CHAPTER 9

Cost Allocation for Joint Products and By-Products

LEARNING OBJECTIVES

After completing this chapter, you should be able to answer the following questions:

1. How are the outputs of a joint process classified?
2. At what point in a joint process are joint products identifiable?
3. What management decisions must be made before a joint process is begun?
4. How are joint costs allocated to products?
5. How are by-products treated in accounting systems?
6. How should not-for-profit organizations account for joint costs?

INTRODUCING

Buckhead Beef Company

http://www.buckheadbeef.com

Buckhead Beef Company, headquartered in Atlanta, is the largest provider of Certified Angus Beef™ in the United States. Howard Halpern cofounded the company in 1983, and the company currently has revenues approaching $300 million.

Approximately 75 percent of Buckhead Beef's sales are select, choice, and prime grades of steak. The rest of the company's sales are pork, veal, lamb, game meats and birds, provisions, deli meats, and seafood.

Buckhead's truck fleet delivers products to customers in the southeastern and northeastern states, and through a distribution center in Puerto Rico, serves the Caribbean market. In addition, however, through the company's steakhouse accounts, it achieves nationwide distribution. Customers also include hotels, country clubs, upscale retail outlets, and a small number of prestigious, well-established grocery stores.

The company's strength results, to some extent, from combining the expertise of an in-house cut shop with the efficiency of a large-scale distributor. Buckhead uses energy-efficient equipment in its USDA inspected plant and a state-of-the-art computerized bar coding system. This system allows the company to track products from the time they are processed at the packing plant to the time they are aged, portion-cut, vacuum-packed, and delivered to customers. The bar codes contain information on cost per pound and historical data such as production line and packaging date. Restaurant managers are particularly delighted with this technology. Buckhead has an open-book policy with its customers and sells on a true cost-plus basis.

SOURCE: Adapted from Bob Swientek, "A Cut Above," *Prepared Foods* (October 1998), Rising Stars feature section. Reprinted with permission of Cahners Business Information.

Almost every company produces and sells more than one type of product. Although companies may engage in multiple production processes to manufacture a variety of products, they may also engage in a single process to simultaneously generate various different outputs such as those of Buckhead Beef and its customers (meat processors cut, segment, process, and package meats from a side of beef). In a like manner, the refining of crude oil may produce gasoline, motor oil, heating oil, and kerosene. A single process in which one product cannot be manufactured without producing others is known as a **joint process**. Such processes are common in the extractive, agricultural, food, and chemical industries. The costs incurred for materials, labor, and overhead during a joint process are referred to as the **joint cost** of the production process.

joint process

joint cost

This chapter discusses joint processes, their related product outputs, and the accounting treatment of joint cost. Outputs of a joint process are classified based on their revenue-generating ability, and joint cost is allocated only to the primary products of a joint process, using either a physical or monetary measure. Although joint cost allocations are necessary to determine financial statement valuations, such allocations should not be used in internal decision making.[1]

Joint costs may also be incurred in service businesses and not-for-profit organizations. Such costs in these organizations are often for advertisements that publicize different product lines or locations, or ads for different purposes, such as public service information and requests for donations. Joint costs of not-for-profit firms are covered in the last section of this chapter.

[1] Sometimes, correct pricing of a product depends on knowledge of the full cost of making the product, particularly when contractual agreements require cost-plus pricing. Joint cost allocation is also necessary to the valuation of products, estimation of product line profitability, and (in some cases) determination of product selling price.

OUTPUTS OF A JOINT PROCESS

1

How are the outputs of a joint process classified?

A joint process simultaneously produces more than one product line. The product categories resulting from a joint process that have a sales value are referred to as (1) joint products, (2) by-products, and (3) scrap. **Joint products** are the *primary* outputs of a joint process; each joint product individually has substantial revenue-generating ability. Joint products are the primary reason management undertakes the production process yielding them. These products are also called *primary products, main products,* or *coproducts.*

joint product

Joint products do not necessarily have to be totally different products; the definition of joint products has been extended to include similar products of differing quality that result from the same process. For example, when an oil refinery processes petroleum into gasoline, the outputs will all have been derived from petroleum, but different grades will have more octane and other characteristics based on the extent and types of additional processing.

by-product
scrap

In contrast, **by-products** and **scrap** are incidental outputs of a joint process. Both are salable, but their sales values alone would not be sufficient for management to justify undertaking the joint process. For example, donut hole cutouts are a by-product of the donut-making process. Scrap may be generated in the setup stage. Contractors may tear out old fixtures, cupboards, etc., in remodeling a home. Such items are often resold to other contractors.[2]

waste

By-products are viewed as having a higher sales value than scrap. A final output from a joint process is **waste**, which is a residual output that has no sales value. A normal amount of waste may create a production cost that cannot be avoided in some industries. Alternatively, many companies have learned either to minimize their production waste by changing their processing techniques or to reclassify waste as a by-product or scrap through selling it to generate some minimal amount of revenue.

A company may change a product classification over time because of changes in technology, consumer demand, or ecological factors. Some products originally classified as by-products are reclassified as joint products, whereas some joint products are reduced to the by-product category. Even products originally viewed as scrap or waste may be upgraded to a joint product status. Years ago, for example, the sawdust and chips produced in a lumber mill were considered waste and discarded. These items are now processed further to produce particleboard used in making inexpensive furniture. Therefore, depending on the company, sawdust and chips may be considered a joint product or a by-product. Sometimes a by-product will be accidentally discovered by good fortune. An interesting example is found in the Internet revolution in the News Note on page 345.

http://www.bestfoods.com
http://www.genmills.com
http://www.nestle.com
http://www.perrier.com
http://www.tropicana.com

Classification of joint process output is based on the judgment of company managers, normally after considering the relative sales values of the outputs. Classifications are unique to each company engaged in the joint process. For example, Lazy-K Ranch and Sterling Steers Ltd. each engage in the same joint production process that produces three outputs: meats, bone, and hide. Lazy-K Ranch classifies all three outputs as joint products, whereas Sterling Steers Ltd. classifies meats and hide as joint products; bone is regarded as a by-product. These classifications could have resulted from the fact that Lazy-K Ranch has the facilities to process bone beyond the joint process, but Sterling Steers does not have such facilities. Further processing endows bone with a substantially higher sales value per unit than selling bone as it exits the joint process.

[2] Recycling is a related issue. Now, about 75 percent of a car's weight can be recycled. (Nissan is close to recycling 90 percent.) Companies are working to similarly recycle waste of other products.

GENERAL BUSINESS  **NEWS NOTE**

Can You Believe It?

E-commerce infomediaries are finding that as they mend broken supply chains, one by-product is aggregated purchase data that have never been available before.

Such is the case with Instill Corp., (http://www.instill.com) which provides an e-marketplace for the food-services industry. Last week the company added a new service called Instill Market Intelligence, which offers subscriptions to the purchase data generated by buyers on its systems.

Who is willing to pay its six-figure price tag? Some of the world's largest food manufacturers, including Bestfoods, General Mills, Nestle, Perrier, Schreiber, and Tropicana.

These vendors have never had access to data about the amount of product being purchased by restaurants and other food-services outlets, such as hospitals. That's because sales in the industry are handled by thousands of regional distributors, making it difficult to get an accurate, aggregated view of purchase data—not just shipment figures—across the manufacturer's segments, categories, and products.

Access to that data will now let manufacturers, such as Bestfoods, better manage production, plan new products, and market and sell existing products to the best-suited buyers, according to T.C. Chatterjee, senior business manager at Bestfoods.

"For the first time, we are able to support sales and marketing efforts based on actual operator purchases," said Trevor Farrell, customer supply-chain manager at Schreiber Foods Inc., another Instill subscriber.

"Using the data to standardize the industry is an absolute must as a first step in a fragmented industry," said Forrester Research Inc. (http://www.forrester.com) analyst Bruce Temkin. "To sell the data back to manufacturers is a big win. Over time, distributors will be forced to operate in a more competitive environment, and you'll see more dynamic pricing."

Food manufacturers have long had market-share data from in-store supermarket sales via data providers such as IRI or Neilsen. But in the food-services area, they have relied on educated guesses as to how their products stack up against competitors.

SOURCE: Richard Karpinski, "Infomediary Repackages Sales Data for Vendors," *Internetweek* (September 27, 1999), p. 8.

THE JOINT PROCESS

2

At what point in a joint process are joint products identifiable?

Joint products are typically produced in companies using mass production processes and, thus, a process costing accounting method.[3] The outputs of a corn processing plant, for example, may include corn on the cob and whole-kernel corn (joint products), partial corn kernels (by-product) used for corn meal and grits, inferior kernels (scrap) for sale to producers of animal food, and husks, corn silk, and cobs (waste) that are discarded. Exhibit 9–1 illustrates the output of such a joint process.

split-off point

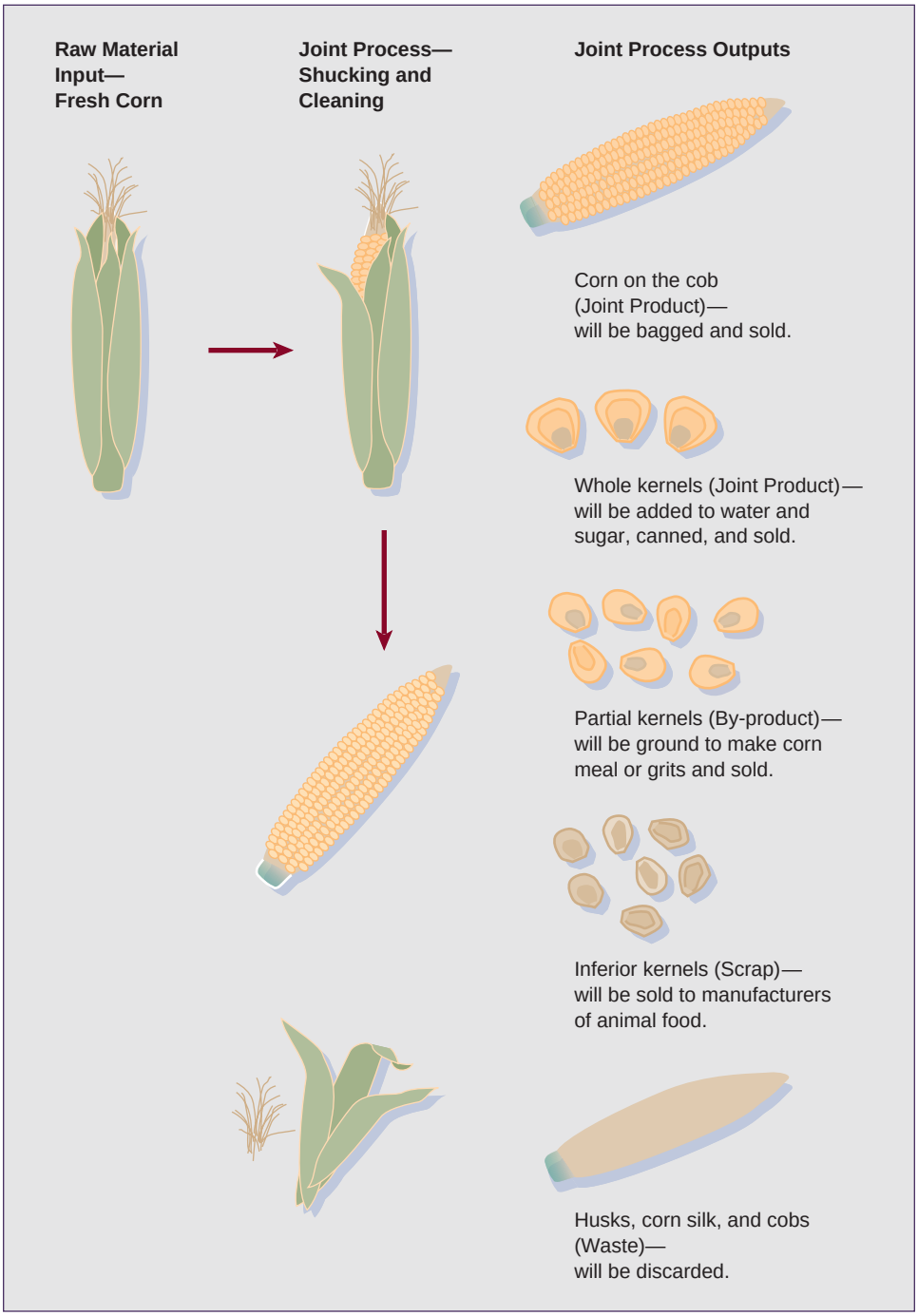
The point at which joint process outputs are first identifiable as individual products is called the **split-off point**. A joint process may have one or more split-off points, depending on the number and types of output produced. Output may be sold at the split-off point if a market exists for products in that condition. Alternatively, some or all of the products may be processed further after exiting the joint process.

Joint cost includes all costs incurred up to the split-off point for direct material, direct labor, and overhead. Joint cost is allocated, at the split-off point, to only the joint products because these products are the reason that management undertook the production process. Allocation is necessary because of the *cost principle.* Joint cost is a necessary and reasonable cost of producing the joint products and, therefore, should be attached to them. Although necessary for valuation purposes

[3] For simplicity, Chapters 6 and 7 on process costing included examples of only single-product processes.

EXHIBIT 9–1

Illustration of Joint Process Output



sunk cost

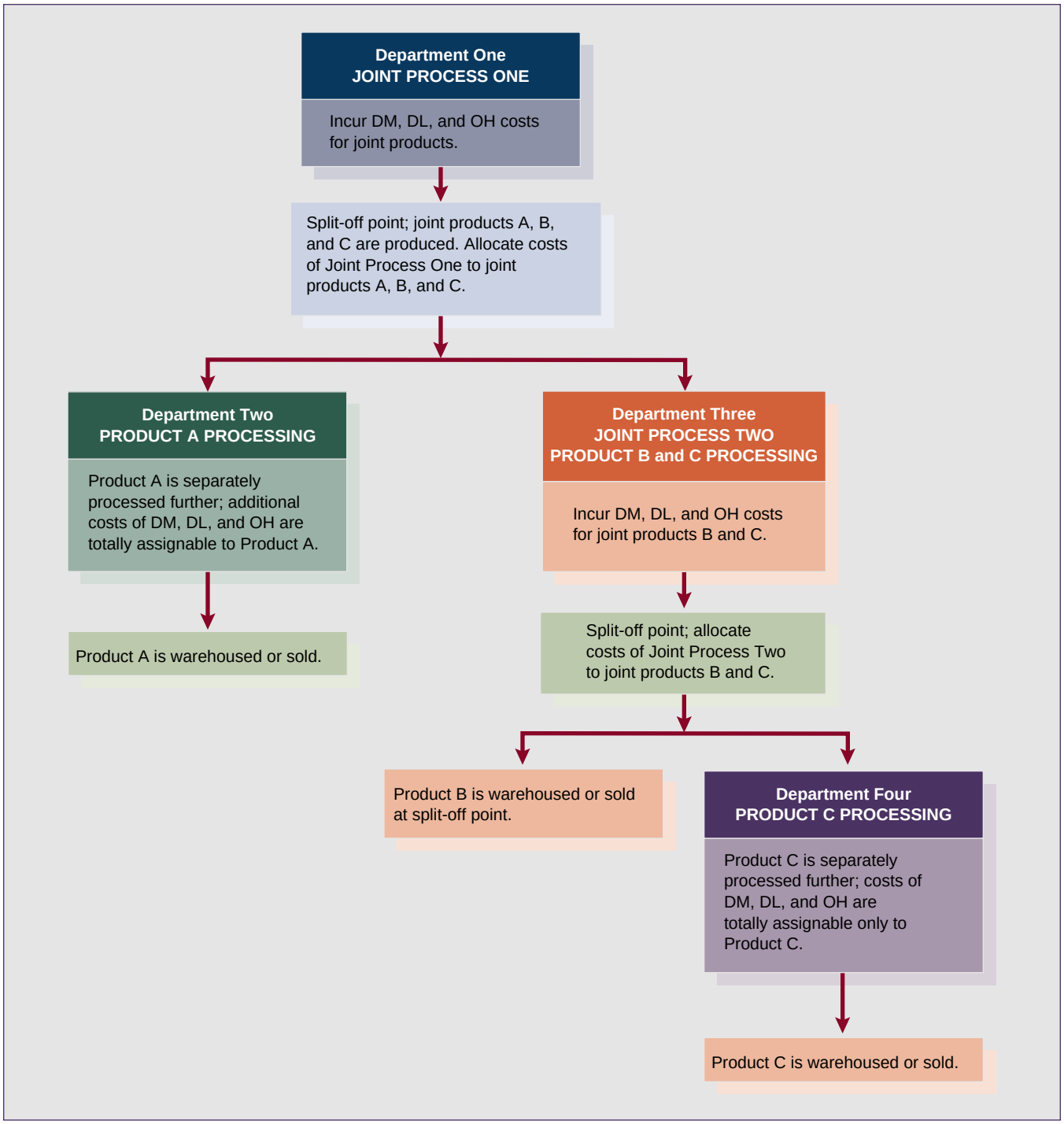
for financial statements, the joint cost allocation to joint products is, however, not relevant to decision making. Once the split-off point is reached, the joint cost has already been incurred and is a **sunk cost** that cannot be changed regardless of what future course of action is taken.

If any of the joint process outputs are processed further, additional costs after split-off will be incurred. Any costs after split-off are assigned to the separate products for which those costs are incurred. Exhibit 9–2 depicts a joint process with multiple split-off points and the allocation of costs to products. For simplicity, all output of this joint process is considered primary output; there are no by-products, scrap, or waste. Note that some of the output of Joint Process One (joint

products B and C) becomes part of the direct material for Joint Process Two. The joint cost allocations will follow products B and C into Joint Process Two for accounting purposes, but these allocated costs should not be used in making decisions about further processing in that department or in Department Four. Such decisions should be made *only after* considering whether the expected additional revenues from further processing are greater than the expected additional costs of further processing.

EXHIBIT 9–2

Model of a Joint Process



MANAGEMENT DECISIONS REGARDING JOINT PROCESSES

3

What management decisions must be made before a joint process is begun?

Certain decisions need to be made by company managers before committing resources to a joint production process. First, total expected revenues from the sale of the joint process output must be estimated and compared to total expected processing costs of the output. If the revenues are expected to exceed the costs, management must then consider other potential costs. Because the joint process results in a "basket" of products, managers must be aware that some of the joint process output may require additional processing to make it salable. Once joint process costs have been incurred, they become sunk costs regardless of whether the output is salable at the end of the joint process or at what amount. Thus, management must consider total joint costs plus expected separate processing and/or selling costs incurred at or after the end of the joint process in making the decision about whether to commit resources to the joint process.

If total anticipated revenues from the "basket" of products exceed the anticipated joint and separate costs, the second management decision must be made. Managers must compare the net income from this use of resources to that which would be provided by all other alternative uses of company resources. If joint process net income were greater than would be provided by other uses, management would decide that this joint production process is the best use of capacity and would begin production.

The next two decisions are made at split-off. The third decision is to determine how the joint process output is to be classified. Some output will be primary; other output will be considered to be by-product, scrap, or waste. This classification decision is necessary for the joint cost to be allocated, because *joint cost is only assigned to joint products*. However, before allocation, joint cost may be reduced by the value of the by-products and scrap. Determination of by-product and scrap value is discussed later in the chapter.

The fourth decision is the most complex. Management must decide whether any (or all) of the joint process output will be sold at split-off or whether it will be processed further. If primary products are marketable at split-off, further processing should only be undertaken if the value added to the product, as reflected by the incremental revenue, exceeds the incremental cost. If a primary product is not marketable at split-off, additional costs *must* be incurred to make that product marketable. For nonprimary output, management must also estimate whether the incremental revenue from additional processing will exceed additional processing cost. If there is no net benefit, the nonmarketable output should be disposed of without further processing after the split-off point.

To illustrate a further-processing decision, assume that a whole turkey has a selling price of $0.18 per pound at split-off, but the minimum selling price for turkey parts after further processing is $0.23 per pound. If the additional processing cost is less than $0.05 per pound, the $0.05 incremental revenue ($0.23 − $0.18) exceeds the incremental cost, and additional processing should occur. Note that the joint cost is not used in this decision process. The joint cost is a sunk cost after it has been incurred, and the only relevant items in the decision to process further are the incremental revenue and incremental cost.

Exhibit 9–3 presents the four management decision points in a joint production process. In making decisions at any potential point of sale, managers must have a valid estimate of the selling price of each type of joint process output. Expected selling prices should be based on both cost and market factors. In the long run, assuming that demand exists, the selling prices and volumes of products must be sufficient to cover their total costs. However, immediate economic influences on setting selling prices, such as competitors' prices and consumers' sensitivity to price changes, cannot be ignored when estimating selling prices and forecasting revenues.

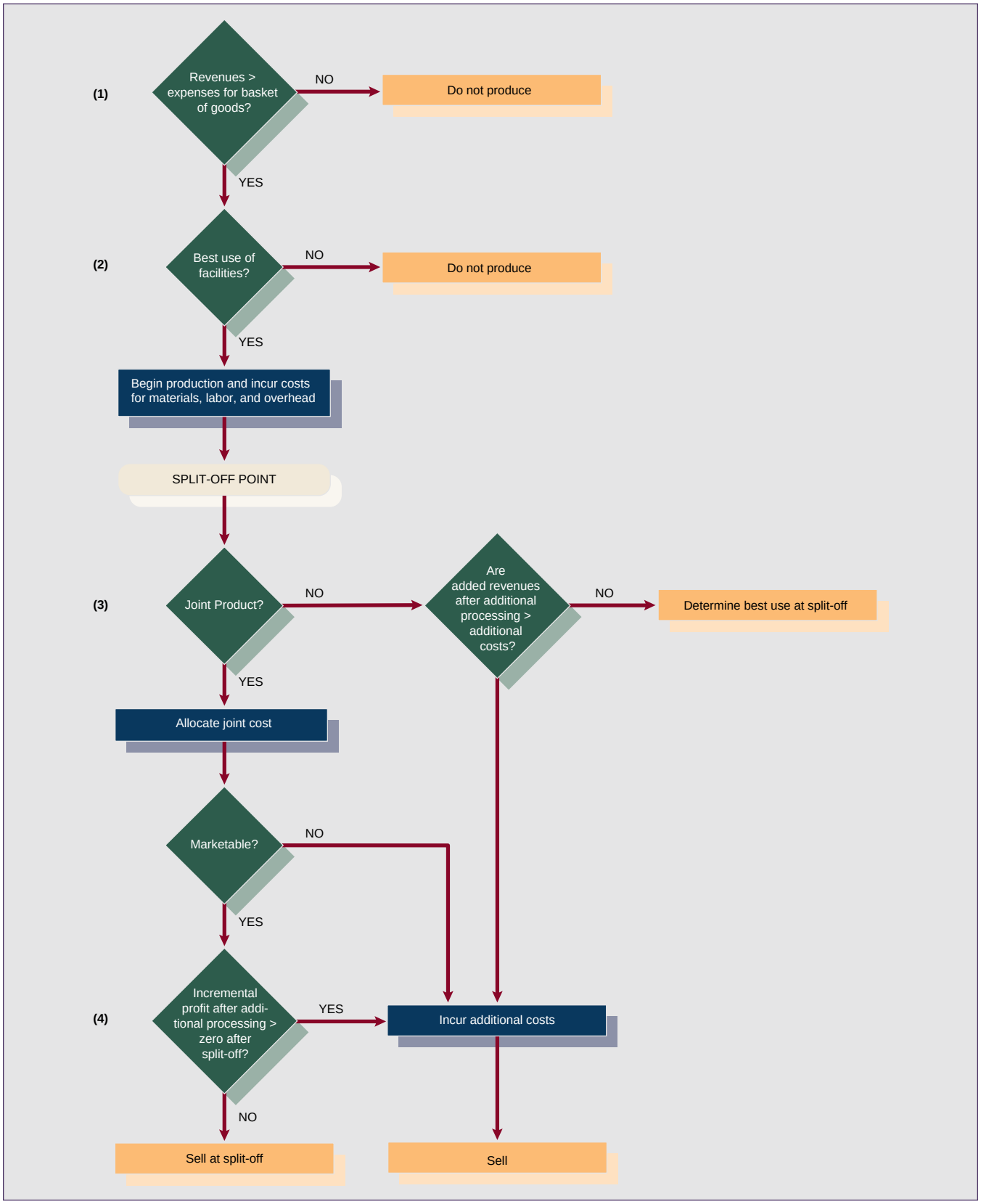


EXHIBIT 9–3

Decision Points in a Joint Production Process

Melted wax can be made into scented or unscented candles as well as into candles of different sizes and shapes, with or without a container. The cost of getting the wax to this stage is a joint cost that should be allocated among the types of products to be manufactured.

ALLOCATION OF JOINT COST

4

How are joint costs allocated to products?

Delectable Edibles Company is used to demonstrate alternative methods of allocating joint processing cost. Because the consumer market for large portions of large farm animals is limited, Delectable Edibles processes sides of beef into three distinct primary products during a joint process: steaks, roasts, and ground meat. (The remaining parts are considered by-products.) All joint products can be sold at split-off. Alternatively, each beef product can be processed further, which will create additional separate costs for the products. Steaks can be processed further to produce steak sandwiches; roasts can be processed further to make special cuts; and ground meat can be processed further to be used as part of a sausage mixture. Certain marketing and disposal costs for advertising, commissions, and transportation are incurred regardless of when the products are sold. Assumed information on Delectable Edibles' processing operations and joint products for October 2000 is presented in Exhibit 9–4.

Physical Measure Allocation

physical measurement allocation

An easy, objective way to prorate joint cost at the split-off point is through the use of a physical measure. **Physical measurement allocation** uses a common physical

EXHIBIT 9–4

Basic Joint Cost Information

Joint processing cost for period: $5,400,000

(1) Joint Products	(2) Tons of Production	(3) Sales Price per Ton at Split-Off	(4) Selling Cost per Ton Regardless of When Sold	(5) Separate Cost per Ton if Processed Further	(6) Final Sales Price per Ton
Steaks	3,800	$2,800	$200	$100	$3,200
Roasts	2,400	1,800	100	100	2,100
Ground	2,800	1,200	50	60	1,500

characteristic of the joint products as the proration base. All joint products must be measurable by the same characteristic, such as

- tons of ore in the mining industry,
- linear board feet in the lumber milling industry,
- barrels of oil in the petroleum refining industry,
- tons of meat, bone, and hide in the meat packing or processing industry, or
- number of computer chips in the semiconductor industry.

Using physical measurement allocation, Delectable Edibles' $5,400,000 of joint cost is assigned as shown in Exhibit 9–5. For Delectable Edibles, physical measurement allocation would assign a cost of approximately $600 ($5,400,000 ÷ 9,000 tons) per ton of beef, regardless of type.

Physical measurement allocation treats each unit of output as equally desirable and assigns the same per-unit cost to each. Also, unlike monetary measures, physical measures provide an unchanging yardstick of output.[4] A ton of output produced from a process 10 years ago is the same measurement as a ton produced from that process today. Physical measures are useful in allocating joint cost to products that have extremely unstable selling prices. These measures are also necessary in rate-regulated industries that use cost to determine selling prices. For example, assume that a rate-regulated company has the right to set selling price at 20 percent above cost. It is circular logic to allocate joint cost based on selling prices that were set based on cost to produce the output.

A major disadvantage of allocating joint cost based on a physical measure is that the method ignores the revenue-generating ability of individual joint products. Products that weigh the most or that are produced in the largest quantity will receive the highest proportion of joint cost allocation—regardless of their ability to bear that cost when they are sold. In the case of Delectable Edibles, each ton of ground has been assigned a cost of $600. However, computations will demonstrate that ground generates the lowest gross profit of the three joint products and yet is being assigned the same joint cost per ton as the more desirable steaks and roasts.

Monetary Measure Allocation

All commonly used allocation methods employ a process of proration. Because of the simplicity of the physical measure allocation process, a detailed proration

EXHIBIT 9–5

Joint Cost Allocation Based on Physical Measurement

Cost per Physical Measure = Total Joint Cost ÷ Total Units of Physical Measurement
= $5,400,000 ÷ 9,000 tons = $600

Joint Product	Cost per Ton	Total per Ton	Allocated Cost
Steaks	3,800	$600	$2,280,000
Roasts	2,400	600	1,440,000
Ground	2,800	600	1,680,000
Total	9,000		$5,400,000

[4] There are occasional exceptions to the belief that physical measures provide an unchanging yardstick of output. To illustrate, many grocery products have been downsized in recent years. For example, coffee was formerly sold in one-pound containers; now it is customarily sold in 13-ounce packages.

scheme was unnecessary. However, the following steps can be used to prorate joint cost to joint products in the more complex monetary measure allocations:

1. Choose a monetary allocation base.
2. List the values that comprise the base for each joint product.
3. Sum the values in step 2 to obtain a total value for the list.
4. Divide each individual value in step 2 by the total in step 3 to obtain a numerical proportion for each value. The sum of these proportions should total 1.00 or 100 percent.[5]
5. Multiply the joint cost by each proportion to obtain the amount to be allocated to each product.
6. Divide the prorated joint cost for each product by the number of equivalent units of production for each product to obtain a cost per EUP for valuation purposes.

The primary benefit of monetary measure allocations over physical measure allocations is that the former recognizes the relative ability of each product to generate a profit at sale.[6] A problem with monetary measure allocations is that the basis used is not constant or unchanging. Because of fluctuations in general and specific price levels, a dollar's worth of output today is different from a dollar's worth of output from the same process five years ago. However, accountants customarily ignore price level fluctuations when recording or processing data; in effect, this particular flaw of monetary measures is not usually viewed as significant.

Three of the many monetary measures that can be used to allocate joint cost to primary output are presented in this text. These measures are sales value at split-off, net realizable value at split-off, and approximated net realizable value at split-off.

SALES VALUE AT SPLIT-OFF

sales value at split-off allocation

The **sales value at split-off allocation** assigns joint cost to joint products based solely on the relative sales values of the products at the split-off point. Thus, to use this method, all joint products must be marketable at split-off. Exhibit 9–6 shows how Delectable Edibles' joint cost is assigned to production using the sales value at split-off allocation method. Under this method, the low selling price per ton of ground, relative to the other joint products, results in a lower allocated cost per ton than resulted from the physical measure allocation technique. This process uses a weighting technique based on both quantity produced and selling price of production.

EXHIBIT 9–6

Joint Cost Allocation Based on Sales Value at Split-Off

Joint Product	Tons	Selling Price	Revenue	Decimal Fraction	Joint Cost	Amount Allocated	Cost per Ton
Steaks	3,800	$2,800	$10,640,000	0.58	$5,400,000	$3,132,000	$824.21
Roasts	2,400	1,800	4,320,000	0.24	5,400,000	1,296,000	540.00
Ground	2,800	1,200	3,360,000	0.18	5,400,000	972,000	347.14
Total	9,000		$18,320,000	1.00		$5,400,000	

[5] Using decimal fractions often requires rounding. Greater precision can be obtained by simply dividing each step 2 value by the step 3 value, leaving the result in the calculator, and multiplying that resulting value by the total joint cost.

[6] Monetary measures are more reflective of the primary reason a joint process is undertaken: profit. Physical base allocations are sometimes of dubious value because they are based on the flawed assumption that all physical units are equally desirable.

NET REALIZABLE VALUE AT SPLIT-OFF

net realizable value at split-off allocation

The **net realizable value at split-off allocation** method assigns joint cost based on the joint products' proportional net realizable values at the point of split-off. Net realizable value (NRV) is equal to product sales revenue at split-off minus any costs necessary to prepare and dispose of the product. This method requires that all joint products be marketable at the split-off point, and it considers the additional costs that must be incurred at split-off to realize the estimated sales revenue. The costs at split-off point for Delectable Edibles' products are shown in the fourth column of Exhibit 9–4. The net realizable value of each product is computed by subtracting the cost at split-off from the selling price at split-off. The $5,400,000 joint cost is then assigned based on each product's relative proportion of total net realizable value (Exhibit 9–7). This method provides an allocated product cost that considers the disposal costs that would be necessitated if the product were to be sold at split-off.

APPROXIMATED NET REALIZABLE VALUE AT SPLIT-OFF

approximated net realizable value at split-off allocation

incremental separate cost

Often, some or all of the joint products are not salable at the split-off point. For these products to be sold, additional processing must take place after split-off, causing additional costs to be incurred. Because of this lack of marketability at split-off, neither the sales value nor the net realizable value approach can be used. **Approximated net realizable value at split-off allocation** requires that a *simulated* net realizable value at the split-off point be calculated.[7] This approximated value is computed on a per-product basis as final sales price minus incremental separate costs. **Incremental separate costs** refers to all costs that are incurred between the split-off point and the point of sale. The approximated net realizable values are then used to distribute joint cost proportionately. An underlying assumption of this method is that the incremental revenue from further processing is equal to or greater than the incremental cost of further processing and selling. Approximated net realizable values at split-off are determined for each product processed by Delectable Edibles using the information in Exhibit 9–4.

Joint Products	Final Selling Price per Ton	Separate Costs per Ton after Split-Off	Approximated Net Realizable Value at Split-Off
Steaks	$3,200	$300	$2,900
Roasts	2,100	200	1,900
Ground	1,500	110	1,390

Further processing should be undertaken only if the incremental revenues will exceed the incremental costs.[8] These computations are shown on the next page.

EXHIBIT 9–7

Joint Cost Allocation Based on Net Realizable Value at Split-Off

Joint Product	Tons	Unit Net Realizable Value per Ton	Total Net Realizable Value	Decimal Fraction	Joint Cost	Amount Allocated	Cost per Ton
Steaks	3,800	$2,600	$ 9,880,000	0.57	$5,400,000	$3,078,000	$810.00
Roasts	2,400	1,700	4,080,000	0.24	5,400,000	1,296,000	540.00
Ground	2,800	1,150	3,220,000	0.19	5,400,000	1,026,000	366.43
Total	9,000		$17,180,000	1.00		$5,400,000	

[7] Another name for this method is the "artificial net realizable value at split-off allocation."
[8] Because some products will not be processed further, the approximated NRV at split-off method sometimes cannot be used by itself and is combined with the NRV at split-off method to form a hybrid method.

Joint Products	Final Sales Price	Sales Price at Split-Off	Cost per Ton at Split-Off	Cost per Ton after Split-Off
Steaks	$3,200	$2,800	$200	$300
Roasts	2,100	1,800	100	200
Ground	1,500	1,200	50	110

Joint Products	Incremental Revenue	Incremental Cost	Difference
Steaks	$400	$100	$300
Roasts	300	100	200
Ground	300	60	240

The previous information shows that Delectable Edibles will be better off if all of the joint products are processed further than if they are sold at split-off. For all products, the incremental revenues from further processing exceed the incremental costs beyond split-off. The same conclusion can be reached by comparing the net realizable values at split-off with the approximated net realizable values at split-off, as follows:

Joint Products	Net Realizable Value at Split-Off	Approximated Net Realizable Value at Split-Off	Difference
Steaks	$2,600	$2,900	$300
Roasts	1,700	1,900	200
Ground	1,150	1,390	240

The decisions made about further processing affect the values used to allocate joint cost in the approximated net realizable sales value method. If one or more products will not be processed further because it is uneconomical to do so, the value base used for allocation of joint cost will be a mixture of actual and approximated net realizable values at split-off. Products that will not be processed further will be valued at their actual net realizable values at split-off; products that will be processed further are valued at approximated net realizable values at split-off. However, using a mixed base is unnecessary in this case because all products are to be processed further. Delectable Edibles' $5,400,000 joint cost is allocated among the products as shown in Exhibit 9–8.

Each of the physical and monetary measures discussed allocates a different amount of joint cost to joint products and results in a different per-unit cost for each product. Each method has advantages and disadvantages. For most companies, approximated net realizable value at split-off provides the best joint cost assignment. This method is the most flexible in that no requirements exist about similar

EXHIBIT 9–8

Joint Cost Allocation Based on Approximated Net Realizable Value at Split-Off

Joint Products	Tons	Approximated Net Realizable Value per Ton	Total Approximated Net Realizable Value	Decimal Fraction	Joint Cost	Amount Allocated	Cost per Ton
Steaks	3,800	$2,900	$11,020,000	0.57	$5,400,000	$3,078,000	$810.00
Roasts	2,400	1,900	4,560,000	0.23	5,400,000	1,242,000	517.50
Ground	2,800	1,390	3,892,000	0.20	5,400,000	1,080,000	385.71
Total	9,000		$19,472,000	1.00		$5,400,000	

measurement bases (pounds, tons, etc.) or actual marketability at split-off. It is, however, more complex than the other methods, because estimations must be made about additional processing costs and potential future sales values.

The values obtained from the approximated net realizable value at split-off allocation method are used to illustrate cost flows in a joint cost environment. Delectable Edibles has four production departments: (1) Meat Processing, (2) Steak Filleting Production (using selected cuts of steak), (3) Marinating Cuts Production (using roasts), and (4) Sausage Production (using ground). Work performed in each of the second, third, and fourth departments creates finished products that have been further processed beyond the split-off point. All of the rest of the production in the Meat Processing Department, referred to as First Cuts, Roasts, and Ground, is sold immediately at the split-off point. Delectable Edibles uses FIFO costing and had the following finished goods inventories at the beginning of April:

Filet mignon	260 tons @ $900 per ton	$234,000
Marinated cuts	280 tons @ $580 per ton	162,400
Sausage	300 tons @ $420 per ton	126,000

During April, the company incurred separate costs for Filets, Marinated Cuts, and Sausage of $186,000, $122,000, and $83,406, respectively. All of the products started into processing in April were also completed during that month. The company sold the following quantities of products in April:

Product	Quantity	Sales Price per Ton	Total Sales Price (Cash)
First cut steaks	1,794 tons	$2,800	$ 5,023,200
Roasts	1,160 tons	1,800	2,088,000
Ground	1,260 tons	1,200	1,512,000
Filet mignon	1,986 tons	3,400	6,752,400
Marinated cuts	1,220 tons	2,200	2,684,000
Sausage	1,500 tons	1,500	2,250,000
Totals	8,920		$20,309,600

The April 2000 journal entries for Delectable Edibles Company are shown in Exhibit 9–9 on page 356. The ending balances of Delectable Edibles' three finished goods accounts are computed as follows:

	TONS		
	Filets	Marinated Cuts	Sausage
Beginning inventory	260	280	300
Tons completed (assumed)	2,006	1,240	1,540
Tons available	2,266	1,520	1,840
Tons sold	1,986	1,220	1,500
Ending inventory	280	300	340
× FIFO unit costs	$ 902.72[a]	$ 615.89[b]	$ 439.87[c]
EI valued at FIFO costs	$252,762	$184,767	$149,556

[a]($186,000 ÷ 2,006 tons) + $810.00 allocated joint cost = $902.72
[b]($122,000 ÷ 1,240 tons) + $517.50 allocated joint cost = $615.89
[c]($83,406 ÷ 1,540 tons) + $385.71 allocated joint cost = $439.87 (rounded)

These ending inventory unit values represent approximate actual costs of production.

Prorating joint cost provides necessary inventory valuations for manufacturing companies. However, the allocation process may be influenced by the net realizable values of the other possible outputs of a joint process—by-products and scrap.

EXHIBIT 9–9

Journal Entries for April 2000

(1)	Work in Process Inventory—Meat Processing	5,400,000	
	Supplies Inventory		185,714
	Wages Payable		3,900,000
	Manufacturing Overhead		1,314,286
	To record joint process costs incurred in April 2000; credit amounts are assumed.		
(2)	Work in Process Inventory—Filets	1,624,860	
	Work in Process Inventory—Marinated Cuts	641,700	
	Work in Process Inventory—Sausage	594,000	
	Work in Process Inventory—Meat Processing		2,860,560
	To allocate some of the joint cost incurred in Meat Processing to other departments for filleting, marinating, and making sausage.		
(3)	Work in Process Inventory—Filets	186,000	
	Work in Process Inventory—Marinated Cuts	122,000	
	Work in Process Inventory—Sausage	83,406	
	Various accounts		391,406
	To record separate costs for further processing incurred in the Filets, Marinated Cuts, and Sausage Production Departments.		
(4)	Finished Goods Inventory—First Cuts	1,453,140	
	Finished Goods Inventory—Roasts	600,300	
	Finished Goods Inventory—Ground	486,000	
	Finished Goods Inventory—Filets	1,810,860	
	Finished Goods Inventory—Marinated Cuts	763,700	
	Finished Goods Inventory—Sausage	677,400	
	Work in Process Inventory—Meat Processing		2,539,440
	Work in Process Inventory—Filets		1,810,860
	Work in Process Inventory—Marinating		763,700
	Work in Process Inventory—Sausage		677,400
	To transfer 9,000 tons of meats to finished goods status: (1,794 tons of First Cuts × $810.00), (1,160 tons of Roasts × $517.50), (1,260 tons of Ground × $385.714), (2,006 tons of Filets—$1,624,860 + $186,000), (1,240 tons of marinated cuts—$641,700 + $122,000), and (1,500 tons of sausage—$594,000 + $83,400).		
(5)	Cash	20,309,600	
	Sales		20,309,600
	To record cash sales.		
(6)	Cost of Goods Sold	5,726,721	
	Finished Goods Inventory—First Cuts		1,453,140
	Finished Goods Inventory—Roasts		600,300
	Finished Goods Inventory—Ground		486,000
	Finished Goods Inventory—Filets		1,792,098
	Finished Goods Inventory—Marinated Cuts		741,333
	Finished Goods Inventory—Sausage		653,850
	To record cost of goods sold on a FIFO basis.		
(7)	Selling Expenses	1,132,000	
	Cash		1,132,000
	To record selling expenses ($200 × 3,780) + ($100 × 2,380) + ($50 × 2,760). (Actual costs are assumed to equal estimated selling costs shown in Exhibit 9–4.)		

ACCOUNTING FOR BY-PRODUCTS AND SCRAP

5

How are by-products treated in accounting systems?

Because the distinction between by-products and scrap is one of degree, these categories have been discussed together by presenting several of the many treatments found in practice. The appropriate choice of method depends on the magnitude of the net realizable value of the by-products/scrap and the need for additional processing after split-off. As the sales value of the by-product/scrap increases, so does the need for inventory recognition. Sales value of the by-products/scrap is generally recorded under either the (1) net realizable value approach or (2) realized value approach. These approaches are discussed in the following sections using additional data for Ballad Beef Company, which considers cow hooves (sold as dog chews) as a by-product. Data for April 2000 are shown in Exhibit 9–10.

EXHIBIT 9–10

April 2000 Data for By-Product

Total processing for month: 9,000 tons of beef

Cow hooves (by-product) included in production: 25,000 pounds
Selling price of cow hooves: $1 per pound
Processing costs per pound of cow hooves: $0.10 for labor and $0.05 for overhead
Net realizable value per pound of cow hooves: $0.85

Net Realizable Value Approach

net realizable value approach

Use of the **net realizable value** (or offset) **approach** requires that the net realizable value of the by-product/scrap be treated as a reduction in the joint cost of manufacturing primary products. This method is normally used when the net realizable value of the by-product or scrap is expected to be significant.

Under the net realizable value approach, an inventory value is recorded that equals the selling price of the by-product/scrap produced minus the related processing, storing, and disposing costs. Any income remaining after covering these costs is used to reduce the joint cost of the main products. Any loss generated by the by-product/scrap is added to the cost of the main products. The credit for this Work in Process Inventory debit may be to one of two accounts. First, under the indirect method, Cost of Goods Sold for the joint products is reduced when the by-product/scrap is generated and joint products are sold:

Work in Process Inventory—Cow hooves	21,250	
Cost of Goods Sold—Main Products		21,250

When additional costs are incurred:

Work in Process Inventory—Cow hooves	3,750	
Various accounts		3,750

When by-product is completed:

Finished Goods Inventory—Cow hooves	25,000	
Work in Process Inventory—Cow hooves		25,000

When by-product is sold:

Cash (or Accounts Receivable)	25,000	
Finished Goods Inventory—Cow hooves		25,000

This technique may result in a slight mismatching of costs if by-products are created in a different period from when joint products are sold. Also, inventory values for the main products will be slightly overstated.

Alternatively, under the direct method, the work in process (WIP) joint cost of the primary products is reduced by the net realizable value of the by-product/scrap produced. Reducing WIP joint cost causes the costs of the primary products to be lowered for both cost of goods sold and inventory purposes. Thus, the only change in the preceding journal entries would be on the date the by-product was generated. The direct approach journal entry at that time is

Work in Process Inventory—Cow hooves	21,250	
Work in Process Inventory—Main Products		21,250

The major advantage of the direct approach is timing. The reduction in main products' joint cost is accomplished simultaneously with production of the main products. The disadvantage of this approach is that it is less conservative than waiting to record revenues until the by-product or scrap is actually sold, as does the realized value approach presented in the next section.

By-products and scrap may have sales potential beyond that currently known to management. Although reducing joint cost by the net realizable value of by-products/scrap is the traditional method of accounting for these goods, it is not necessarily the best method for managerial decision making.

Financial accounting methods used are frequently not geared toward providing information useful to management of by-products. By-products can be treated as either having no assignable cost or as having costs equal to their net sales value. However, in cases in which management considers the by-product to be a moderate source of income, the accounting and reporting methods used should help managers monitor production and further processing of the by-product and make effective decisions regarding this resource.[9]

The net realizable value method does not indicate the sales dollars, expenses, or profits from the by-product/scrap and, thus, does not provide sufficient information to induce management to maximize the inflows from by-product/scrap disposal.

Realized Value Approach

realized value approach

Under the **realized value** (or other income) **approach**, no value is recognized for the by-products/scrap until they are sold. This method is the simplest approach to accounting for by-products/scrap. Several reporting techniques can be used with the realized value approach. One presentation shows total sales of the by-product/scrap on the income statement under an "Other Revenue" caption. Costs of additional processing or disposal of the by-product/scrap are included with the cost of producing the main products. This presentation provides little useful information to management because the costs of producing the by-products/scrap are not matched with the revenues generated by those items.

For the Ballad Beef Company, the entries under the "Other Revenue" method are as follows when labor and overhead costs are incurred:

Work in Process Inventory—Joint Products	2,500	
Manufacturing Overhead	1,250	
Various accounts		3,750
To record the labor cost of grinding and of overhead charges to WIP Inventory for cow hooves (all included in the cost of joint products).		

At point of sale:

Cash (or Accounts Receivable)	25,000	
Other Revenue		25,000
To record sale of cow hooves.		

[9] Advances in technology and science have turned many previous "scrap" items or "by-products" into demand products. Management should not ignore the significance of such products and should seek new uses or markets for them.

Another presentation shows by-product/scrap revenue on the income statement net of additional costs of processing and disposal. This method presents the net by-product revenue as an enhancement of net income in the period of sale under an "Other Income" caption. Such a presentation allows management to recognize the dollar benefit added to company income by managing the costs and revenues related to the by-products/scrap. The entries for the processing and sale of the by-products/scrap under this method for the Ballad Beef Company are as follows when labor and overhead costs are incurred:

Work in Process Inventory—Cow hooves	3,750	
Various accounts		3,750
To record the labor cost of grinding and of overhead charges for cow hooves; this assumes that overhead charges are applied to WIP (with a corresponding credit to Manufacturing Overhead included in the various accounts).		

At point of sale:

Cash (or Accounts Receivable)	25,000	
Work in Process Inventory—Cow hooves		3,750
Other Income		21,250
To record sale of cow hooves net of processing/disposal costs.		

Because the "Other Income" method matches by-product/scrap revenue with related storage, further processing, transportation, and disposal costs, this method provides detailed information on financial responsibility and accountability for disposition, provides better control, and may improve performance. Managers are more apt to look for new or expanded sales potential because the net benefits of doing so are shown directly on the income statement.

Other alternative presentations include showing the realized value from the sale of the by-product/scrap as (1) an addition to gross margin, (2) a reduction of the cost of goods manufactured, or (3) a reduction of the cost of goods sold. The major advantage of these simplistic approaches is that of clerical efficiency.

Regardless of whether a company uses the net realizable value or the realized value approach, the specific method used to account for by-product/scrap should be established before the joint cost is allocated to the primary products. Exhibit 9–11 presents four comparative income statements using different methods of accounting for by-product income for the Ballad Beef Company. Some assumed amounts have been included to provide complete income statements.

EXHIBIT 9–11

Comparative Income Statement By-Product Presentations

(a)
Net Realizable Approach: Reduce CGS

Sales		$6,200,000
Cost of goods sold		
Beginning FG	$ 400,000	
CGM	3,600,000	
CGA	$4,000,000	
Ending FG	(380,000)	
Unadjusted CGS	$3,620,000	
NRV of by-product	(21,250)	(3,598,750)
Gross margin		$2,601,250
Operating expenses		(2,600,000)
Income from principal operations		$ 1,250
Other income		
Commissions		80,000
Income before income taxes		$ 81,250

(b)
Net Realizable Approach: Reduce CGM

Sales		$6,200,000
Cost of goods sold		
Beginning FG	$ 400,000	
CGM ($3,600,000 − $21,250)	3,578,750	
CGA	$3,978,750	
Ending FG [assumed to be smaller than under (a)]	(377,690)	(3,601,060)
Gross margin		$2,598,940
Operating expenses		(2,600,000)
Loss from principal operations		$ (1,060)
Other income		
Commissions		80,000
Income before income taxes		$ 78,940

(continued)

(c)
Net Realized Value Approach: Increase Revenue

Sales		$6,200,000
Other revenue		
By-product sales		25,000
Total revenue		$6,225,000
Cost of goods sold		
Beginning FG	$ 400,000	
CGS (main products)	3,600,000	
CGS (processing by-product)	3,750	
CGA	$4,003,750	
Ending FG	(380,000)	(3,623,750)
Gross margin		$2,601,250
Operating expenses		(2,600,000)
Income from principal operations		$ 1,250
Other income		
Commissions		80,000
Income before income taxes		$ 81,250

(d)
Net Realized Value Approach: Present as Other Income

Sales		$6,200,000
Cost of goods sold		
Beginning FG	$ 400,000	
CGM	3,600,000	
CGA	$4,000,000	
Ending FG	(380,000)	(3,620,000)
Gross margin		$2,580,000
Operating expenses		(2,600,000)
Loss from principal operations		$ (20,000)
Other income		
Commissions	$ 80,000	
By-product sales (NRV)	21,250	101,250
Income before income taxes		$ 81,250

EXHIBIT 9–11

(Concluded)

By-products, scrap, and waste are created in all types of businesses, not just manufacturing. Managers may not see the need to determine the cost of these secondary types of products. However, as discussed in Chapters 7 and 8, the importance of cost of quality information has only recently been recognized. Many companies are becoming aware of the potential value of scrap as a substantial source of revenue and are devoting time and attention to exploiting it. Sometimes old dreams of using scrap take on new energy as technology progresses. The accompanying News Note on page 361 is an example.

BY-PRODUCTS OR SCRAP IN JOB ORDER COSTING

Although joint products normally are not associated with job order costing systems, these systems may have by-products or scrap. Either the realized value approach or the net realizable value approach can be used with regard to the timing of recognition of the value of by-product/scrap.

The value of by-product/scrap in a job order system is appropriately credited to either manufacturing overhead or to the specific jobs in process. The former account is credited if by-product/scrap value is generally created by a significant proportion of all jobs undertaken. In contrast, if only a few or specific jobs generate a substantial amount of by-product/scrap, then individual jobs should be credited with the value because they directly generated the by-product/scrap.

To illustrate, assume that Versatile Foods occasionally prepares special meat-based foods for several large institutional clients. Recently, the company received an order for 20,000 beef patties from the Crestview Senior High School. As the patties are prepared, some scrap meat is generated. During October 2000, Versatile Foods sold $250 of scrap meat to the Canine Catering Corporation. The entry to record the sale, using the realized value approach, is

Cash	250	
Manufacturing Overhead		250

In contrast, assume that Versatile Foods Company seldom has salable scrap on its jobs. However, during October 2000, Versatile Foods contracted with the Green

QUALITY  **NEWS NOTE**

Get a Load of This!

Two of our most pressing concerns are the development of alternatives to our heavy reliance on fossil fuels and nuclear power, and what to do with the waste that we continue to generate in ever increasing amounts.

Working on the "where there's muck, there's brass" principle, three power stations in the eastern counties of England have taken this to a logical conclusion. Bernard Matthews and producers of his ilk have an awful lot of poultry, which in turn produce copious amounts of waste. This waste has traditionally been ploughed in as manure but the storage and spreading is a messy business. Waterways may become polluted with run-off from fields treated in this way. Given that animals are relatively inefficient converters of the energy in their foodstuff into meat, there is, so far, untapped energy in their manure. Much of the energy still present can be released by burning the stuff.

The technology is not exactly radical and has been refined with each new station built. (Italy is the only other country in on the "poultry power" act.) Its environmentally friendly credentials are good, producing less of the gases that contribute to acid rain compared to burning coal, gas or oil. Although the greenhouse gas CO_2 is released, this is not an additional load to the atmosphere, as it represents gas absorbed during photosynthesis by the plants which then became foodstuff or bedding for the poultry.

Together, the three stations have a power output of just under 65 megawatts (65 million watts). This would satisfy the electricity demand of a town the size of Nottingham. The power output is modest compared to the 1,000 MW plus of an average coal-fired or nuclear power station, but is not a bad return on 3/4 million tons of poultry waste each year. An ash by-product is marketed as a fertilizer, making the whole enterprise even more economically viable.

Despite the "green" credentials and a secure, plentiful supply of poultry litter, we are unlikely to see many more poultry waste power stations built. This is not because of the cost of building them or any political considerations, but for an altogether more pragmatic reason. The stench of burning poultry manure is not even an acquired taste. Think of the "country smell" that townies find so abhorrent and then imagine it a hundred times worse. Give me a nuclear power station in my backyard any day.

SOURCE: Anonymous, "Poultry Poo," www.zyworld.com/frncs/Poultry_Poo (December 31, 1999) p. 1.

Cove Convalescent Centers to prepare 25,000 frozen chicken croquettes. Specific raw material had to be acquired for the job because Versatile Foods normally does not process chicken. Thus, all raw material costs will be charged directly to the Green Cove Convalescent Centers. As the chicken is prepared for the order, some scraps are generated that can be sold to the Chicken Soup Cannery for $375. Because the cost of the material is directly related to this job, the sale of the scrap from that raw material also relates to the specific job. Under these circumstances, the production of the scrap is recorded (using the net realizable value approach) as follows:

Scrap Inventory—Chicken	375	
Work in Process Inventory—Green Cove Centers		375

In this case, the net realizable value approach is preferred because of the timing of recognition. To affect the specific job cost that caused an unusual incidence and amount of scrap, it may be necessary to recognize the by-product/scrap on production; otherwise, the job may be completed before a sale of the by-product/scrap can be made.

Manufacturing processes frequently create the need to allocate costs. However, some costs incurred in service businesses and not-for-profit organizations may be allocated among product lines, organizational locations, or types of activities performed by the organizations.

JOINT COSTS IN SERVICE AND NOT-FOR-PROFIT ORGANIZATIONS

6

How should not-for-profit organizations account for joint costs?

Service and not-for-profit organizations may incur joint costs for advertising multiple products, printing multipurpose documents, or holding multipurpose events. For example, not-for-profit entities often issue brochures containing information about the organization, its purposes, and its programs; simultaneously, these documents make an appeal for funds.

If a service business decides to allocate a joint cost, either a physical or monetary allocation base can be chosen. Joint costs in service businesses often relate to advertisements rather than to processes. For example, a local bicycle and lawnmower repair company may advertise a sale and list all store locations in a single newspaper ad. The ad cost could be allocated equally to all locations or be based on sales volume for each location during the period of the sale. Alternatively, a grocery delivery service may deliver several customers' orders on the same trip. The cost of the trip could be allocated based on the number of bags or the pounds of food delivered for each customer.

Service businesses may decide that allocating joint costs is not necessary. Not-for-profit organizations, however, are required under the American Institute of Certified Public Accountants (AICPA) Statement of Position (SOP) 98-2 to allocate joint costs among the activities of fundraising, accomplishing an organizational program, or conducting an administrative function.[10] A major purpose of SOP 98-2 is to ensure that external users of financial statements are able to clearly determine amounts spent by the organization for various activities—especially fundraising. Thus, SOP 98-2 provides guidance on allocating and reporting these costs.

http://www.arthurandersen.com

[10] AICPA Accounting Standards Executive Committee, *Statement of Position 98-2: Accounting for Costs of Activities of Not-for-Profit Organizations and State and Local Governmental Entities That Include Fund Raising* (effective for years beginning on or after December 15, 1998).

REVISITING

Buckhead Beef Company

http://www.buckheadbeef.com

To ensure customer satisfaction, Buckhead Beef employs Executive Chef Ray Farmer to assist clients. Also, about one-third of the company's 50-person sales team have culinary degrees.

Howard Halpern says of his company, "We are the back of the house for our customers who trust us to buy the right animal from the right part of the country and then to handle it properly. We either hold the meat to age it properly or send it to our cut shop for further processing."

Such is the role of Buckhead's skilled meat cutters. Managers at the company attribute their success in recruiting and training quality employees to wages above industry standards, offering a career not just a job, an impressive safety record, and antidrug and antiharassment policies.

The company also enjoys strong ties to its suppliers by treating its packers as partners. Buckhead buys truckload volumes of carcasses and boxed beef on contract, spot buying, and price programs. This keeps costs lower.

Halpern proudly discussed Buckhead's significant investment in 1998 in a special high-quality process for preparing beef when he said, "Last year we instituted a dry-aging process, which improves the flavor, juiciness and tenderness of our steaks up to 50%."

Buckhead Beef was chosen as an official supplier to the 1996 Atlanta Olympic Games. It was honored with an Atlanta 100 Award for the highest one-year growth from Arthur Andersen. The company was also recognized with the 1996 and 1997 National Beef Backer Award from the National Cattleman's Beef Association.

SOURCE: Adapted from Bob Swientek, "A Cut Above," *Prepared Foods* (October 1998), Rising Stars feature section; and Barbara Young-Huguenin, "Aged to Perfection," *The National Provisioner* (1998).

CHAPTER SUMMARY

Multiple products from a joint process are defined (based on market value) as joint products, by-products, and scrap. A residual product that has no market value is called waste. Joint process cost is allocated solely to joint products. However, before the allocation is made, the joint cost may be reduced by the net realizable value of by-products and/or scrap. Costs incurred after the split-off point(s) are traced directly to the products with which those costs are associated.

A multiple product setting has four decision points: (1) two before the joint process is started, (2) at a split-off point, and (3) after a split-off point. At any of these points, management should consider further processing only if it believes that the incremental revenues from proceeding will exceed the incremental costs of proceeding. How joint cost was allocated is irrelevant to these decisions because the joint cost is considered sunk and, therefore, unrecoverable.

All the commonly used techniques for allocating joint process cost to the joint products use proration. Allocation bases are classified as either physical or monetary. Physical measures provide an unchanging yardstick of output over time and treat each unit of product as equally desirable. Monetary measures, because of inflation, are a changing yardstick of output over time, but these measures consider the different market values of the individual joint products.

The realized value approach to accounting for by-products and scrap ignores the value of such output until it is sold. At that time, either revenue is recorded or by-product/scrap selling price is used to reduce the joint cost of production. Alternatively, when by-products or scrap are generated, the net realizable value of the by-products/scrap at the split-off point can be recorded in a special inventory account, and the production cost of the primary products can be reduced. Additional processing costs for the by-product/scrap are debited to the special inventory account. Regardless of the approach used, if joint cost is to be reduced by the value of the by-product/scrap, the method and value to be used must be determined before allocating the net joint processing cost to the primary products.

Joint costs can also be incurred in service businesses and not-for-profit organizations for some types of processes or for things such as communications instruments (brochures, media advertisements) that serve multiple purposes. Service businesses may allocate joint costs if they so desire. Not-for-profits must allocate joint costs among fundraising, program, and/or administrative activities based on some reasonable measure, such as percentage of space or time.

KEY TERMS

approximated net realizable value at split-off allocation (p. 353)
by-product (p. 344)
incremental separate cost (p. 353)
joint cost (p. 343)
joint process (p. 343)
joint product (p. 344)
net realizable value approach (p. 357)
net realizable value at split-off allocation (p. 353)
physical measurement allocation (p. 350)
realized value approach (p. 358)
sales value at split-off allocation (p. 352)
scrap (p. 344)
split-off point (p. 345)
sunk cost (p. 346)
waste (p. 344)

SOLUTION STRATEGIES

Allocation of Joint Cost

Joint cost is allocated only to joint products; however, joint cost can be reduced by the value of by-product/scrap before the allocation process begins.

For physical measure allocations: Divide joint cost by the products' total physical measurements to obtain a cost per unit of physical measure.

For monetary measure allocation:

1. Choose an allocation base.
2. List the values that comprise the allocation base for each joint process.
3. Sum the values in step 2.
4. Calculate the decimal fraction of value of the base to the total of all values in the base. The decimal fractions so derived should add to 100 percent or 1.00.
5. Multiply the total joint cost to be allocated by each of the decimal fractions to separate the total cost into prorated parts.
6. Divide the prorated joint cost for each product by the number of equivalent units of production for each product to obtain a cost per EUP for valuation purposes.

Allocation bases, measured at the split-off point, by which joint cost is prorated to the joint products include the following:

Type of Measure	Allocation Base
Physical output	Physical measurement of units of output (e.g., tons, feet, barrels, liters)
Monetary:	Currency units of value:
Sales value	Revenues of the several products
Net realizable value	Net realizable value of the several joint products
Approximated net realizable value	Approximated net realizable value of the several joint products (may be a hybrid measure)

DEMONSTRATION PROBLEM

Rolling Meadow Farms incurred $65,000 of production cost in 2000 in a joint process to grow a crop with two joint products, Alpha and Beta. The following are data related to 2000 operations:

(1) Joint Products	(2) Tons of Production	(3) Sales Price per Ton at Split-Off	(4) Per Ton Separate Costs if Sold at Split-Off	(5) Per Ton Separate Costs if Processed Further	(6) Per Ton Final Sales Price
Alpha	45	$ 950	$ 50	$236	$1,450
Beta	20	1,200	110	200	1,600

Required:

a. Allocate the joint process cost to Alpha and Beta using tons as the allocation base.

b. Allocate the joint process cost to Alpha and Beta using the sales values at split-off.

c. Allocate the joint process cost to Alpha and Beta using the net realizable values at split-off.

d. Allocate the joint process cost to Alpha and Beta using the approximated net realizable values at split-off.

Solution to Demonstration Problem

a. $65,000 ÷ 65 tons = $1,000 per ton

Product	Tons of Production	Cost per Ton	Allocation of Joint Cost
Alpha	45	$1,000	$45,000
Beta	20	1,000	20,000
Total	65		$65,000

b.

Product	Tons of Production	Sales Price at Split-Off	Sales Value	Decimal Fraction	Joint Cost	Allocation of Joint Cost
Alpha	45	$ 950	$42,750	0.64	$65,000	$41,600
Beta	20	1,200	24,000	0.36	65,000	23,400
Total	65		$66,750	1.00		$65,000

c.

Product	Tons of Production	Per Ton NRV at Split-Off	Total NRV at Split-Off	Decimal Fraction	Joint Cost	Allocation of Joint Cost
Alpha	45	$ 900	$40,500	0.65	$65,000	$42,250
Beta	20	1,090	21,800	0.35	65,000	22,750
Total	65		$62,300	1.00		$65,000

d.

Product	Tons of Production	Per Ton Approximated NRV	Total Approximated NRV	Decimal Fraction	Joint Cost	Allocation of Joint Cost
Alpha	45	$1,164	$52,380	0.67	$65,000	$43,550
Beta	20	1,290	25,800	0.33	65,000	21,450
Total	65		$78,180	1.00		$65,000

QUESTIONS

1. What is a joint production process? If managers wanted to produce only one of the main outputs of a joint process, could they? Explain. Give several examples of joint processes.
2. What are joint products, by-products, and scrap? How do they differ? Which of these product categories provides the greatest incentive or justification to produce?
3. How does management determine into which category to classify each type of output from a joint process? Is this decided before or after production?
4. When do the multiple products of a joint process gain separate identity? Does the joint process stop there?
5. How are separate costs distinguished from joint costs?
6. To which type of joint process output is joint cost allocated? Why? Is all of the joint process cost allocated to that type of output?
7. What are the decision points associated with multiple products? By what criteria would management assess whether to proceed at each point?
8. What is cost allocation and why is it necessary in a joint process? Can you think of any other situations in which accountants allocate costs?
9. What are the two primary methods used to allocate joint cost to joint products? Compare the advantages and disadvantages of each.
10. Why is it sometimes necessary to use approximated rather than actual net realizable values at split-off to allocate joint cost? How is this approximated value calculated?

11. Describe two common approaches used to account for by-products. Which do you think is best and why?

12. When are by-product or scrap costs considered in setting the predetermined overhead rate in a job order costing system? When are they not considered?

13. Why must not-for-profit organizations allocate joint costs among fundraising, program, and administrative activities?

14. Go to the Internet and find a discussion about the number of potential outputs of a peanut crop. Report your findings along with examples. Examine the relationship of your findings to accounting for joint products, by-products, and scrap.

EXERCISES

15. *(Terminology)* Match the following lettered terms on the left with the appropriate numbered description on the right.

a. Approximated sales value at split-off method
b. By-product
c. Incremental separate costs
d. Joint cost
e. Joint process
f. Joint product
g. Monetary measure allocation
h. Net realizable value
i. Physical measure allocation
j. Proration
k. Realized value approach
l. Sales value at split-off method
m. Scrap
n. Split-off point
o. Sunk cost
p. Waste

1. Proration of joint cost on nonmonetary basis
2. Proration of joint cost on basis of dollar values
3. Calculation employed by all commonly used allocation methods
4. Cost incurred to produce several products at the same time in one process
5. Residual output with no sales value
6. Production process yielding more than one product
7. Output that has sales value less than that of a by-product
8. Proration of joint cost on the basis of relative sales values of joint products at split-off
9. Material, labor, and overhead incurred in a joint process
10. Additional costs incurred between split-off point and sale
11. A cost that cannot change, no matter what course of future action is taken
12. Incidental output with value greater than scrap
13. Primary output of a joint process
14. Point at which outputs first become identifiable as individual products
15. A method that does not recognize by-product value until sale
16. Selling price less costs to complete and dispose

16. *(Joint process decision making)* Andrew Berwick has been asked by his aged aunt to take over the family butcher shop. Andrew has learned that you are majoring in accounting—he majored in art—and asks you to help him understand the butcher shop business. He wants you to do the following:

a. Explain, in nontechnical terms, what questions about joint processes someone who manages a butcher shop must answer. Also, indicate the points in a joint process at which these questions should be addressed.

b. Describe, in your own words, the proper managerial use of a joint cost; also, describe whether a joint cost may be used inappropriately and the basis on which you think a particular use is inappropriate.
c. Compare and contrast the various categories of outputs generated by a joint process.

17. *(Physical and sales value allocations)* Scott Community College runs two noncredit evening programs. During 2000, the following operating data were generated:

	Small Business Management	Introduction to Internet
Class hours taught	4,000	2,000
Hourly tuition	$5	$15

The general ledger accounts show $37,000 for direct instructional costs and $5,000 for overhead associated with these two programs. The Board of Trustees wants to know the cost of each program.
a. Determine the cost of each program using a physical measurement base.
b. Determine the cost of each program using the sales value at split-off method.
c. Make a case for each allocation method from parts (a) and (b).

18. *(Physical measure allocation)* Patterson Chemical Company uses a joint process to manufacture two chemicals. During October 2000, the company incurred $12,000,000 of joint production cost in producing 12,000 tons of Chemical A and 8,000 tons of Chemical B (a ton is equal to 2,000 pounds). Joint cost incurred by the company is allocated on the basis of tons of chemicals produced. Patterson Chemical is able to sell Chemical A at the split-off point for $0.50 per pound, or the chemical can be processed further at a cost of $1,500 per ton and then sold for $1.50 per pound. There is no opportunity for the company to further process Chemical B.
a. What amount of joint cost is allocated to Chemical A and to Chemical B?
b. If Chemical A is processed further and then sold, what is the incremental effect on Patterson Chemical Company's net income? Should the additional processing be performed?

19. *(Allocation of joint cost)* Nova Scotia Fish Processors produces three products from a common input: fish, fish oil, and fish meal. For June 2001, the firm produced the following average quantities of each product from each pound of fish processed:

Product	Obtained from Each Pound of Fish
Fish	8 ounces
Fish oil	4 ounces
Fish meal	2 ounces
Total	14 ounces

Note that 2 ounces of each pound (1 pound = 16 ounces) of fish processed is waste that has no market value. In June, the firm processed 50 tons of fish (one ton is equal to 2,000 pounds). Joint cost amounted to $95,200. On average, each pound of fish sells for $3; each pound of fish oil sells for $4; and each pound of fish meal sells for $2.
a. Allocate the joint cost using weight as the basis.
b. Allocate the joint cost using sales value as the basis.
c. Discuss the advantages and disadvantages of your answers to parts (a) and (b).

20. *(Sales value allocation)* Elsie Dairy produces milk and sour cream from a joint process. During May, the company produced 120,000 quarts of milk and 160,000 pints of sour cream. Sales value at split-off point was $50,000 for the

milk and $110,000 for the sour cream. The milk was assigned $21,600 of the joint cost.

a. Using the sales value at split-off approach, what was the total joint cost for May?

b. Assume, instead, that the joint cost was allocated based on units (quarts) produced. What was the total joint cost incurred in May?

21. *(Net realizable value allocation)* Galaxy Communications is a broadband network and television company. The firm has three service groups: Communications, News, and Entertainment. Joint production costs (costs incurred for facilities, administration, and other) for May 2000 were $12,000,000. The revenues and separate production costs of each group for May follow:

	Communications	News	Entertainment
Revenues	$18,000,000	$15,000,000	$95,000,000
Separate costs	17,000,000	8,000,000	55,000,000

a. What amounts of joint cost are allocated to each service group using the net realizable value approach? Compute the profit for each group after the allocation.

b. What amount of joint cost is allocated to each service group if the allocation is based on revenues? Compute the profit for each group after the allocation.

c. Assume you are head of the Communications Group. Would the difference in allocation bases create significant problems for you when you report to Galaxy Communications' board of directors? Develop a short presentation to make to the board if the allocation base in part (b) is used to determine group relative profitability. Be certain to discuss important differences in revenues and cost figures between the Communications and Entertainment groups.

22. *(Approximated net realizable value method)* Avignon Parfum Compagnie makes three products that can either be sold, or processed further and then sold. The cost associated with the Avignon joint process is $120,000.

Product	Units of Output	Sales Prices at Split-Off	Separate Costs after Split-Off	Final Sales Price
Product 1	7,500	$3.00	$1.00	$4.25
Product 2	10,000	2.00	0.50	3.00
Product 3	12,500	2.00	0.75	3.00

Per unit, Product 1 weighs 3 ounces, Product 2 weighs 2 ounces, and Product 3 weighs 3 ounces. Assume that all additional processing is undertaken.

a. Allocate the joint cost based on the units of output, weight, and approximated net realizable values at split-off.

b. Assume all products are additionally processed and completed. At the end of the period, the inventories are as follows: Product 1, 500 units; Product 2, 1,000 units; Product 3, 1,500 units. Determine the values of the inventories based on answers obtained in part (a).

23. *(Processing beyond split-off and cost allocations)* Planetary Products has a joint process that makes three products. Joint cost for the process is $30,000.

Product	Units of Output	Per Unit Selling Price at Split-Off	Incremental Processing Costs	Final Sales Price
Sun	5,000	$2.00	$1.50	$3.00
Moon	10,000	1.00	2.00	6.00
Mars	250	1.50	0.20	1.80

Sun, Moon, and Mars weigh 10 pounds, 6 pounds, and 2 pounds, respectively.

a. Determine which products should be processed beyond the split-off point.

b. Determine whether Mars should be treated as a by-product. Allocate the joint processing cost based on units produced, weight, and approximated net realizable value at split-off. Use the net realizable value method in accounting for any by-products.

24. *(Sell or process further)* A certain joint process yields two joint products, A and B. The joint cost for May 2001 is $20,000, and the sales value of the output at split-off is $120,000 for Product A and $100,000 for Product B. Management is trying to decide whether to process the products further. If the products are processed beyond split-off, the final sales value will be $180,000 for Product A and $140,000 for Product B. The additional costs of processing are expected to be $40,000 for A and $34,000 for B.

a. Should management process the products further? Show computations.

b. Were any revenues and/or costs irrelevant to the decision? If so, what were they and why were they irrelevant?

25. *(Processing beyond split-off)* Crews Cannery makes three products in a single joint process. For 2000, the firm processed all three products beyond the split-off point. The following data are generated for the year:

Joint Product	Final Revenues	Incremental Separate Costs
Candied peaches	$62,000	$26,000
Peach jelly	74,000	38,000
Peach jam	27,000	15,000

Analysis of 2000 market data reveals that these three products could have been sold at split-off for $40,000, $40,000, and $10,000, respectively.

a. Evaluate, based on hindsight, management's production decisions in 2000.

b. How much additional profit could the company have generated in 2000 with a better ability to forecast prices?

26. *(Net realizable value method)* Ankara Processing produces three seafood products in a single process. The joint cost is $32,000.

Product	Units Produced	Unit Costs at Split-Off	Selling Price
X	9,000	$0.75	$4.00
Y	10,000	1.00	4.25
Z	1,000	0.10	0.50

a. Allocate the joint cost based on net realizable value at split-off. If necessary, use the net realizable value method for accounting for any by-products.

b. Determine the value of the inventory, assuming the following finished goods inventories:

Product	Units
X	600
Y	900
Z	54

27. *(By-product accounting method selection)* Your company engages in joint processes that produce significant quantities and types of by-products. You have been requested by the chairman of your company's board of directors to give a report to the board regarding making a good choice of accounting methods for by-products. Develop a set of criteria for making such a choice and provide reasons why each of the criteria has been selected. On the basis of your criteria, along with any additional assumptions you may wish to provide

about the nature of your company, recommend a particular method of accounting for by-products and explain why you consider it to be better than the alternatives.

28. *(Monetary measure allocation)* Marianna Realty has two operating divisions: Leasing and Sales. In March 2001, the firm spent $100,000 for general company promotions (as opposed to advertisements promoting specific properties). Sally Savoie, the corporate controller, is now faced with the task of fairly allocating the promotion costs to the two operating divisions.

Sally has reduced the potential bases for allocating the promotion costs to two alternatives: the expected revenue to be generated from the promotions for each division, or the expected profit to be generated from the promotions in each division.

The promotions are expected to have the following effects on the two divisions:

	Leasing	Sales
Increase in revenue	$800,000	$1,600,000
Increase in net income before allocated promotion costs	150,000	100,000

a. Allocate the total promotion costs to the two divisions using change in revenue.
b. Allocate the total promotion costs to the two divisions using change in net income before joint cost allocation.
c. Which of the two approaches is most appropriate? Explain.

29. *(By-products and cost allocation)* Bayshore Manufacturing has a joint process that yields three products: M, N, and O. The company allocates the joint cost to the products on the basis of pounds of output. A particular joint process run cost $115,000 and yielded the following output by weight:

Product	Weight in Pounds
M	4,800
N	13,000
O	4,200

The run also produced by-products having a total net realizable value of $15,000. The company records by-product inventory at the time of production. Allocate the joint cost to the joint products.

30. *(Sell or process further)* Midwest Clothing produces three products (precut fabrics for hats, shirts, and pants) from a joint process. Joint cost is allocated on the basis of relative sales value at split-off. Rather than sell the products at split-off, the company has the option to complete each of the products. Information related to these products is shown below:

	Hats	Shirts	Pants	Total
Number of units produced	5,000	8,000	3,000	16,000
Joint cost allocated	$87,000	?	?	$180,000
Sales values at split-off point	?	?	$40,000	$300,000
Additional costs of processing further	$13,000	$10,000	$39,000	$62,000
Sales values after all processing	$150,000	$134,000	$105,000	$389,000

a. What amount of joint cost should be allocated to the Shirts and Pants products?
b. What are the sales values at split-off for Hats and Shirts?
c. Which products should be processed further? Show computations.
d. If 4,000 Shirts are processed further and sold for $67,000, what is gross profit on the sale?

31. *(By-products and cost allocation)* Bergen Productions produced two different movies from the same original footage (joint products). The company also generated revenue from admissions paid by fans touring the movie production set. Bergen regards the net income from tours as a by-product of movie production. The firm accounts for this income as a reduction in the joint cost before that joint cost is allocated to movies. The following information pertains to the two movies:

Products	Total Receipts	Separate Costs
Movie 1	$ 4,000,000	$ 2,400,000
Movie 2	27,000,000	18,600,000
Tours	300,000	140,000

The joint cost incurred to produce the two movies was $8,000,000. Joint cost is allocated based on net realizable value.

a. How much of the joint cost is allocated to each movie?

b. How much profit was generated by each movie?

32. *(Accounting for by-products)* Clark Textiles Company manufactures various wood products that yield sawdust as a by-product. The only costs associated with the sawdust are selling costs of $6 per ton sold. The company accounts for sales of sawdust by deducting sawdust's net realizable value from the major product's cost of goods sold. Sawdust sales in 2000 were 12,000 tons at $40 each. If Clark Textiles changes its method of accounting for sawdust sales to show the net realizable value as other revenue (presented at the bottom of the income statement), how would its gross margin be affected?

33. *(Accounting for by-products)* A by-product produced from processing potatoes into the joint products of frozen potato patties and potatoes for dehydration is potato skins. Potato skins can be sold to restaurants for use in preparing appetizers. The additional processing and disposal costs associated with such by-product sales are $0.30 per pound of skins. During May 2001, Homestead Potato Processors produced and sold 45,000 pounds of potato skins for $23,850. In addition, joint cost for its dehydrated potatoes and frozen potato patties totaled $60,000, and 80 percent of all joint production was sold for $79,000. Nonfactory operating expenses for May were $7,600.

a. Prepare an income statement for Homestead Potato Processors if sales of the by-product are shown as other revenue and its additional processing and disposal costs are shown as additional cost of goods sold of the joint products.

b. Prepare an income statement for Homestead Potato Processors if the net realizable value of the by-product is shown as other income.

c. Prepare an income statement for Homestead Potato Processors if the net realizable value of the by-product is subtracted from the joint cost of the main products.

d. Which of the above presentations do you think would be most helpful to managers and why?

34. *(Accounting for by-products)* Thompson EDP provides computing services for its commercial clients. Records for clients are maintained on both computer files and paper files. After 7 years, the paper records are sold for recycling material. The net realizable value of the recycled paper is treated as a reduction to operating overhead. Data pertaining to operations for 2000 follow:

Estimated operating overhead	$400,500
Estimated CPU time (hours)	35,000
Estimated net realizable value of recycled paper	$20,400
Actual operating overhead	$399,500
Actual CPU time	34,200
Actual net realizable value of recycled paper	$19,588

a. What was the company's estimated predetermined overhead rate?
b. What journal entry should the company make to record the sale of the recycled paper?
c. What was the company's underapplied or overapplied overhead for 2000?

35. *(Accounting for scrap)* Elegant Mosaics restores antique stained glass windows. Regardless of the job, there is always some breakage or improper cuts. This scrap can be sold to amateur stained glass hobbyists. The following estimates are made in setting the predetermined overhead rate for 2001:

Overhead costs other than breakage		$128,600
Estimated cost of scrap	$8,800	
Estimated sales value of scrap	(2,400)	6,400
Total estimated overhead		$135,000

Elegant Mosaics expects to incur approximately 15,000 direct labor hours during 2001.

One job that Elegant Mosaics worked on during 2001 was a stained glass window of a family crest; the job took 63 hours. Direct materials cost $420; direct labor is invoiced at $20 per hour. The actual cost of the scrap on this job was $55; this scrap was sold for $18.

a. What predetermined overhead rate was set for 2001?
b. What was the cost of the family crest stained glass window?
c. What journal entry is made to record the cost and selling value of the scrap from the family crest stained glass window?

36. *(Scrap, job order costing)* Escambia Architects offers a variety of architectural services for its commercial construction clients. For each major job, architectural models of the completed structures are built for use in presentations to clients. The firm tracks all costs using a job order costing system. At the completion of the job, the architectural models can be sold to an arts and crafts retailer. The firm uses the realized value method of accounting for the sale of the models. The sales value of each model is credited to the cost of the specific job for which the model was built. During 2001, the model for the Barney Building was sold for $4,500.

a. Using the realized value approach, give the entry to record the sale.
b. Independent of your answer to part (a), assume instead that the sales value of the models is not credited to specific jobs. Give the entry to account for the sale of the Barney Building model.

37. *(Net realizable value versus realized value)* Indicate whether each item listed below is associated with the (1) realized value approach or (2) the net realizable value approach.

a. Has the advantage of better timing
b. Ignores value of by-product/scrap until it is sold
c. Is simpler
d. Is used to reduce the cost of main products when by-products are produced
e. Credits either cost of goods sold of main products or the joint cost when the by-product inventory is recorded
f. Presents proceeds from sale of by-products as other revenue or other income
g. Is appropriate if the by-product's net realizable value is small
h. Is less conservative
i. Is the most clerically efficient
j. Should be used when the by-product's net realizable value is large

38. *(Not-for-profit, program, and support cost allocation)* The Grand Rapids Opera Company is preparing a small pamphlet that will provide information on the types of opera, opera terminology, and storylines of some of the more well-known

operas. In addition, there will be a request for funds to support the opera company at the end of the brochure. The company has tax-exempt status and operates on a not-for-profit basis.

The cost of designing and printing 100,000 copies of the pamphlet is $360,000. One page out of ten is devoted to soliciting funding; however, 98% of the time spent in the design stage was on developing and writing the opera information.

a. If space is used as the allocation measure, how much of the pamphlet's cost should be assigned to program activities? To fundraising activities?

b. If design time is used as the allocation measure, how much of the pamphlet's cost should be assigned to program activities? To fundraising activities?

PROBLEMS

39. *(Journal entries)* Madeleine Products uses a joint process to make two main products: Elegance (a perfume) and Sooosoft (a skin lotion). Two departments, Mixing and Cooking, are used, but the products do not become separable until they have been through the cooking process. After cooking, the perfume is removed from the vats and bottled without further processing. The residue remaining in the vats is then blended with aloe and lanolin to become the lotion.

In the Mixing Department, these costs were incurred during October 2000:

Direct material	$28,000
Direct labor	7,560
Manufacturing overhead applied	4,250

In the Cooking Department, costs incurred during October 2000, before separation of the joint products, were

Direct material	$6,100
Direct labor	2,150
Manufacturing overhead applied	3,240

In that same month, the Cooking Department incurred separable costs for each of the products as follows:

Elegance perfume (bottles only)	$2,120
Sooosoft lotion:	
Direct material	1,960
Direct labor	3,120
Manufacturing overhead applied	4,130

Neither department had beginning Work in Process Inventory balances, and all work started in October was completed in that month. The joint costs are allocated to perfume and lotion on the basis of approximated net realizable values at split-off. For October, the approximated net realizable values at split-off were $158,910 for perfume and $52,970 for lotion.

a. Prepare journal entries for the Mixing and Cooking Departments for October 2000.

b. Determine the joint cost allocated to, and the total cost of, Elegance and Sooosoft.

c. Diagram the flow of costs for Madeleine Products for these two products.

40. *(Joint cost allocation; by-product; income determination)* St. Louis Bank & Trust has two main service lines: commercial checking and credit cards. As a by-product of these two main services, the firm also generates some revenue from selling antitheft and embezzlement insurance. Joint costs for producing the two

main services include expenses for facilities, legal support, equipment, record keeping, and administration. The joint service cost incurred during June 2000 was $800,000.

These costs are to be allocated on the basis of total revenues generated from each main service.

The following table presents the results of operations and revenues for June:

Service	Number of Accounts	Total Revenues
Commercial checking	3,000	$1,897,500
Credit cards	7,000	1,402,500
Theft insurance	6,500	65,000

Management accounts for the theft insurance on a realized value basis. When commissions on theft insurance are received, management has elected to present the proceeds as a reduction in the Cost of Services Rendered for the main services.

Separate costs for the two main services for June were $250,000 and $180,000, respectively, for checking accounts and credit cards.

a. Allocate the joint cost.

b. Determine the income for each main service and the company's overall gross margin for June 2000.

41. *(Joint cost allocation; scrap)* Washington Filaments produces cloth products for hotels. The company buys the fabric in 60-inch-wide bolts. In the first process, the fabric is set up, cut, and separated into pieces. Setup can either be for robes and bath towels or for hand towels and washcloths.

During July, the company set up and cut 3,000 robes and 6,000 bath towels. Because of the irregular pattern of the robes, scrap is produced in the process and is sold to various institutions (prisons, hospitals, etc.) for rags at $1.25 per pound. July production and cost data for Washington Filaments are as follows:

Fabric used, 12,500 feet at $1.91 per foot	$23,875
Labor, joint process	$6,000
Overhead, joint process	$5,900
Pounds of scrap produced	1,800

Washington Filaments assigns the joint processing cost to the robes and towels based on approximated net realizable value at split-off. The final selling prices for robes and bath towels are $20 and $11 per unit, respectively. Costs after split-off are $8.40 and $2.30, respectively, for the robes and the towels. The selling price of the scrap is treated as a reduction of joint cost.

a. Determine the joint cost to be allocated to the joint products for July.

b. How much joint cost is allocated to the robes in July? To the bath towels? Prepare the journal entry necessary at the point of split-off.

c. What amount of cost for robes is transferred to Finished Goods Inventory for July? What amount of cost for towels is transferred to Finished Goods Inventory for July?

42. *(Joint products; by-product)* Valley Mangoes runs a fruit-packing business in southern California. The firm buys mangoes by the truckload in season. The fruit is then separated into three categories according to its condition. Group 1 is suitable for selling as is to supermarket chains and specialty gift stores. Group 2 is suitable for slicing and bottling in light syrup to be sold to supermarkets. Group 3 is considered a by-product and is sold to another company that processes it into jelly. The firm has two processing departments: (1) Receiving and Separating and (2) Slicing and Bottling.

A particular truckload cost the company $1,500 and yielded 1,500 mangoes in Group 1, 2,000 mangoes in Group 2, and 500 mangoes in Group 3. The labor to separate the fruit into categories was $300, and the company uses a predetermined overhead application rate of 50 percent of direct labor cost. Only Group 2 has any significant additional processing cost, estimated at $220, but each group has boxing and delivery costs as follows:

Group 1	$150
Group 2	220
Group 3	50

The final sales revenue of Group 1 is $3,000, of Group 2 is $1,500, and of Group 3 is $450.

a. Determine the sum of the material, labor, and overhead costs associated with the joint process.
b. Allocate the total joint cost using the approximated net realizable value at split-off method, assuming that the by-product is recorded when realized and is shown as other income on the income statement.
c. Prepare the entries for parts (a) and (b) assuming that the by-product is sold for $450 and that all costs were incurred as estimated.
d. Allocate the total joint cost using the approximated net realizable value at split-off method, assuming that the by-product is recorded using the net realizable value approach and that the joint cost is reduced by the net realizable value of the by-product.
e. Prepare the entries for parts (a) and (d), assuming that the estimated realizable value of the by-product is $400.

43. *(Process costing; joint cost allocation; by-product)* Romano's Hair Salon provides hair styling services and sells a variety of cosmetic and hair-care products. The firm also generates some revenue from the sale of hair, which is periodically swept from the floor of the styling salon.

The net realizable value of hair is accounted for as a reduction in the joint cost assigned to the Styling Services and Cosmetic Products. Hair sells for $6 per pound. The cost of packaging the hair is $0.50 per pound, and selling costs of the hair are $0.30 per pound. The following information is available for 2001 on the inventory of Cosmetic Products (the firm does not produce these products; they are purchased):

Beginning inventory	$ 35,000
Ending inventory	21,500
Purchases	181,350

Joint cost is to be allocated to Styling Services and Cosmetic Products based on approximated net realizable values (revenues less separate costs). For 2001, total revenues were $753,000 from Styling Services and $289,000 from Cosmetic Products. The following joint costs were incurred:

Rent	$36,000
Insurance	23,800
Utilities	3,000

Separate costs were as follows:

	Styling Services	Cosmetic Products
Labor	$431,000	$24,000
Supplies	98,000	700
Equipment depreciation	65,000	1,200
Administration	113,000	3,700

For the year, 2,510 pounds of hair were collected and sold.

a. What is the total net realizable value of hair that is applied to reduce the joint cost assigned to Styling Services and to Cosmetic Products?
b. What is the joint cost to be allocated to Styling Services and Cosmetic Products?
c. What is the approximated pretax realizable value of each main product or service for 2001?
d. How much joint cost is allocated to each main product or service?
e. Determine the net income produced by each main product or service.

44. *(Joint cost allocation; by-product)* The Farmers' Delight Company produces tomato paste and tomato sauce from a joint process. In addition, second-stage processing of the tomato sauce creates a residue mixture of tomato peels and seeds (simply referred to as P&S) as a by-product. P&S is sold for $0.08 per gallon to Pavlov's Doggy Products for that company's use in Canine Delight Chow. Distribution expenses for P&S total $110.

In May 2000, 140,000 pounds of tomatoes are processed in the first department; the cost of this input is $44,200. An additional $33,700 is spent on conversion costs. There are 56,000 gallons of output from Department 1. Thirty percent of the output is transferred as tomato paste to Department 2, and 70 percent of the output is transferred to Department 3. Of the input to Department 3, 20 percent will result in P&S and 80 percent will result in tomato sauce. Joint cost is allocated to tomato paste and sauce on the basis of approximated net realizable values at split-off.

The tomato paste in Department 2 is processed at a total cost of $9,620; the tomato sauce in Department 3 is processed at a total cost of $6,450. The net realizable value of P&S is accounted for as a reduction in the separate processing costs in Department 3. Selling prices per gallon are $5.25 and $3.45 for tomato paste and tomato sauce, respectively.

a. How many gallons leaving Department 1 are sent to Department 2 for further processing? To Department 3?
b. How many gallons leave Department 3 as P&S? As tomato sauce?
c. What is the net realizable value of P&S?
d. What is the total approximated net realizable value of the tomato paste? The tomato sauce?
e. What amount of joint cost is assigned to each main product?
f. If 85 percent of the final output of each main product is sold during May and Farmers' Delight had no beginning inventory of either product, what is the value of the ending inventory of tomato paste and tomato sauce?

45. *(By-product/joint product journal entries)* Missouri Grain Agriculture is a 5,000-acre wheat farm. The growing process yields two principal products: wheat and straw. Wheat is sold for $3.50 per bushel (assumes a bushel of wheat weighs 60 pounds). Without further processing, the straw sells for $30 per ton (a ton equals 2,000 pounds). If the straw is processed further, it is baled and then sells for $45 per ton. In 2001, total joint cost to the split-off point (harvest) was $175 per acre.

The farm produced 70 bushels of wheat per acre and 1 ton of straw per acre. If all of the straw were processed further, processing costs (baling) for the straw would amount to $50,000.

Prepare the 2001 journal entries for straw, if straw is:

a. transferred to storage at sales value as a by-product without further processing, with a corresponding reduction of wheat's production costs.
b. further processed as a by-product and transferred to storage at net realizable value, with a corresponding reduction of the manufacturing costs of wheat.

c. further processed and transferred to finished goods, with joint cost being allocated between wheat and straw based on relative sales value at the split-off point. *(CPA adapted)*

CASE

46. *(Ending inventory valuation; joint cost allocation)* Gainesville Meat Packers experienced the operating statistics in the following table for its joint meat cutting process during March 2000, its first month of operations. The costs of the joint process were direct material, $20,000; direct labor, $11,700; and overhead, $5,000. Products X, Y, and Z are main products; B is a by-product. The company's policy is to recognize the net realizable value of any by-product inventory at split-off and reduce the total joint cost by that amount. Neither the main products nor the by-product require any additional processing or disposal costs, although management may consider additional processing.

Products	Weight in Pounds	Sales Value at Split-Off	Units Produced	Units Sold
X	4,300	$66,000	3,220	2,720
Y	6,700	43,000	8,370	7,070
Z	5,400	11,200	4,320	3,800
B	2,300	2,300	4,600	4,000

a. Calculate the ending inventory values of each joint product based on (1) relative sales value and (2) pounds.
b. Discuss the advantages and disadvantages of each allocation base for (1) financial statement purposes and (2) decisions about the desirability of processing the joint products beyond the split-off point.

REALITY CHECK

47. Use the Internet to find five examples of businesses that engage in joint processes. For each of these businesses, describe the following:
a. The various outputs classified as joint products, by-products, scrap, or waste.
b. Your recommendation of the most appropriate methods of allocating joint costs to the output you have described in part (a). Express, in nontechnical terms, your justification for each of your recommendations.

48. *Some waste, scrap, or by-product materials have little value. In fact, many such materials represent liabilities for companies because the materials require companies to incur significant disposal costs. Alternatively, some companies have historically found "cheap" ways to dispose of such materials. For example, between 1991 and 1994, Borden Chemicals and Plastics shipped mercury-laden-waste to Thor Chemicals' plant at Cato Ridge, South Africa. Borden maintains that the material—spent mercuric chloride catalysts—was not hazardous waste and that it expected Thor to recycle it. According to the EPA, little or none of the material was recycled. Greenpeace says Borden's barrels are leaking at the Thor site. Thor has settled a civil suit brought by families of employees whose exposure to the waste allegedly killed them. Greenpeace says the settlement exceeded $9 million. More litigation has ensued.*

SOURCE: Andrea Foster, "Borden Faces Criminal Charges in Waste Dumping Case," *Chemical Week* (February 3–10, 1999), p. 16.

a. Comment on whether this method of disposing of industrial waste is a "cheap" alternative.
b. Discuss the ethical and legal implications of disposing of industrial waste in this manner.
c. What actions can people take to reduce these kinds of incidents?
d. Ethically, what obligation does the vendor/manufacturer of these industrial materials have to the industrial consumer of the materials?

49. Find the Web site for Buckhead Beef on the Internet. On its Web site, the company provides much information regarding its philosophies, product lines, strategy, production, and distribution systems. Review the information provided. Then, discuss how an operating environment, such as that at Buckhead in which there are many joint production processes, creates unique opportunities for new product innovation. Also, discuss the characteristics of employees that would be important in such an environment.

50. Search the Internet for associations that promote the sale of beef or pork products. One or more of the associations will provide information on the many applications of beef and pork by-products. Review these materials and write a brief summary of how various by-products of beef or pork production benefit many other industries.