, so the first quarter's beginning inventory is 0 units. As shown in Figure 7.7, sales in quarter 2 are estimated at 1,000 units; since 30% is required to be in ending inventory, the ending inventory for quarter 1 needs to be 300 units. With expected sales of 1,000 units for quarter 2 and a required ending inventory of 30%, or 300 units, Big Bad Bikes needs to have 1,300 units available during the quarter. Since 1,300 units needed to be available and there are zero units in beginning inventory, Big Bad Bikes needs to manufacture 1,300 units, as shown in Figure 7.8

BIG BAD BIKES
Production Budget
For the Year Ended December 31, 2019

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Expected Sales	1,000	1,000	1,500	2,500
Desired Ending Inventory	300	450	750	1,050
Total Required Units	1,300	1,450	2,250	3,550
– Beginning Inventory	0	300	450	750
Required Production	1,300	1,150	1,800	2,800

Figure 7.8 Production Budget for Big Bad Bikes. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

The ending inventory from one quarter is the beginning inventory for the next quarter and the calculations are all the same. In order to determine the ending inventory in quarter 4, Big Bad Bikes must estimate the sales for the first quarter of the next year. Big Bad Bikes's marketing department believes sales will increase in each of the next several quarters, and they estimate sales as 3,500 for the first quarter of the next year and 4,500 for

the second quarter of the next year. Thirty percent of 3,500 is 1,050, so the number of units required in the ending inventory for quarter 4 is 1,050.

The number of units needed in production for the first quarter of the next year provides information needed for other budgets such as the direct materials budget, so Big Bad Bikes must also determine the number of units needed in production for that first quarter. The estimated sales of 3,500 and the desired ending inventory of 1,350 (30% of the next quarter's estimated sales of 4,500) determines that 4,850 units are required during the quarter. The beginning inventory is estimated to be 1,050, which means the number of units that need to be produced during the first quarter of year 2 is 3,800.

The number of units needed to be produced each quarter was computed from the estimated sales and is used to determine the quantity of direct or raw material to purchase, to schedule enough direct labor to manufacture the units, and to approximate the overhead required for production. It is also necessary to estimate the sales for the first quarter of the next year. The ending inventory for the current year is based on the sales estimates for the first quarter of the following year. From this amount, the production budget and direct materials budget are calculated and flow to the operating and cash budget.

Direct Materials Budget

From the production budget, management knows how many units need to be produced in each budget period. Management is already aware of how much material it needs to produce each unit and can combine the direct material per unit with the production budget to compute the **direct materials budget**. This information is used to ensure the correct quantity of materials is ordered and the correct amount is budgeted for those materials.

Similar to the production budget, management wants to have an ending inventory available to ensure there are enough materials on hand. The direct materials budget illustrates how much material needs to be ordered and how much that material costs. The calculation is similar to that used in the production budget, with the addition of the cost per unit.

If Big Bad Bikes uses 3.2 pounds of material for each trainer it manufactures and each pound of material costs $1.25, we can create a direct materials budget. Management's goal is to have 20% of the next quarter's material needs on hand as the desired ending materials inventory. Therefore, the determination of each quarter's material needs is partially dependent on the following quarter's production requirements. The desired ending inventory of material is readily determined for quarters 1 through 3 as those needs are based on the production requirements for quarters 2 through 4. To compute the desired ending materials inventory for quarter 4, we need the production requirements for quarter 1 of year 2. Recall that the number of units to be produced during the first quarter of year 2 is 3,800. Thus, quarter 4 materials ending inventory requirement is 20% of 3,800. That information is used to compute the direct materials budget shown in Figure 7.9.

BIG BAD BIKES Direct Materials Budget For the Year Ended December 31, 2019					
	Quarter 1	**Quarter 2**	**Quarter 3**	**Quarter 4**	**Total**
Units to be Produced	1,300	1,150	1,800	2,800	7,050
Direct Material per Unit	3.20	3.20	3.20	3.20	3.20
Total Pounds Needed for Production	4,160	3,680	5,760	8,960	22,560
+ Desired Ending Inventory	736	1,152	1,792	2,432	2,432
Total Material Required	4,896	4832	7,552	11,392	24,992
– Beginning Inventory	0	736	1,152	1,792	0
Pounds of Direct Material Required	4,896	4,096	6,400	9,600	24,992
Cost per Pound	$ 1.25	$ 1.25	$ 1.25	$ 1.25	$ 1.25
Total Cost of Direct Material Purchase	$6,120	$5,120	$8,000	$12,000	$31,240

Figure 7.9 Direct Materials Budget for Big Bad Bikes. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Management knows how much the materials will cost and integrates this information into the schedule of expected cash disbursements, which will be shown in Prepare Financial Budgets. This information will also be used in the budgeted income statement and on the budgeted balance sheet. With 6,000 units estimated for sale, 3.2 pounds of material per unit, and $1.25 per pound, the direct materials used represent $24,000 of the cost of goods sold. The remaining $7,240 is included in ending inventory as units completed and raw material.

Direct Labor Budget

Management uses the same information in the production budget to develop the **direct labor budget**. This information is used to ensure that the proper amount of staff is available for production and that there is money available to pay for the labor, including potential overtime. Typically, the number of hours is computed and then multiplied by an hourly rate, so the total direct labor cost is known.

If Big Bad Bikes knows that they need 45 minutes or 0.75 hours of direct labor for each unit produced, and the labor rate for this type of manufacturing is $20 per hour, the computation for direct labor simply begins with the number of units in the production budget. As shown in Figure 7.10, the number of units produced each quarter multiplied by the number of hours per unit equals the required direct labor hours needed to be scheduled in order to meet production needs. The total number of hours is next multiplied by the direct labor rate per hour, and the labor cost can be budgeted and used in the cash disbursement budget and operating budget illustrated in Prepare Financial Budgets.

BIG BAD BIKES Direct Labor Budget For the Year Ended December 31, 2019					
	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Units to be Produced	1,300	1,150	1,800	2,800	7,050
Direct Labor Hours per Unit	00.75	00.75	00.75	00.75	00.75
Total Required Direct Labor Hours	975	862.50	1,350	2,100	5,287.50
Labor Cost per Hour	$ 20	$ 20	$ 20	$ 20	$ 20
Total Direct Labor Cost	$19,500	$17,250	$27,000	$42,000	$ 105,750

Figure 7.10 Direct Labor Budget for Big Bad Bikes. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

The direct labor of $105,750 will be apportioned to the budgeted income statement and budgeted balance sheet. With 0.75 hours of direct labor per unit and $20 per direct labor hour, each unit will cost $15 in direct labor. Of the 7,050 units produced, 6,000 units will be sold, so $90,000 represents the labor portion of the cost of goods sold and will be shown on the income statement, while the remaining $15,750 will be the labor portion of ending inventory and will be shown on the balance sheet.

Manufacturing Overhead Budget

The **manufacturing overhead budget** includes the remainder of the production costs not covered by the direct materials and direct labor budgets. In the manufacturing overhead budgeting process, producers will typically allocate overhead costs depending upon their cost behavior production characteristics, which are generally classified as either variable or fixed. Based on this allocation process, the variable component will be treated as occurring proportionately in relation to budgeted activity, while the fixed component will be treated as remaining constant. This process is similar to the overhead allocation process you learned in studying product, process, or activity-based costing.

For Big Bad Bikes to create their manufacturing overhead budget, they first determine that the appropriate driver for assigning overhead costs to products is direct labor hours. The overhead allocation rates for the variable overhead costs are: indirect material of $1.00 per hour, indirect labor of $1.25 per hour, maintenance of $0.25 per hour, and utilities of $0.50 per hour. The fixed overhead costs per quarter are: supervisor salaries of $15,000, fixed maintenance salaries of $4,000, insurance of $7,000, and depreciation expenses of $3,000.

Given the direct labor hours for each quarter from the direct labor budget, the variable costs are the number of hours multiplied by the variable overhead application rate. The fixed costs are the same for each quarter, as shown in the manufacturing overhead budget in Figure 7.11.

BIG BAD BIKES
Manufacturing Overhead Budget
For the Year Ended December 31, 2019

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Variable Costs					
Indirect Material	$ 975	$ 863	$ 1,350	$ 2,100	$ 5,288
Indirect Labor	1,219	1,078	1,688	2,625	6,609
Maintenance	244	216	338	525	1,322
Utilities	488	431	675	1,050	2,644
Total Variable Manufacturing Costs	$ 2,926	$ 2,588	$ 4,051	$ 6,300	$ 15,863
Fixed Costs					
Supervisory Salaries	$15,000	$15,000	$15,000	$15,000	$ 60,000
Maintenance Salaries	4,000	4,000	4,000	4,000	16,000
Insurance	7,000	7,000	7,000	7,000	28,000
Depreciation	3,000	3,000	3,000	3,000	12,000
Total Fixed Manufacturing Costs	$29,000	$29,000	$29,000	$29,000	$116,000
Total Manufacturing Overhead	$31,925	$31,588	$33,050	$35,300	$131,863

Figure 7.11 Manufacturing Overhead Budget for Big Bad Bikes. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

The total manufacturing overhead cost was $131,863 for 7,050 units, or $18.70 per unit (rounded). Since 6,000 units are sold, $112,200 (6,000 units × $18.70 /unit) will be expensed as cost of goods sold, while the remaining $19,663 will be part of finished goods ending inventory.

Sales and Administrative Expenses Budget

The direct materials budget, the direct labor budget, and the manufacturing overhead budget plan for all costs related to production, while the **selling and administrative expense budget** contains a listing of variable and fixed expenses estimated to be incurred in all areas other than production costs. While this one budget contains all nonmanufacturing expenses, in practice, it actually comprises several small budgets created by managers in sales and administrative positions. All managers must follow the budget, but setting an appropriate budget for selling and administrative functions is complicated and is not always thoroughly understood by managers without a background in managerial accounting.

If Big Bad Bikes pays a sales commission of $2 per unit sold and a transportation cost of $0.50 per unit, they can use these costs to put together their sales and administrative budget. All other costs are fixed costs per quarter: sales salaries of $5,000; administrative salaries of $5,000; marketing expenses of $5,000; insurance of $1,000; and depreciation of $2,000. The sales and administrative budget is shown in Figure 7.12, along with the budgeted sales used in the computation of variable sales and administrative expenses.

BIG BAD BIKES
Sales and Administrative Expense Budget
For the Year Ended December 31, 2019

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Budgeted Sales in Units	1,000	1,000	1,500	2,500	6,000
Variable Expenses					
Sales Commissions	2,000	2,000	3,000	5,000	12,000
Transportation	500	500	750	1,250	3,000
Total Variable Expenses	$ 2,500	$ 2,500	$ 3,750	$ 6,250	$15,000
Fixed Expenses					
Sales Salaries	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$20,000
Administrative Salaries	5,000	5,000	5,000	5,000	20,000
Marketing Expenses	5,000	5,000	5,000	5,000	20,000
Insurance Expenses	1,000	1,000	1,000	1,000	4,000
Depreciation Expenses	2,000	2,000	2,000	2,000	8,000
Total Fixed Expenses	$18,000	$18,000	$18,000	$18,000	$72,000
Total Selling and Administrative expenses	$20,500	$20,500	$21,750	$24,250	$87,000

Figure 7.12 Sales and Administrative Expense Budget for Big Bad Bikes. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Only manufacturing costs are treated as a product cost and included in ending inventory, so all of the expenses in the sales and administrative budget are period expenses and included in the budgeted income statement.

Budgeted Income Statement

A **budgeted income statement** is formatted similarly to a traditional income statement except that it contains budgeted data. Once all of the operating budgets have been created, these costs are used to prepare a budgeted income statement and budgeted balance sheet. The manufacturing costs are allocated to the cost of goods sold and the ending inventory.

Big Bad Bikes uses the information on direct materials (Figure 7.9), direct labor (Figure 7.10), and manufacturing overhead (Figure 7.11) to allocate the manufacturing costs between the cost of goods sold and the ending work in process inventory, as shown in (Figure 7.13).

	Cost of Goods Sold	Ending Inventory	Total
Direct Materials	$ 24,000*	$ 7,240	$ 31,240
Direct Labor	90,000**	15,750	105,750
Manufacturing Overhead	112,200	19,639	131,863
Total	$226,224	$42,629	$268,853

*6,000 units × 3.2 lbs/unit × $1.25/lb
**6,000 units × 0.75 hr/unit × $20/hr

Figure 7.13 Allocating Costs to Cost of Goods Sold and Ending Work in Process Inventory for Big Bad Bikes. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Once they perform this allocation, the budgeted income statement can be prepared. Big Bad Bikes estimates an interest of $954. It also estimates that $22,000 of its income will not be collected and will be reported as uncollectible expense. The budgeted income statement is shown in Figure 7.14.

BIG BAD BIKES
Budgeted Income Statement
For the Year Ended December 31, 2019

Sales	$440,000
Cost of Goods Sold	226,200
Gross Profit	213,800
Sales and Administrative Expenses	87,000
Uncollectible Expense	22,000
Income before Interest	104,800
Interest Expense	954
Income Tax	4,000
Net Income	$ 99,846

Figure 7.14 Budgeted Income Statement for Big Bad Bikes. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

THINK IT THROUGH

Errors in a Budgeted Balance Sheet

Which error has the potential to cause more problems with the budgeted balance sheet: overstating sales or understating the cash collected?

7.3 Prepare Financial Budgets

Now that you have developed an understanding of operating budgets, let's turn to the other primary component of the master budget: financial budgets. Preparing financial budgets involves examining the expectations for financing the operations of the business and planning for the cash needs of the organization. The budget helps estimate the source, amount, and timing of cash collection and cash payments as well as determine if and when additional financing is needed or debt can be paid.

Individual Financial Budgets

Preparing a financial budget first requires preparing the capital asset budget, the cash budgets, and the budgeted balance sheet. The capital asset budget represents a significant investment in cash, and the amount is carried to the cash budget. Therefore, it needs to be prepared before the cash budget. If the cash will not be available, the capital asset budget can be adjusted and, again, carried to the cash budget.

When the budgets are complete, the beginning and ending balance from the cash budget, changes in

financing, and changes in equity are shown on the budgeted balance sheet.

Capital Asset Budget

The **capital asset budget**, also called the capital expenditure budget, shows the company's plans to invest in long-term assets. Some assets, such as computers, must be replaced every few years, while other assets, such as manufacturing equipment, are purchased very infrequently. Some assets can be purchased with cash, whereas others may require a loan. Budgeting for these types of expenditures requires long-range planning because the purchases affect cash flows in current and future periods and affect the income statement due to depreciation and interest expenses.

Cash Budget

The **cash budget** is the combined budget of all inflows and outflows of cash. It should be divided into the shortest time period possible, so management can be quickly made aware of potential problems resulting from fluctuations in cash flow. One goal of this budget is to anticipate the timing of cash inflows and outflows, which allows a company to try to avoid a decrease in the cash balance due to paying out more cash than it receives. In order to provide timely feedback and alert management to short-term cash needs, the cash flow budget is commonly geared toward monthly or quarterly figures. Figure 7.15 shows how the other budgets tie into the cash budget.

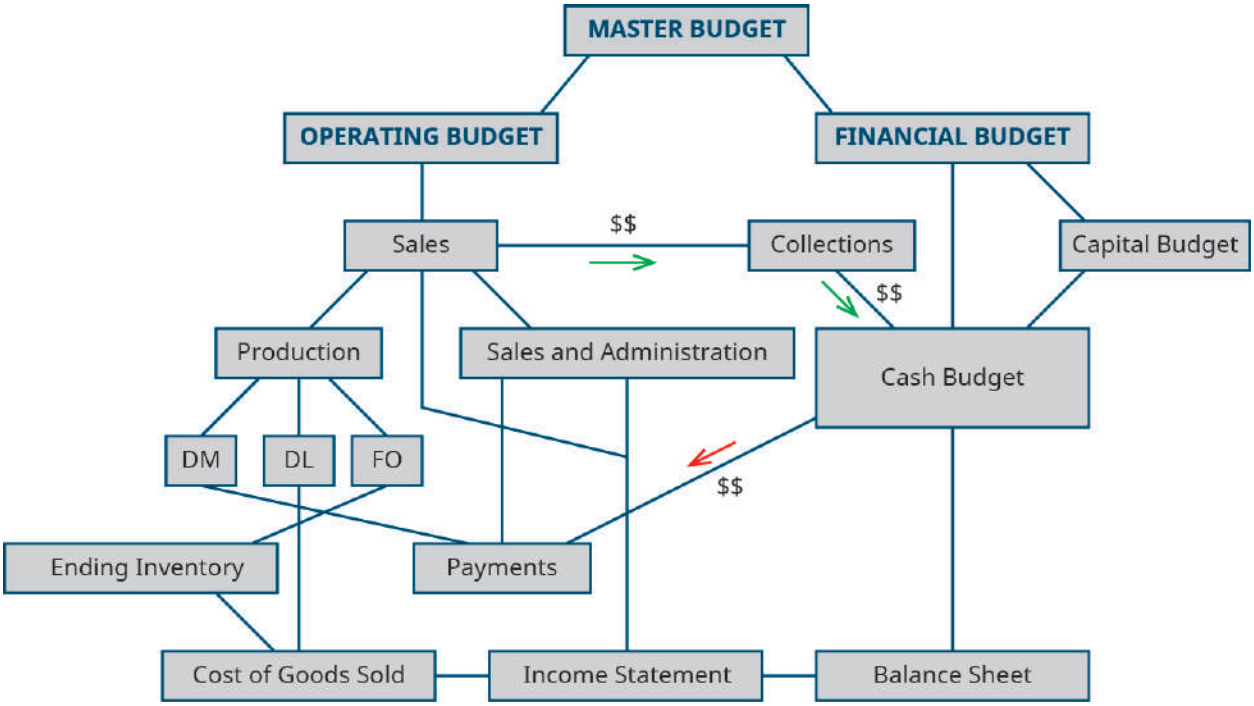


Figure 7.15 Relationship between Budgets. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Cash is so important to the operations of a company that, often, companies will arrange to have an emergency cash source, such as a *line of credit*, to avoid defaulting on current payables due and also to protect against other unanticipated expenses, such as major repair costs on equipment. This line of credit would be similar in function to the *overdraft protection* offered on many checking accounts.

Because the cash budget accounts for every inflow and outflow of cash, it is broken down into smaller components. The **cash collections schedule** includes all of the cash inflow expected to be received from customer sales, whether those customers pay at the same rate or even if they pay at all. The cash collections schedule includes all the cash expected to be received and does not include the amount of the receivables estimated as uncollectible. The **cash payments schedule** plans the outflow or payments of all accounts payable, showing when cash will be used to pay for direct material purchases. Both the cash collections schedule and the cash payments schedule are included along with other cash transactions in a cash budget. The cash budget, then, combines the cash collection schedule, the cash payment schedule, and all other budgets that plan for the inflow or outflow of cash. When everything is combined into one budget, that budget shows if financing arrangements are needed to maintain balances or if excess cash is available to pay for additional liabilities or assets.

The operating budgets all begin with the sales budget. The cash collections schedule does as well. Since purchases are made at varying times during the period and cash is received from customers at varying rates, data are needed to estimate how much will be collected in the month of sale, the month after the sale, two months after the sale, and so forth. Bad debts also need to be estimated, since that is cash that will not be collected.

To illustrate, let's return to Big Bad Bikes. They believe cash collections for the trainer sales will be similar to the collections from their bicycle sales, so they will use that pattern to budget cash collections for the trainers. In the quarter of sales, 65% of that quarter's sales will be collected. In the quarter after the sale, 30% will be collected. This leaves 5% of the sales considered uncollectible. Figure 7.16 illustrates when each quarter's sales will be collected. An estimate of the net realizable balance of Accounts Receivable can be reconciled by using information from the cash collections schedule:

Quarter 4: Beginning balance of Accounts Receivable (Quarter 3 Sales of $112,500 × 30%)	$ 33,750
+ Quarter 4: Sales	187,500
– Quarter 4: Cash Receipts (65% of Quarter 4 Sales)	121,875
= Quarter 4: Ending Balance in Gross Accounts Receivable	$ 99,375

Note the Ending Balance is gross accounts receivable which includes the 5% estimated uncollectible, but that amount would be excluded from net realizable accounts receivable.

	Percentage of Sales Collected			
	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Prior year, Quarter 4 Sales	30%			
Quarter 1 Sales	65%	30%		
Quarter 2 Sales		65%	30%	
Quarter 3 Sales			65%	30%
Quarter 4 Sales				65%

Figure 7.16 Illustration of a Cash Collections Schedule. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

For example, in quarter 1 of year 2, 65% of the quarter 1 sales will be collected in cash, as well as 30% of the sales from quarter 4 of the prior year. There were no sales in quarter 4 of the prior year so 30% of zero sales

shows the collections are $0. Using information from Big Bad Bikes sales budget, the cash collections from the sales are shown in Figure 7.17.

BIG BAD BIKES
Cash Collections Schedule
For the Year Ended December 31, 2019

	Sales	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Collections from prior year Quarter 4	0	0				
Quarter 1	$ 70,000	$45,500	$21,000			$ 66,500
Quarter 2	70,000		45,500	$21,000		66,500
Quarter 3	112,500			73,125	$ 33,750	106,875
Quarter 4	187,500				121,875	121,875
Total Collections	$440,000	$45,500	$66,500	$94,125	$155,625	$361,750
Accounts Receivable	$ 78,250					

Figure 7.17 Cash Collections Schedule for Big Bad Bikes. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

When the cash collections schedule is made for sales, management must account for other potential cash collections such as cash received from the sale of equipment or the issuance of stock. These are listed individually in the cash inflows portion of the cash budget.

The cash payments schedule, on the other hand, shows when cash will be used to pay for Accounts Payable. One such example are direct material purchases, which originates from the direct materials budget. When the production budget is determined from the sales, management prepares the direct materials budget to determine when and how much material needs to be ordered. Orders for materials take place throughout the quarter, and payments for the purchases are made at different intervals from the orders. A schedule of cash payments is similar to the cash collections schedule, except that it accounts for the company's purchases instead of the company's sales. The information from the cash payments schedule feeds into the cash budget.

Big Bad Bikes typically pays half of its purchases in the quarter of purchase. The remaining half is paid in the following quarter, so payments in the first quarter include payments for purchases made during the first quarter as well as half of the purchases for the preceding quarter. Figure 7.18 shows when each quarter's purchases will be paid. Additionally, the balance of purchases in Accounts Payable can be reconciled by using information from the cash payment schedule as follows:

Quarter 4: Beginning balance of Accounts Payable	$ 4,000*
+ Quarter 4: purchase of direct material	12,000
– Quarter 4: Cash Payments	10,000
= Quarter 4: Ending balance in Accounts Payable	$ 6,000*

* Big Bad Bikes has a policy of paying 50% of purchases in the quarter of purchases, and the remaining 50% the month after the purchase. The beginning balance of accounts payable should be 50% of the prior quarter's purchases.

	Percentage of Cash Payments for Purchases			
	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Prior year, Quarter 4 Purchases	50%			
Quarter 1 Purchases	50%	50%		
Quarter 2 Purchases		50%	50%	
Quarter 3 Purchases			50%	50%
Quarter 4 Purchases				50%

Figure 7.18 Cash Payment Schedule. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

The first quarter of the year plans cash payments from the prior quarter as well as the current quarter. Again, since the trainers are a new product, in this example, there are no purchases in the preceding quarter, and the payments are $0. Figure 7.19.

BIG BAD BIKES
Cash Payments Schedule
For the Year Ended December 31, 2019

Payments	Purchases	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Quarter 4, prior year	$ 0	$ 0				
Quarter 1	6,120	3,060	$3,060			$ 6,120
Quarter 2	5,120		2,560	$2,560		5,120
Quarter 3	8,000			4,000	$ 4,000	8,000
Quarter 4	12,000				6,000	6,000
Total payments	$31,240	$3,060	$5,620	$6,560	$10,000	$25,240
Accounts Payable	$ 6,000					

Figure 7.19 Cash Payments Schedule for Big Bad Bikes. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

While the cash payments schedule is made for purchases of material on account, there are other outflows of cash for the company, and management must estimate all other cash payments for the year. Typically, this includes the manufacturing overhead budget, the sales and administrative budget, the capital asset budget, and any other potential payments of cash. Since depreciation is an expense not requiring cash, the cash budget includes the amount from the budgets less depreciation. Cash payments are listed on the cash budget following cash receipts. Figure 7.20 shows the major components of the cash budget.

JOB COST SHEET
General Overview of Cash Budget Components*

Cash Receipts from Sales
+ Other cash receipts (issuance of stock, borrowing money, receiving interest or dividends, from selling assets such as equipment, etc.)
– Cash Payments for Purchases or Production of Inventory
– Cash Payments for manufacturing expenses**
– Cash Payments for selling and administrative expenses**
– Cash payments for capital asset purchases
– Other cash payments (paying interest, paying loan payments, etc.)
= Net Cash

*This is a general overview of the types of cash transactions that might appear in a cash budget and is representative of the components but not of a typical presentation of those components
**Note that depreciation, a non-cash expense, would be excluded from these expenses

Figure 7.20 General Overview of Cash Budget Components. A cash budget will contain all the budgeted cash inflows and out flows from the sub-budgets as well as any cash items that might not appear on one of the sub-budgets. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

The cash budget totals the cash receipts and adds it to the beginning cash balance to determine the available cash. From the available cash, the cash payments are subtracted to compute the net cash excess or deficiency of cash for the quarter. This amount is the potential ending cash balance. Organizations typically require a minimum cash balance. If the potential ending cash balance does not meet the minimum amount, management must plan to acquire financing to reach that amount. If the potential ending cash balance exceeds the minimum cash balance, the excess amount may be used to pay any financing loans and interest.

Big Bad Bikes has a minimum cash balance requirement of $10,000 and has a line of credit available for an interest rate of 19%. They also plan to issue additional capital stock for $5,000 in the first quarter, to pay taxes of $1,000 during each quarter, and to purchase a copier for $8,500 cash in the third quarter. The beginning cash balance for Big Bad Bikes is $13,000, which can be used to create the cash budget shown in Figure 7.21.

BIG BAD BIKES Cash Budget For the Year Ended December 31, 2019					
	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Beginning Cash Balance	$13,000	$10,000	$ 10,000	$ 10,000	$ 13,000
Collections from Customers (Cash Collections Schedule)	45,500	66,500	94,125	155,625	361,750
Issuing of Stock	5,000				5,000
Total Cash Collected during the Period	$50,500	$66,500	$ 94,125	$155,625	$366,750
Total Available Cash	$63,500	$76,500	$104,125	$165,625	$379,750
– Disbursements					
Direct Materials (Cash Payments Schedule)	3,060	5,620	6,560	10,000	25,240
Direct Labor (Direct Labor Budget)	19,500	17,250	27,000	42,000	105,750
Manufacturing Overhead Less Depreciation (MFG OH Budget)	28,925	28,588	30,050	32,300	119,863
Selling and Administrative Expenses Less Depreciation (Sales and Administrative Expense Budget)	18,500	18,500	19,750	22,250	79,000
Income Tax Expense	1,000	1,000	1,000	1,000	4,000
Purchase of Copier (Capital Asset Budget)			8,500		8,500
Total Disbursements	$70,985	$70,958	$ 92,860	$107,550	$342,353
Excess (deficiency) of Available Cash	($ 7,485)	$ 5,542	$ 11,265	$ 58,075	$ 37,397
Financing					
+ Borrowings	17,485	4,458			21,943
– Repayments Including Interest			(1,265)	(21,632)	(22,897)
Ending Cash Balance	$10,000	$10,000	$ 10,000	$ 36,443	$ 36,443

Figure 7.21 Cash Budget for Big Bad Bikes. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Budgeted Balance Sheet

The cash budget shows how cash changes from the beginning of the year to the end of the year, and the ending cash balance is the amount shown on the budgeted balance sheet. The **budgeted balance sheet** is the estimated assets, liabilities, and equities that the company would have at the end of the year if their performance were to meet its expectations. Table 7.1 shows a list of the most common changes to the balance sheet and where the information is derived.

Common Changes in the Budgeted Balance Sheet

Information Source	Balance Sheet Change
Cash balance	ending cash balance from the cash budget
Accounts Receivable balance	uncollected receivables from the cash collections schedule

Table 7.1

Common Changes in the Budgeted Balance Sheet

Information Source	Balance Sheet Change
Inventory	ending balance in inventory as shown from calculations to create the income statement
Machinery & Equipment	ending balance in the capital asset budget
Accounts Payable	unpaid purchases from the cash payments schedule

Table 7.1

Other balance sheet changes throughout the year are reflected in the income statement and statement of cash flows. For example, the beginning cash balance of Accounts Receivable plus the sales, less the cash collected results in the ending balance of Accounts Receivable. A similar formula is used to compute the ending balance in Accounts Payable. Other budgets and information such as the capital asset budget, depreciation, and financing loans are used as well.

To explain how to use a budgeted balance sheet, let's return to Big Bad Bikes. For simplicity, assume that they did not have accounts receivable or payable at the beginning of the year. They also incurred and paid back their financing during the year, so there is no ending debt. However, the cash budget shows cash inflows and outflows not related to sales or the purchase of materials. The company's capital assets increased by $8,500 from the copier purchase, and their common stock increased by $5,000 from the additional issue as shown in Figure 7.22.

BIG BAD BIKES
Budgeted Balance Sheet
December 31, 2019

	Jan. 1	Dec. 31
Cash	$13,000	$ 36,443
Accounts Receivable	0	78,250
– Allowance for Doubtful Accounts		(22,000)
Inventory	0	42,629
Machinery and Equipment	15,000	23,500
Accumulated Depreciation	(2,000)	(22,000)
Total Assets	$26,000	$136,822
Accounts Payable	$ 0	$ 6,000
Line of Credit		
Common Stock	15,000	20,000
Retained Earnings	11,000	110,822
Total Liability and Owner's Equity	$26,000	$136,822

Figure 7.22 Budgeted Balance Sheet for Big Bad Bikes. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Though there seem to be many budgets, they all fit together like a puzzle to create an overall picture of how a

company expects the upcoming business year to look. Figure 7.15 detailed the components of the master budget, and can be used to summarize the budget process. All budgets begin with the sales budget. This budget estimates the number of units that need to be manufactured and precedes the production budget. The production budget (refer to Figure 7.6) provides the necessary information for the budgets needed to plan how many units will be produced. Knowing how many units need to be produced from the production budget, the direct materials budget, direct labor budget, and the manufacturing overhead budget are all prepared. The sales and administrative budget is a nonmanufacturing budget that relies on the sales estimates to pay commissions and other variable expenses. The sales and expenses estimated in all of these budgets are used to develop a budgeted income statement.

The estimated sales information is used to prepare the cash collections schedule, and the direct materials budget is used to prepare the cash payment schedule. The cash receipts and cash payments budget are combined with the direct labor budget, the manufacturing overhead budget, the sales and administrative budget, and the capital assets budget to develop the cash budget. Finally, all the information is used to flow to the budgeted balance sheet.

YOUR TURN

Creating a Master Budget

Molly Malone is starting her own company in which she will produce and sell Molly's Macaroons. Molly is trying to learn about the budget process as she puts her business plan together. Help Molly by explaining the optimal order for preparing the following budgets and schedules and why this is the optimal order.

- budgeted balance sheet
- budgeted income statement
- capital asset budget
- cash budget
- cash collections schedule
- cash payments schedule
- direct materials budget
- direct labor budget
- master budget
- manufacturing overhead
- production budget
- sales budget
- selling and administrative budget

Solution

A master budget always begins with the sales budget must be prepared first as this determines the number of units that will need to be produced. The next step would be to create the production budget, which helps determine the number of units that will need to be produced each period to meet sales goals. Once Molly knows how many units she will need to produce, she will need to budget the costs

associated with those units, which will require her to create the direct materials budget, the direct labor budget and the manufacturing overhead budget. But Molly will have costs other than manufacturing costs so she will need to create a selling and administrative expenses budget. Molly will need to determine what are her capital asset needs and budget for those. Now that Molly has all her revenues budgeted and her costs budgeted, she can determine her budgeted cash inflows and outflows by putting together the cash schedules that lead to the cash budget. Molly will then need to create a cash collections schedule and a cash payments schedule and that information, along with the cash inflow and outflow information from her other budgets, will allow her to create her cash budget. Once Molly has completed her cash budget she will be able to put together her budgeted income statement and budgeted balance sheet.

7.4 Prepare Flexible Budgets

A company makes a budget for the smallest time period possible so that management can find and adjust problems to minimize their impact on the business. Everything starts with the estimated sales, but what happens if the sales are more or less than expected? How does this affect the budget? What adjustments does a company have to make in order to compare the actual numbers to budgeted numbers when evaluating results? If production is higher than planned and has been increased to meet the increased sales, expenses will be over budget. But is this bad? To account for actual sales and expenses differing from budgeted sales and expenses, companies will often create flexible budgets to allow budgets to fluctuate with future demand.

Flexible Budgets

A **flexible budget** is one based on different volumes of sales. A flexible budget flexes the static budget for each anticipated level of production. This flexibility allows management to estimate what the budgeted numbers would look like at various levels of sales. Flexible budgets are prepared at each analysis period (usually monthly), rather than in advance, since the idea is to compare the operating income to the expenses deemed appropriate at the actual production level.

Big Bad Bikes is planning to use a flexible budget when they begin making trainers. The company knows its variable costs per unit and knows it is introducing its new product to the marketplace. Its estimations of sales and sales price will likely change as the product takes hold and customers purchase it. Big Bad Bikes developed a flexible budget that shows the change in income and expenses as the number of units changes. It also looked at the effect a change in price would have if the number of units remained the same. The expenses that do not change are the fixed expenses, as shown in Figure 7.23.

BIG BAD BIKES Flexible Budget For Year Ended December 31, 2019				
Units Sold		1,000	1,500	1,500
Sales Price		$ 70	$ 70	$ 75
Sales		$70,000	$105,000	$112,500
	Per-unit cost			
Cost of Goods Sold				
Direct Material	$ 4	$ 4,000	$ 6,000	$ 6,000
Direct Labor	15	15,000	22,500	22,500
Variable Manufacturing Overhead	3	3,000	4,500	4,500
Fixed Manufacturing Overhead		29,000	29,000	29,000
Total Cost of Goods Sold		51,000	62,000	62,000
Gross Profit		19,000	43,000	50,500
Variable Sales and Admin	2.50	2,500	3,750	3,750
Fixed Sales and Admin		18,000	18,000	18,000
Income Taxes		1,000	1,000	1,000
Total Other Expenses		21,500	22,750	22,750
Net Income (Loss)		(2,500)	20,250	27,750

Figure 7.23 Flexible Budget for Big Bad Bikes. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Static versus Flexible Budgets

A **static budget** is one that is prepared based on a single level of output for a given period. The master budget, and all the budgets included in the master budget, are examples of static budgets. Actual results are compared to the static budget numbers as one means to evaluate company performance. However, this comparison may be like comparing apples to oranges because variable costs should follow production, which should follow sales. Thus, if sales differ from what is budgeted, then comparing actual costs to budgeted costs may not provide a clear indicator of how well the company is meeting its targets. A flexible budget created each period allows for a comparison of apples to apples because it will calculate budgeted costs based on the actual sales activity.

For example, Figure 7.24 shows a static quarterly budget for 1,500 trainers sold by Big Bad Bikes. The budget will change if there are more or fewer units sold.

BIG BAD BIKES Static Quarterly Budget For Each Quarter	
Units Sold	1,500
Sales Price	$ 70
Sales	105,000
Cost of Goods Sold	
Direct Material	6,000
Direct Labor	22,500
Variable Manufacturing Overhead	4,500
Fixed Manufacturing Overhead	29,000
Total Cost of Goods Sold	$ 62,000
Gross Profit	$ 43,000
Variable Sales and Admin	3,750
Fixed Sales and Admin	18,000
Interest Expense	0
Income Taxes	1,000
Total Other Expenses	$ 22,750
Net Income (Loss)	$ 20,250

Figure 7.24 Static Budget for Big Bad Bikes. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

Budget with Varying Levels of Production

Companies develop a budget based on their expectations for their most likely level of sales and expenses. Often, a company can expect that their production and sales volume will vary from budget period to budget period. They can use their various expected levels of production to create a flexible budget that includes these different levels of production. Then, they can modify the flexible budget when they have their actual production volume and compare it to the flexible budget for the same production volume. A flexible budget is more complicated, requires a solid understanding of a company's fixed and variable expenses, and allows for greater control over changes that occur throughout the year. For example, suppose a proposed sale of items does not occur because the expected client opted to go with another supplier. In a static budget situation, this would result in large variances in many accounts due to the static budget being set based on sales that included the potential large client. A flexible budget on the other hand would allow management to adjust their expectations in the budget for both changes in costs and revenue that would occur from the loss of the potential client. The changes made in the flexible budget would then be compared to what actually occurs to result in more realistic and representative variance. This ability to change the budget also makes it easier to pinpoint who is responsible if a revenue or cost target is missed.

Big Bad Bikes used the flexible budget concept to develop a budget based on its expectation that production levels will vary by quarter. By the fourth quarter, sales are expected to be strong enough to pay back the financing from earlier in the year. The budget shown in Figure 7.25 illustrates the payment of interest and contains information helpful to management when determining which items should be produced if production capacity is limited.

BIG BAD BIKES Varying Production Budget Flexible Budget					
		Quarter 1	Quarter 2	Quarter 3	Quarter 4
Units Sold		1,000	1,000	1,500	2,500
Sales Price		$ 70	$ 70	$ 75	$ 75
Sales		70,000	70,000	112,500	187,500
	Per-unit cost				
Cost of Goods Sold					
Direct Material	$ 4	$ 4,000	$ 4,000	$ 6,000	$ 10,000
Direct Labor	15	15,000	15,000	22,500	37,500
Variable Manufacturing Overhead	3	3,000	3,000	4,500	7,500
Fixed Manufacturing Overhead		29,000	29,000	29,000	29,000
Total Cost of Goods Sold		51,000	51,000	62,000	84,000
Gross Profit		19,000	19,000	50,500	103,500
Variable Sales and Admin	2.50	2,500	2,500	3,750	6,250
Fixed Sales and Admin		18,000	18,000	18,000	18,000
Interest Expense					1,653
Income Taxes		1000	1000	1000	1000
Total Other Expenses		21,500	21,500	22,750	26,903
Net Income (Loss)		(2,500)	(2,500)	27,750	76,597

Figure 7.25 Varying Production Levels for Big Bad Bikes. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

CONCEPTS IN PRACTICE

Flexible Budgets and Sustainability

The ability to provide flexible budgets can be critical in new or changing businesses where the accuracy of estimating sales or usage my not be strong. For example, organizations are often reporting their sustainability efforts and may have some products that require more electricity than other products. The reporting of the energy per unit of output has sometimes been in error and can mislead management into making changes that may or may not help the company. For example, based on the energy per unit reported, management may decide to change the product mix, the amount that is outsourced, and/or the amount that is produced.[1] If the energy output isn't correct, the decisions may be wrong and create an adverse impact on the budget.

LINK TO LEARNING

In theory, a flexible budget is not difficult to develop since the variable costs change with production and

1 Jon Bartley, et al. "Using Flexible Budgeting to Improve Sustainability Measures.: *American Institute of CPAs*. Jan. 23, 2017. https://www.aicpa.org/interestareas/businessindustryandgovernment/resources/sustainability/improvesustainabilitymeasures.html

the fixed costs remain the same. However, planning to meet an organization's goals can be very difficult if there are not many variable costs, if the cash inflows are relatively fixed, and if the fixed costs are high. For example, this article shows some large U.S. cities are faced with complicated budgets (https://openstax.org/l/50HighFixedCost) because of high fixed costs.

7.5 Explain How Budgets Are Used to Evaluate Goals

As you've learned, an advantage of budgeting is evaluating performance. Having a strong understanding of their budgets helps managers keep track of expenses and work toward the company's goals. Companies need to understand their revenue and expense details to develop budgets as a tool for planning operations and cash flow. Part of understanding revenue and expenses is evaluating the prior year. Did the company earn the expected profit? Could it have earned a higher profit? What expenses or revenues were not on the budget? Critically evaluating the actual results versus the estimated budgetary results can help management plan for the future. Variance analysis helps the manager analyze its results. It does not necessarily find a problem, but it does indicate where a problem may exist. The same is true for favorable variances as well as unfavorable variances. A favorable variance occurs when revenue is higher than budgeted or expenses are lower than budgeted. An unfavorable variance is when revenue is lower than budgeted or expenses are higher than budgeted.

Comparing Favorable to Unfavorable Variances

Favorable	Unfavorable
Actual Sales > Budgeted Sales	Actual Sales < Budgeted Sales
Actual Expenses < Budgeted Expenses	Actual Expenses > Budgeted expenses

Table 7.2

It is easy to understand that an unfavorable variance may be a problem. But that is not always true, as a higher labor rate may mean the company has a higher quality employee who is able to waste less material. Likewise, having a favorable variance indicates that more revenue was earned or less expenses were incurred but further analysis can indicate if costs were cut too far and better materials should have been purchased.

If a company has only a static budget, meaningful comparisons are difficult. Analyzing the sales for Bid Bad Bikes will illustrate whether there was a profit and how net income impacts the company. In the third quarter, Big Bad Bikes sold 1,400 trainers and had third quarter net income of $15,915 as shown in Figure 7.26.

BIG BAD BIKES Income Statement For the Quarter Ended September 30, 2019	
Units Sold	1,400
Sales Price	$ 75
Sales	$98,000
Cost of Goods Sold	
Direct Material	$ 5,550
Direct Labor per Unit	21,500
Variable Manufacturing Overhead	4,100
Fixed Manufacturing Overhead	28,900
Total Cost of Goods Sold	60,050
Gross Profit	37,950
Variable Sales and Administration	3,550
Fixed Sales and Administration	17,500
Interest Expense	0
Income Taxes	985
Total Other Expenses	22,035
Net Income (Loss)	22,915

Figure 7.26 Actual Quarter 3 Income Statement for Big Bad Bikes. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

The company earned a profit during the third quarter, but what does that mean to the company? Simply having net income instead of a net loss does not help plan for the future. The third quarter static budget was for the sale of 1,500 units. Comparing that budget to the actual results shows whether there is a favorable variance or an unfavorable variance. A comparison of the actual costs with the budget for the third quarter, as shown in Figure 7.27, has a favorable variance for all of the expenses and an unfavorable variance for everything associated with revenues.

BIG BAD BIKES Actual Versus Static Budget Variance Quarter Ended September 30, 2019				
	Actual	**Budget**	**Variance**	
Units Sold	1,400	1,500	(100)	Unfavorable
Sales Price	$ 75	$ 75	$ 75	
Sales	$105,000	$112,500	($7,500)	Unfavorable
Cost of Goods Sold				
Direct Material	$ 5,550	$ 6,000	$ 450	Favorable
Direct Labor	21,500	22,500	1,000	Favorable
Variable Manufacturing Overhead	4,100	4,500	400	Favorable
Fixed Manufacturing Overhead	28,900	29,000	100	Favorable
Total Cost of Goods Sold	60,050	62,000	1,950	Favorable
Gross Profit	44,950	50,500	(5,550)	Unfavorable
Variable Sales and Administration	3,550	3,750	200	Favorable
Fixed Sales and Administration	17,500	18,000	500	Favorable
Income Taxes	985	1,000	15	Favorable
Total Other Expenses	22,035	22,750	715	Favorable
Net Income (Loss)	22,915	27,750	(4,835)	Unfavorable

Figure 7.27 Actual versus Static Budget for Big Bad Bikes. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

How do those results advise management when evaluating the company's performance? It is difficult to look at one variance and make a conclusion about the company or its management. However, the variances can help narrow down the areas that need addressing because they differ from the budgeted amount. For example, looking at the variance when using a static budget does not indicate the amount of the variance results because they sold 100 fewer units than budgeted. The variance for the cost of goods sold is favorable, but it should be if production was less than the budget. A static budget does not evaluate whether costs for 1,400 were appropriate for production of those 1,400 units.

Using a static budget to evaluate performance affects the bottom line as well as the individual expenses. The net income for the sale of 1,400 units is less than the budgeted net income for 1,500 units, but it does not indicate whether expenses were appropriate for 1,400 units. If there had been 1,600 units sold, the expenses would be more than the budgeted amount, but sales would be higher. Would it be fair to evaluate a manager's control over their expenses using a static budget?

ETHICAL CONSIDERATIONS

Budget Manipulation and Ethics Training

Why is ethics training important? An organization that bases a manager's evaluation and pay on how close to the budget the division performs may inadvertently encourage that manager to act unethically in order to get a pay raise. Many employees manipulate the budget process to enhance their earnings by garnering bonuses based upon questionably ethical behavior and improper financial reporting. Generally, this unethical behavior involves either manipulating the numbers in the budget or modifying the timing of reports to apply income to a different budget period. Kenton Walker and Gary Fleischman

studied ethics in budgeting and determined that certain ethics-related structures in a business created a better operational environment.

The study found that the existence of formal ethical codes, ethics training, good management role models, and social pressure to be disclosing within an organization can be a deterrent to budget manipulation by employees. The authors recommended: "Therefore, organizations should carefully cultivate an ethical atmosphere that is sensitive to the pressures employees may feel to game the budget through actions that involve cheating and/or manipulating earnings targets to maximize bonuses." [2] The study concluded that requiring organizational ethics training that includes role playing helps teach ethical behavior in budgeting and other areas of business. Ethics training never goes out so style.

Evaluating the expenses on a flexible budget computed for the number of units sold would provide an indication of management's ability to control expenses. As shown in Figure 7.28, some expenses have a favorable variance, while others have an unfavorable variance. This type of variance analysis provides more information to evaluate management and help prepare the next year's budget. For example, the direct labor in the flexible budget comparison shows an unfavorable variance, meaning the direct labor expense was more than budgeted for the production of 1,400 units. When comparing direct labor expense, the direct labor in the static budget mentioned earlier was even larger because it computed direct labor required to manufacture 1,500 units. It is not surprising that the static budget variance is favorable because 100 fewer units were actually produced. However, that information is not as useful as the unfavorable variance when comparing 1,400 units produced versus the budgeted direct labor for 1,400 units used.

BIG BAD BIKES
Actual Versus Flexible Budget Variance
Quarter Ended September 30, 2019

	Actual	Budget	Variance	
Units Sold	1,400	1,400	None	
Sales Price	$ 75	$ 75		
Sales	$105,000	$105,000	None	
Cost of Goods Sold				
Direct Material	$ 5,550	$ 5,600	$ 50	Favorable
Direct Labor	21,500	21,000	(500)	Unfavorable
Variable Manufacturing Overhead	4,100	4,200	100	Favorable
Fixed Manufacturing Overhead	28,900	29,000	100	Favorable
Total Cost of Goods Sold	60,050	59,800	(250)	Unfavorable
Gross Profit	44,950	45,200	(250)	Unfavorable
Variable Sales and Administration	3,550	3,500	(50)	Unfavorable
Fixed Sales and Administration	17,500	18,000	500	Favorable
Interest Expense	0	0	0	
Income Taxes	985	1,000	15	Favorable
Total Other Expenses	22,035	22,500	465	Favorable
Net Income (Loss)	22,915	22,700	215	Favorable

Figure 7.28 Actual versus Flexible Budget for Big Bad Bikes. (attribution: Copyright Rice University, OpenStax, under CC BY-NC-SA 4.0 license)

2 Kenton B. Walker, et al. "Toeing the Line: The Ethics of Manipulating Budgets and Earnings." *Management Accounting Quarterly* 14, no. 3 (Spring 2013). https://www.imanet.org/-/media/f4869589d9d444de8c211d245a0192ff.ashx

THINK IT THROUGH

A Budget for a New Business

You are beginning your own business and developed a budget based on modest sales and expense assumptions. The actual results are very close to the budget at the end of the first and second months. During the third month, both cash collected and paid differ significantly from the budget. What could be the cause and what should you do?

LINK TO LEARNING

Budgeting is only the beginning of the process. Evaluating the results to determine if the financial goals are being met can make the difference in whether an organization or individual meets its goals or not. Forbes recognizes that budgeting is an important personal task that should start early in one's professional career. This article provides some custom budgeting guidelines for young adults (https://openstax.org/l/50BudgetGuide) to help.

Key Terms

budget quantitative plan estimating when and how much cash or other resources will be received and how the cash or other resources will be used

budgeted balance sheet estimated assets, liabilities, and equities that the company would have at the end of the year if their performance were to meet its expectations

budgeted income statement statement similar to a traditional income statement except it contains budgeted data

capital asset budget budget showing the organization's plans to invest in long-term assets

cash budget combined budget of all cash inflows and outflows of the organization

cash collections schedule schedule showing when cash will be received from customers

cash payments schedule schedule showing when cash will be used to pay for direct material purchases

direct labor budget budget based on the production budget used to ensure the proper amount of staff is available for production and that there is money available to pay for the labor

direct materials budget budget combining the production budget with the direct material per unit to ensure the proper quantity of direct materials is available when needed for production

financial budget category of budgeting that details estimates for cash inflows and outflows through planned operations and changes capital investments of assets, liabilities, and equities

flexible budget budget based on different levels of activity

manufacturing overhead budget budget including the remainder of the production costs not covered by the direct materials and direct labor budgets

master budget overall budget that includes the operating and financial budgets

operating budget category of budgeting that helps managers plan and manage production, order materials, schedule direct labor, and monitor overhead expenses

production budget budget showing the number of units that need to be produced for each period based on sales estimates and required inventory levels

rolling budget budget that is continuously updated by adding an additional budget period at the end of the current budget period

sales budget budget showing the expected sales in units and the sales price for the budget period

selling and administrative expense budget budget showing the variable and fixed expenses estimated to be incurred in all areas other than production

static budget budget prepared for a single level of activity for a given period

zero-based budgeting budget that begins with zero dollars and then includes in the budget only revenue and expenses that can be supported or justified

Summary

7.1 Describe How and Why Managers Use Budgets

- A good budgeting system assists management in reaching their goals through the planning and control of cash inflows through revenue and financing and outflows through payment and expenses.
- There are various budgeting strategies including bottom-up, top-down, and zero-based budgeting.
- A static budget is prepared at one level of activity, while a flexible budget allows the variable expenses to be adjusted for various levels of activity.
- A master budget includes the subcategories of operating budgets and financial budgets.
- A master budget is developed at the estimated level of activity.

7.2 Prepare Operating Budgets

- The sales budget is the first budget developed, and the estimated sales in turn guide the production budget.
- The production budget shows the quantity of goods produced for each time period and leads to computing when and how much direct material needs to be ordered, when and how much labor needs to be scheduled, and when and how much manufacturing overhead needs to be planned.
- The sales and administrative budget plans for the nonmanufacturing expenses.
- All operating budgets combine to develop the budgeted income statement.

7.3 Prepare Financial Budgets

- The financial budgets include the capital asset budget and the cash budget. The cash collections schedule and cash payments schedule are computed and combined with the other budgets to develop the cash budget.
- Information from the other budgets and the budgeted income statement are used to develop the budgeted balance sheet.

7.4 Prepare Flexible Budgets

- A master budget and related budgets are prepared as static budgets for the estimated level of activity.
- A flexible budget adjusts the budgets for various levels of activity and allows for the actual results to be evaluated at the actual volume of activity.

7.5 Explain How Budgets Are Used to Evaluate Goals

- Management's evaluations of the actual results versus the estimated budgetary results help plan for the future.
- Favorable variances occur when sales are higher or expenses are lower than budgeted.
- Unfavorable variances occur when sales are lower or expenses are higher than budgeted.

Multiple Choice

1. LO 7.1 Which of the following is *not* a part of budgeting?

A. planning
B. finding bottlenecks
C. providing performance evaluations
D. preventing net operating losses

2. LO 7.1 Which of the following is an operating budget?

A. cash budget
B. production budget
C. tax budget
D. capital budget

3. LO 7.1 Which of the following is a finance budget?

A. cash budget
B. production budget
C. direct materials purchasing budget
D. tax budget

4. LO 7.1 Which approach is most likely to result in employee buy-in to the budget?
A. top-down approach
B. bottom-up approach
C. total participation approach
D. basing the budget on the prior year

5. LO 7.1 Which approach requires management to justify all its expenditures?
A. bottom-up approach
B. zero-based budgeting
C. master budgeting
D. capital allocation budgeting

6. LO 7.1 Which of the following is true in a bottom-up budgeting approach?
A. Every expense needs to be justified.
B. Supervisors tell departments their budget amount and the departments are free to work within those amounts.
C. Departments budget their needs however they see fit.
D. Departments determine their needs and relate them to the overall goals.

7. LO 7.1 The most common budget is prepared for a _____.
A. week
B. month
C. quarter
D. year

8. LO 7.2 Which of the operating budgets is prepared first?
A. production budget
B. sales budget
C. cash received budget
D. cash payments budget

9. LO 7.2 The direct materials budget is prepared using which budget's information?
A. cash payments budget
B. cash receipts budget
C. production budget
D. raw materials budget

10. LO 7.2 Which of the following is *not* an operating budget?
A. sales budget
B. production budget
C. direct labor budget
D. cash budget

11. LO 7.2 Which of the following statements is *not* correct?
A. The sales budget is computed by multiplying estimated sales by the sales price.
B. The production budget begins with the sales estimated for each period.
C. The direct materials budget begins with the sales estimated for each period.
D. The sales budget is typically the first budget prepared.

12. LO 7.2 The units required in production each period are computed by which of the following methods?
A. adding budgeted sales to the desired ending inventory and subtracting beginning inventory
B. adding beginning inventory, budgeted sales, and desired ending inventory
C. adding beginning inventory to budgeted sales and subtracting desired ending inventory
D. adding budgeted sales to the beginning inventory and subtracting the desired ending inventory.

13. LO 7.3 The cash budget is part of which category of budgets?
A. sales budget
B. cash payments budget
C. finance budget
D. operating budget

14. LO 7.3 Which is *not* a section of the cash budget?
A. cash receipts
B. cash disbursements
C. allowance for uncollectible accounts
D. financing needs

15. LO 7.3 Which budget is the starting point in preparing financial budgets?
A. the budgeted income statement
B. the budgeted balance sheet
C. the capital expense budget
D. the cash receipts budget

16. LO 7.3 Which of the following includes only financial budgets?
A. capital asset budget, budgeted income statement, sales budget
B. production budget, capital asset budget, budgeted balance sheet
C. cash budget, budgeted balance sheet, capital asset budget
D. budgeted income statement, direct material purchases budget, cash budget

17. LO 7.4 Which budget evaluates the results of operations at the actual level of activity?
A. capital budget
B. cash budget
C. flexible budget
D. static budget

18. LO 7.4 What is the main difference between static and flexible budgets?
A. The fixed manufacturing overhead is adjusted for units sold in the flexible budget.
B. The variable manufacturing overhead is adjusted in the static budget.
C. There is no difference between the budgets.
D. The variable costs are adjusted in a flexible budget.

Questions

1. LO 7.1 What is a budget and what are the different types of budgets?

2. LO 7.1 What is the difference between budgeting and long-range planning?

3. LO 7.1 What are the advantages and disadvantages of the bottom-up budgeting approach?

4. LO 7.1 Why might a rolling budget require more management participation than an annual budget?

5. LO 7.2 What information is necessary for the operating budgets?

6. LO 7.2 What operating budget exists for manufacturing but not for a retail company?

7. LO 7.3 What is the process for developing a budgeted balance sheet?

8. LO 7.3 Which of the financial budgets is the most important? Why?

9. LO 7.4 A company has prepared the operating budget and the cash budget. It is now preparing the budgeted balance sheet. Identify the document that contains each of these balances.

A. cash
B. accounts receivable
C. finished goods inventory
D. accounts payable
E. equipment purchases

10. LO 7.4 Fill in the blanks: A flexible budget summarizes _____ and _____ for various volume levels by adjusting the _____ costs for the various levels of activities. The _____ costs remain the same for all levels of activities.

11. LO 7.4 What information is included in the capital asset budget?

12. LO 7.5 Why does budget planning typically begin with the sales forecast?

13. LO 7.5 What steps should be considered if a budget is to be set and later have its results evaluated?

Exercise Set A

EA1. LO 7.2 Blue Book printing is budgeting sales of 25,000 units and already has 5,000 in beginning inventory. How many units must be produced to also meet the 7,000 units required in ending inventory?

EA2. LO 7.2 How many units are in beginning inventory if 32,000 units are budgeted for sales, 35,000 units are produced, and the desired ending inventory is 9,000 units?

EA3. LO 7.2 Navigator sells GPS trackers for $50 each. It expects sales of 5,000 units in quarter 1 and a 5% increase each subsequent quarter for the next 8 quarters. Prepare a sales budget by quarter for the first year.

EA4. LO 7.2 One Device makes universal remote controls and expects to sell 500 units in January, 800 in February, 450 in March, 550 in April, and 600 in May. The required ending inventory is 20% of the next month's sales. Prepare a production budget for the first four months of the year.

EA5. LO 7.2 Sunrise Poles manufactures hiking poles and is planning on producing 4,000 units in March and 3,700 in April. Each pole requires a half pound of material, which costs $1.20 per pound. The company's policy is to have enough material on hand to equal 10% of the next month's production needs and to maintain a finished goods inventory equal to 25% of the next month's production needs. What is the budgeted cost of purchases for March?

EA6. LO 7.2 Given the following information from Rowdy Enterprises' direct materials budget, how much direct materials needs to be purchased?

Beginning materials inventory	$ 75,800
Ending materials inventory	79,200
Materials needed for production	500,000

EA7. LO 7.2 Each unit requires direct labor of 2.2 hours. The labor rate is $11.50 per hour and next year's direct labor budget totals $834,900. How many units are included in the production budget for next year?

EA8. LO 7.2 How many units are estimated to be sold if Skyline, Inc., has a planned production of 900,000 units, a desired beginning inventory of 160,000 units, and a desired ending inventory of 100,000 units?

EA9. LO 7.3 Cash collections for Wax On Candles found that 60% of sales were collected in the month of the sale, 30% was collected the month after the sale, and 10% was collected the second month after the sale. Given the sales shown, how much cash will be collected in January and February?

Nov.	Dec.	Jan.	Feb.
$25,000	$35,000	$20,000	$25,000

EA10. LO 7.3 Nonna's Re-Appliance Store collects 55% of its accounts receivable in the month of sale and 40% in the month after the sale. Given the following sales, how much cash will be collected in February?

Dec. 2017	Jan. 2018	Feb. 2018
$20,000	$60,000	$70,000

EA11. LO 7.3 Dream Big Pillow Co. pays 65% of its purchases in the month of purchase, 30% the month after the purchase, and 5% in the second month following the purchase. It made the following purchases at the end of 2017 and the beginning of 2018:

Nov. 2017	Dec. 2017	Jan. 2018	Feb. 2018	Mar. 2018
$60,000	$50,000	$35,000	$40,000	$45,000

EA12. LO 7.3 Desiccate purchases direct materials each month. Its payment history shows that 70% is paid in the month of purchase with the remaining balance paid the month after purchase. Prepare a cash payment schedule for March if in January through March, it purchased $35,000, $37,000, and $39,000, respectively.

EA13. LO 7.3 What is the amount of budgeted cash payments if purchases are budgeted for $420,000 and the beginning and ending balances of accounts payable are $95,000 and $92,000, respectively?

EA14. LO 7.3 Halifax Shoes has 30% of its sales in cash and the remainder on credit. Of the credit sales, 65% is collected in the month of sale, 25% is collected the month after the sale, and 5% is collected the second month after the sale. How much cash will be collected in August if sales are estimated as $75,000 in June, $65,000 in July, and $90,000 in August?

EA15. LO 7.4 Cold X, Inc. uses this information when preparing their flexible budget: direct materials of $2 per unit, direct labor of $3 per unit, and manufacturing overhead of $1 per unit. Fixed costs are $35,000. What would be the budgeted amounts for 20,000 and 25,000 units?

EA16. LO 7.4 Using the provided budgeted information for production of 10,000 and 15,000 units, prepare a flexible budget for 17,000 units.

Production	10,000 units	15,000 units
Expense A	$15,000	$22,500
Expense B	21,000	21,000
Expense C	43,000	43,000

EA17. LO 7.5 The production cost for a waterproof phone case is $7 per unit and fixed costs are $23,000 per month. How much is the favorable or unfavorable variance if 5,500 units were produced for a total of $61,000?

Exercise Set B

EB1. LO 7.2 Lovely Wedding printing is budgeting sales of 32,000 units and already has 4,000 in beginning inventory. How many units must be produced to also meet the 6,000 units required in ending inventory?

EB2. LO 7.2 How many units are in beginning inventory if 32,000 units are budgeted for sales, 35,000 units are produced, and the desired ending inventory is 9,000 units?

EB3. LO 7.2 Barnstormer sells airplane accessories for $20 each. It expects sales of 120,000 units in quarter 1 and a 7% increase each subsequent quarter for the next 8 quarters. Prepare a sales budget by quarter for the first year.

EB4. LO 7.2 Rehydrator makes a nutrition additive and expects to sell 3,000 units in January, 2,000 in February, 2,500 in March, 2,700 in April, and 2,900 in May. The required ending inventory is 20% of the next month's sales, and the beginning inventory on January 1 was 600 units. Prepare a production budget for the first four months of the year.

EB5. LO 7.2 Cloud Shoes manufactures recovery sandals and is planning on producing 12,000 units in March and 11,500 in April. Each sandal requires 1.2 yards if material, which costs $3.00 per yard. The company's policy is to have enough material on hand to equal 15% of next month's production needs and to maintain a finished goods inventory equal to 20% of the next month's production needs. What is the budgeted cost of purchases for March?

EB6. LO 7.2 Given the following information from Power Enterprises' direct materials budget, how much direct materials needs to be purchased?

Beginning materials inventory	$101,200
Ending materials inventory	105,300
Materials needed for production	890,250

EB7. LO 7.2 Each unit requires direct labor of 4.1 hours. The labor rate is $13.75 per hour and next year's production is estimated at 75,000 units. What is the amount to be included in next year's direct labor budget?

EB8. LO 7.2 How many units are estimated to be sold if Kino, Inc., has planned production of 750,000 units, a desired beginning inventory of 30,000 units, and a desired ending inventory of 45,000 units?

EB9. LO 7.3 Cash collections for Renew Lights found that 65% of sales were collected in the month of sale, 25% was collected the month after the sale, and 10% was collected the second month after the sale. Given the sales shown, how much cash will be collected in March and April?

Jan.	Feb.	Mar.	Apr.
$90,000	$120,000	$75,000	$85,000

EB10. LO 7.3 My Aunt's Closet Store collects 60% of its accounts receivable in the month of sale and 35% in the month after the sale. Given the following sales, how much cash will be collected in March?

Feb. 2018	Mar. 2018	Apr. 2018
$20,000	$60,000	$70,000

EB11. LO 7.3 Gear Up Co. pays 65% of its purchases in the month of purchase, 30% in the month after the purchase, and 5% in the second month following the purchase. What are the cash payments if it made the following purchases in 2018?

Feb. 2018	Mar. 2018	Apr. 2018	May 2018	June 2018
$90,000	$92,000	$101,000	$98,000	$99,500

EB12. LO 7.3 Drainee purchases direct materials each month. Its payment history shows that 65% is paid in the month of purchase with the remaining balance paid the month after purchase. Prepare a cash payment schedule for January using this data: in December through February, it purchased $22,000, $25,000, and $23,000 respectively.

EB13. LO 7.3 What is the amount of budgeted cash payments if purchases are budgeted for $190,500 and the beginning and ending balances of accounts payable are $21,000 and $25,000, respectively?

EB14. LO 7.3 Earthie's Shoes has 55% of its sales in cash and the remainder on credit. Of the credit sales, 70% is collected in the month of sale, 15% is collected the month after the sale, and 10% is collected the second month after the sale. How much cash will be collected in June if sales are estimated as $75,000 in April, $65,000 in May, and $90,000 in June?

EB15. LO 7.4 Judge's Gavel uses this information when preparing their flexible budget: direct materials of $3 per unit, direct labor of $2.50 per unit, and manufacturing overhead of $1.25 per unit. Fixed costs are $49,000. What would be the budgeted amounts for 33,000 and 35,000 units?

EB16. LO 7.4 Using the following budgeted information for production of 5,000 and 12,000 units, prepare a flexible budget for 9,000 units.

Production	5,000 units	12,000 units
Expense A	$17,500	$42,000
Expense B	19,000	19,000
Expense C	21,000	21,000

EB17. LO 7.5 The production cost for UV protective sunglasses is $5.50 per unit and fixed costs are $19,400 per month. How much is the favorable or unfavorable variance if 14,000 units were produced for a total of $97,000?

Problem Set A

PA1. LO 7.2 Lens Junction sells lenses for $45 each and is estimating sales of 15,000 units in January and 18,000 in February. Each lens consists of 2 pounds of silicon costing $2.50 per pound, 3 oz of solution costing $3 per ounce, and 30 minutes of direct labor at a labor rate of $18 per hour. Desired inventory levels are:

	Jan. 31	Feb. 28	Mar. 31
Beginning inventory			
Finished goods	4,500	4,900	5,000
Direct materials: silicon	8,500	9,100	9,200
Direct materials: solution	11,200	12,000	13,000

Prepare a sales budget, production budget, direct materials budget for silicon and solution, and a direct labor budget.

PA2. LO 7.2 The data shown were obtained from the financial records of Italian Exports, Inc., for March:

Estimated sales	$560,000
Sales	567,923
Purchases	294,823
Ending inventory	10%*
Administrative salaries	50,320
Marketing expense	5%**
Sales commissions	2%**
Rent expense	7,500
Depreciation expense	1,100
Utilities	2,500
Taxes	15%***

*of next month's sales
**of sales
***of income before taxes

Sales are expected to increase each month by 10%. Prepare a budgeted income statement.

PA3. LO 7.2 Echo Amplifiers prepared the following sales budget for the first quarter of 2018:

	Jan.	Feb.	Mar.
Units	1,000	1,200	1,500
Sales price	$ 100	$ 100	$ 100
Budgeted sales	$10,000	$12,000	$15,000

It also has this additional information related to its expenses:

Direct material per unit	$ 1.50
Direct labor per unit	2
Variable manufacturing overhead per hour	0.50
Fixed manufacturing overhead per month	3,000
Sales commissions per unit	15
Sales salaries per month	5,000
Delivery expense per unit	0.50
Factory utilities per month	5,000
Administrative salaries per month	20,000
Marketing expenses per month	8,000
Insurance expense per month	11,000
Depreciation expense per month	9,000

Prepare a sales and administrative expense budget for each month in the quarter ending March 31, 2018.

PA4. LO 7.2 Prepare a budgeted income statement using the information shown.

Sales (units)	15,000
Sales price per unit	$ 40
Uncollectible expense	1%*
Direct material per unit	$ 2
Direct labor per unit (hours)	0.5
Direct labor rate per hour	$ 20
Manufacturing overhead	$15,000
Variable sales and administration expenses per unit	$ 2
Fixed sales and administration expenses	$20,000
Taxes	15%**

*of sales
**of income before taxes

PA5. LO 7.2 Spree Party Lights overhead expenses are:

Indirect material, pounds per unit	0.25
Indirect material, cost per pound	$ 2
Indirect labor hours	1
Indirect labor rate per hour	$ 16.50
Variable maintenance per unit	$ 0.75
Variable utilities per unit	$ 0.20
Supervisor salaries	$10,000
Maintenance salaries	$ 9,000
Insurance	$ 3,000
Depreciation	$ 1,500

Prepare a manufacturing overhead budget if the number of units to produce for January, February, and March are 2,500, 3,000, and 2,700, respectively.

PA6. LO 7.3 Relevant data from the Poster Company's operating budgets are:

	Quarter 1	Quarter 2
Sales	$208,470	$211,539
Direct material purchases	115,295	120,832
Direct labor	75,205	73,299
Manufacturing overhead	25,300	25,300
Selling and administration expenses	33,500	33,500
Depreciation included in selling and administration	1,500	1,000
Collections from customers	215,392	240,155
Cash payments for purchases	114,295	119,253

Additional data: Capital assets were sold in January for $10,000 and $4,500 in May. Dividends of $4,500 were paid in February. The beginning cash balance was $60,359 and a required minimum cash balance is $59,000. Use this information to prepare a cash budget for the first two quarters of the year

PA7. LO 7.3 Fill in the missing information from the following schedules:

Sales Budget
For the Year Ended December 31, 2018

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Expected sales (units)	7,500	8,250	8,750	9,000	?
Sales price per unit	$ 45	$ 50	$ 50	$ 55	
Total sales revenue	$337,500	$412,500	$437,500	?	?

Production Budget
For the Year Ended December 31, 2018

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Q1, Year 2
Expected sales	7,500	8,250	8,750	9,000	8,000
Desired ending inventory	1,650	1,750	1,800	?	900
Total required units	9,150	10,000	10,550	10,600	8,900
– beginning inventory	1,500	1,650	1,750	1,800	1,600
Required production	7,650	8,350	8,800	?	7,300
Total					

Direct Materials Budget
For the Year Ended December 31, 2018

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Units to be produced	7,650	8,350	8,800	8,800	33,600
Direct material per unit	2	2	2	2	2
Total pounds needed for production	15,300	16,700	17,600	17,600	67,200
+ desired ending inventory	4,175	4,400	4,400	3,650	3,650
Total material required	19,475	21,100	22,000	21,250	70,850
– beginning inventory	0	4,175	4,400	4,400	0
Pounds of direct material purchase requirements	19,475	16,925	17,600	16,850	70,850
Cost per pound	$ 1.50	$ 1.50	$ 1.50	$ 1.50	$ 1.50
Total cost of direct material purchase	$29,213	$25,388	$26,400	$25,275	$106,275
Total				?	$106,275

Direct Labor Budget
For the Year Ended December 31, 2018

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Units to be produced	7,650	8,350	8,800	?	?
Direct labor hours per unit	0.75	0.75	0.75	0.75	0.75
Total required direct labor hours	5,738	6,263	6,600	6,600	?
Labor cost per hour	$ 25	$ 25	$ 25	$ 25	$ 25
Total direct labor cost	$143,438	$156,563	$165,000	?	$630,000

PA8. LO 7.3 Direct labor hours are estimated as 2,000 in Quarter 1; 2,100 in Quarter 2; 1,900 in Quarter 3; and 2,300 in Quarter 4. Prepare a manufacturing overhead budget using the information provided.

Indirect material per hour	$1.00	Supervisory salaries	$17,000
Indirect labor per hour	1.25	Maintenance	5,000
Maintenance per hour	0.25	Property taxes and insurance	6,000
Utilities per hour	0.50	Depreciation	3,500

PA9. LO 7.3 Fitbands' estimated sales are:

October	$131,982
November	195,723
December	249,283
January	124,298
February	124,284
March	124,373

What are the balances in accounts receivable for January, February, and March if 65% of sales is collected in the month of sale, 25% is collected the month after the sale, and 10% is second month after the sale?

PA10. LO 7.3 Sports Socks has a policy of always paying within the discount period and each of its suppliers provides a discount of 2% if paid within 10 days of purchase. Because of the purchase policy, 85% of its payments are made in the month of purchase and 15% are made the following month. The direct materials budget provides for purchases of $129,582 in November, $294,872 in December, $239,582 in January, and $234,837 in February. What is the balance in accounts payable for January 31, and February 28?

PA11. LO 7.4 Prepare a flexible budgeted income for 120,000 units using the following information from a static budget for 100,000 units:

Sales price	$ 90
Direct material per unit	30
Direct labor per unit	15
Variable manufacturing overhead per unit	13
Fixed manufacturing overhead	75,000
Variable sales and administration expenses per unit	3
Fixed sales and administration expenses	25,000
Taxes	30%*

*of income before taxes

PA12. LO 7.4 Before the year began, the following static budget was developed for the estimated sales of 100,000. Sales are sluggish and management needs to revise its budget. Use this information to prepare a flexible budget for 80,000 and 90,000 units of sales.

Sales	$3,500,000
Cost of goods sold	
Direct material	900,000
Direct labor	1,000,000
Variable manufacturing overhead	250,000
Fixed manufacturing overhead	80,000
Cost of goods sold	2,230,000
Gross profit	1,270,000
Variable sales and administration expenses	100,000
Fixed sales and administration expenses	950,000
Income before taxes	220,000
Taxes	66,000
Net income	$ 154,000

PA13. LO 7.4 Caribbean Hammocks currently sells 75,000 units at $50 per unit. Its expenses are:

Direct materials per unit	$ 9
Direct labor per unit	10
Variable manufacturing overhead per unit	7
Variable sales and administration expenses per unit	2
Fixed manufacturing overhead	75,000
Fixed sales and administration expenses	850,000
Taxes	30%*

*of income before taxes

Management believes it can increase sales by 5,000 units for every $5 decrease in sales price. It also believes the additional sales will allow a decrease in direct material of $1 for each additional 5,000 units. Prepare a flexible budgeted income statement for 75,000-, 80,000-, and 85,000-unit sales.

PA14. LO 7.4 Total Pop's data show the following information:

	Jan.	Feb.	Mar.	Apr.	May
Estimated sales units	15,000	14,500	16,000	15,500	15,800
Sales price per unit	$ 45	$ 45	$ 45	$ 45	$ 45
Direct labor per unit	3	3	2.25	2	2
Labor rate per hour	$ 18	$ 18	$ 21	$ 21	$ 21

New machinery will be added in April. This machine will reduce the labor required per unit and increase the labor rate for those employees qualified to operate the machinery. Finished goods inventory is required to be 20% of the next month's requirements. Direct material requires 2 pounds per unit at a cost of $3 per pound. The ending inventory required for direct materials is 15% of the next month's needs. In January, the beginning inventory is 3,000 units of finished goods and 4,470 pounds of material. Prepare a production budget, direct materials budget, and direct labor budget for the first quarter of the year.

PA15. LO 7.4 Identify the document that contains the information listed in these lines from the budgeted balance sheet shown.

A. Cash
B. Accounts receivable
C. Raw materials inventory
D. Computers
E. Accounts payable

Cash	$ 2,500,000
Accounts receivable	5,381,239
Raw materials inventory	3,149,183
Finished goods inventory	6,239,138
Total current assets	$17,269,560
Property, plant, and equipment	
Computers	$ 150,000
Machinery	9,745,231
Accumulated depreciation	(5,385,733)
Net property, plant, and equipment	$ 4,509,498
Total assets	$21,779,058
Liabilities	
Accounts payable	$ 3,242,938
Notes payable	8,289,722
Total liabilities	$11,532,660
Stockholders' equity	
Common stock	$ 5,000,000
Retained earnings	5,246,398
Total stockholders' equity	$ 10,246,398
Total liabilities and stockholders' equity	$ 21,779,058

PA16. LO 7.5 Titanium Blades refines titanium for use in all brands of razor blades. It prepared a static budget for the sales of 5,000 units. These variances were observed:

	Actual Results	Variances	
Sales	$150,000	$25,000	Favorable
Variable expenses	77,800	12,800	Unfavorable
Fixed expenses	70,300	300	Unfavorable
Net income (loss)	1,900	11,900	Unfavorable

Determine the static budget and use the information to prepare a flexible budget and analysis for the 6,000 units actually sold.

Problem Set B

PB1. LO 7.2 Lens & Shades sells sunglasses for $37 each and is estimating sales of 21,000 units in January and 19,000 in February. Each lens consists of 2.00 mm of plastic costing $2.50 per mm, 1.7 oz of dye costing $2.80 per ounce, and 0.50 hours direct labor at a labor rate of $18 per unit. Desired inventory levels are:

	Jan.	Feb.	Mar.
Beginning inventory			
Finished goods	3,500	3,800	4,500
Direct materials: plastic	4,100	4,500	4,600
Direct materials: dye	10,100	11,300	12,200

Prepare a sales budget, production budget, direct materials budget for silicon and solution, and a direct labor budget.

PB2. LO 7.2 The following data were obtained from the financial records of Sonicbrush, Inc., for March:

Estimated sales	$330,000
Purchases	$179,431
Ending inventory	15%*
Administrative salaries per month	$ 70,200
Marketing expense	3%**
Sales commissions	4%**
Rent expense per month	$ 8,400
Depreciation expense per month	$ 1,200
Utilities per month	$ 2,800
Taxes	15%***

*of next month's sales
**of sales
***of income before taxes

Sales are expected to increase each month by 15%. Prepare a budgeted income statement.

PB3. LO 7.2 TIB makes custom guitars and prepared the following sales budget for the second quarter

	April	May	June
Units	80	86	84
Sales price	$ 1,200	$ 1,200	$ 1,200
Budgeted sales	$96,000	$103,200	$100,800

It also has this additional information related to its expenses:

Direct material per unit $55, Direct labor per hour 20, Variable manufacturing overhead per hour 3.50, Fixed manufacturing overhead per month 3,000, Sales commissions per unit 20, Sales salaries per month 5,000, Delivery expense per unit 0.50, Utilities per month 4,000, Administrative salaries per month 20,000, Marketing expenses per month 8,000, Insurance expense per month 11,000, Depreciation expense per month 9,000.

Prepare a sales and administrative expense budget for each month in the quarter ended June 30, 2018.

PB4. LO 7.2 Prepare a budgeted income statement using the information shown.

Sales units	84,000
Sales price per unit	$ 22
Uncollectible expense	1%
Direct material per unit	$ 1.50
Direct labor hours per unit	0.8
Direct labor rate per hour	$ 19
Manufacturing overhead	$14,000
Variable sales and administration expenses per unit sold	$ 2.10
Fixed sales and administration expenses	$23,000
Taxes	15%*

*of income before taxes

PB5. LO 7.2 Sunshine Gardens overhead expenses are:

Indirect material pounds per unit	0.50
Indirect material cost per pound	$ 1.00
Indirect labor hours	1.00
Indirect labor rate per hour	$ 16.50
Variable maintenance per unit	$ 0.75
Variable utilities per unit	$ 0.20
Supervisor salaries	$10,000
Maintenance salaries	$ 9,000
Insurance	$ 3,000
Depreciation	$ 1,500

Given production of 10,200; 11,300; 12,900; and 13,200 for each quarter of the next year, prepare a manufacturing overhead budget for each quarter.

PB6. LO 7.3 Relevant data from the operating budget of The Framers are:

	Quarter 1	Quarter 2
Sales	$33,948	$76,482
Direct material purchases	25,312	26,423
Direct labor	29,948	24,328
Manufacturing overhead	9,322	10,299
Selling and administration	19,283	19,238
Depreciation included in selling and administration	950	800
Collections	34,324	76,938
Cash payments	29,349	20,937
Cash received: other	8,000	500
Dividend	0	500

Other data:

- Capital assets were sold in quarter 1 and $8,000 was collected in quarter 1 and $500 collected in quarter 2.
- Dividends of $500 will be paid in May
- The beginning cash balance was $50,000 and a required minimum cash balance is $10,000.
- Prepare a cash budget for the first two quarters of the year.

PB7. LO 7.3 Fill in the missing information from the following schedules:

Sales Budget
For the Year Ended December 31, 2018

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Expected sales (units)	21,000	26,250	8,750	9,000	65,000
Sales price per unit	?	?	?	?	
Total sales revenue	$315,000	?	?	?	$975,000

Production Budget
For the Year Ended December 31, 2018

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Q1, Year 2
Expected sales	21,000	26,250	8,750	9,000	8,000
Desired ending inventory	5,250	?	?	1,600	0
Total required units	26,250	28,000	10,550	10,600	8,000
– beginning inventory	5,250	5,250	1,750	1,800	1,600
Required production	?	?	?	?	6,400
Total				61,350	

Direct Materials Budget
For the Year Ended December 31, 2018

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Units to be produced	?	?	?	?	61,350
Direct material per unit	2	2	2	2	2
Total pounds needed for production	42,000	45,500	17,600	17,600	122,700
+ desired ending inventory	11,375	?	?	3,200	3,200
Total material required	53,375	49,900	22,000	20,800	125,900
– beginning inventory	0	11,375	4,400	4,400	0
Pounds of direct material purchase requirements	53,375	38,525	17,600	16,400	125,900
Cost per pound	$ 1.5	$ 1.5	$ 1.5	$ 1.5	$ 1.5
Total cost of direct material purchase	$80,063	$57,788	$26,400	$ 24,600	$188,850
Total				$188,850	$188,850

Direct Labor Budget
For the Year Ended December 31, 2018

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Units to be produced	?	?	?	?	?
Direct labor hours per unit	0.75	0.75	0.75	0.75	0.75
Total required direct labor hours	15,750	17,063	6,600	6,600	46,013
Labor cost per hour	$ 25	?	?	?	?
Total direct labor cost	$393,750	$426,563	$165,000	$165,000	$1,150,313

PB8. LO 7.3 Mesa Aquatics, Inc. estimated direct labor hours as 1,900 in quarter 1, 2,000 in quarter 2, 2,200 in quarter 3, and 1,800 in quarter 4. a sales and administration budget using the information provided.

Indirect material per hour	$1.00	Supervisory salaries	$17,000
Indirect labor per hour	1.25	Maintenance	5,000
Maintenance per hour	0.25	Property taxes and insurance	6,000
Utilities per hour	0.50	Depreciation	3,500

PB9. LO 7.3 Amusement tickets estimated sales are:

January	$231,837
February	231,937
March	381,274
April	212,947
May	282,172
June	281,836

What are the balances in accounts receivable for April, May, and June if 60% of sales are collected in the month of sale, 30% are collected the month after the sale, and 10% are collected the second month after the sale?

PB10. LO 7.3 All Temps has a policy of always paying within the discount period, and each of its suppliers provides a discount of 2% if paid within 10 days of purchase. Because of the purchase policy, 80% of its payments are made in the month of purchase and 20% are made the following month. The direct materials budget provides for purchases of $23,812 in February, $23,127 in March, $21,836 in April, and $28,173 in May. What is the balance in accounts payable for April 30, and May 31?

PB11. LO 7.4 Prepare a flexible budgeted income statement for 47,000 units using the following information from a static budget for 45,000 units:

Sales price per unit	$ 50
Direct material per unit	12
Direct labor per unit	5
Variable manufacturing overhead per unit	3
Fixed manufacturing overhead	25,000
Variable sales and administration expenses per unit	3
Fixed sales and administration expenses	9,000
Taxes	15%*

*of income before taxes

PB12. LO 7.4 Before the year began, the following static budget was developed for the estimated sales of 50,000. Sales are higher than expected and management needs to revise its budget. Prepare a flexible budget for 100,000 and 110,000 units of sales.

Sales	50,000 units
Cost of goods sold	$1,250,000
Direct material	450,000
Direct labor	500,000
Variable manufacturing overhead	125,000
Fixed manufacturing overhead	32,000
Cost of goods sold	$1,107,000
Gross profit	$ 143,000
Variable sales and administration expenses	50,000
Fixed sales and administration expenses	105,000
Income before taxes	(12,000)
Taxes	(1,800)
Net income	($ 10,200)

PB13. LO 7.4 Artic Camping Gear's currently sells 35,000 units at $73 per unit. Its expenses are as follows:

Direct materials per unit	$ 4
Direct labor per unit	7
Variable manufacturing overhead per unit	3
Variable sales and administration expenses per unit	1.50
Fixed manufacturing overhead	21,000
Fixed sales and administration expenses	89,000
Taxes	15%*

*of income before taxes

Management believes it can increase sales by 2,000 units for every $5 decrease in sales price. It also believes the additional sales will allow a decrease in direct material of $1 for each additional 2,000 units. Prepare a flexible budgeted income statement for 35,000-, 37,000-, and 39,000-unit sales.

PB14. LO 7.4 Fruit Tea's data show the following information:

	Aug.	Sept.	Oct.	Nov.	Dec.
Estimated sales (units)	25,000	25,000	27,000	27,500	28,000
Sales price per unit	$ 31	$ 31	$ 31	$ 31	$ 31
Direct labor per unit	$ 1.75	$ 1.75	$ 1.50	$ 1.50	$ 1.50
Labor rate per hour	$ 21	$ 21	$ 24	$ 24	$ 24

New machinery will be added in October. This machine will reduce the labor required per unit and increase the labor rate for those employees qualified to operate the machinery. Finished goods inventory is required to be 20% of the next month's requirements. Direct material requires 2.5 pounds per unit at a cost of $5 per pound. The ending inventory required for direct materials is 20% of the next month's needs. In August, the beginning inventory is 3,750 units of finished goods and 13,125 pounds of materials. Prepare a production budget, direct materials budget, and direct labor budget for the first quarter of the year.

PB15. LO 7.4 Identify the document that contains the information listed in these lines from the budgeted balance sheet shown.

A. Accounts receivable
B. Finished goods inventory
C. Machinery
D. Accumulated depreciation
E. Notes payable
F. Common stock

Assets	
Cash	$ 2,500,000
Accounts receivable	5,381,239
Raw materials inventory	3,149,183
Finished goods inventory	6,239,138
Total current assets	$17,269,560
Property, plant, and equipment	
Computers	$ 150,000
Machinery	9,745,231
Accumulated depreciation	(5,385,733)
Net property, plant, and equipment	$ 4,509,498
Total assets	$21,779,058
Liabilities	
Accounts payable	$ 3,242,938
Notes payable	8,289,722
Total liabilities	$11,532,660
Stockholders' equity	
Common stock	$ 5,000,000
Retained earnings	5,246,398
Total stockholders' equity	$10,246,398
Total liabilities and stockholders' equity	$21,779,058

PB16. LO 7.5 Replenish sells shampoo that removes chlorine from hair. It prepared a static budget for the sales of 10,000 units. These variances were observed:

	Actual Results	Variances	
Sales	$264,000	$66,000	Unfavorable
Variable expenses	70,500	19,500	Favorable
Fixed expenses	70,270	270	Unfavorable
Net income (loss)	123,230	46,770	Unfavorable

Determine the static budget and use the information to prepare a flexible budget and analysis for the 8,000 units actually sold.

Thought Provokers

TP1. LO 7.1 Why is a clear understanding of management's goals and objectives necessary for effective budgets?

TP2. LO 7.1 It is proper budgeting procedure to begin with estimated revenues, but why might some nonprofit entities begin planning their expenditures instead of their revenues?

TP3. LO 7.2 How would a human resources department use information in the operating budgets?

TP4. LO 7.2 How would maintenance departments use information in the budget?

TP5. LO 7.2 How might service industries predict revenue?

TP6. LO 7.4 The management of Hess, Inc., is developing a flexible budget for the upcoming year. It was not pleased with the small amount of net income the budget showed at all sales levels and is contemplating using a less expensive material. This action reduces direct material cost by $1 per unit. What would be the effects on financial statements and a flexible budget if management takes this approach? Are there other factors that need to be considered?

TP7. LO 7.4 When would a static budget be effective in evaluating a manager's performance?

TP8. LO 7.5 If management is being evaluated on their ability to manage a budget, what can they do to increase cash flow?

TP9. LO 7.5 If management is being evaluated on their ability to manage a budget, what can they do to decrease cash outflow?