

## Activity-Based Costing

### Solutions to Review Questions

**9-1. Give examples of cost drivers commonly used to allocate overhead costs to products and services.**

Common allocation bases are direct labor-hours, direct labor costs, and machine-hours. Somewhat less common is direct material costs.

**9-2. Give examples of cost drivers commonly used to allocate overhead costs to products and services.**

The term "death spiral" refers to a process that begins by attempting to increase prices to meet reported product costs. Higher prices reduce demand, leading to production and still higher reported product costs. Eventually, the firm loses products as the market will not support them and goes out of business. The death spiral is not the result of the cost system directly, but the result of managers making decisions (in this case raising prices) based on the cost system that is (often inaccurately) signaling increased costs.

**9-3. Give examples of cost drivers commonly used to allocate overhead costs to products and services.**

False. Department allocation is a two-stage process, so the first-stage assignment of costs and the choice of cost drivers affects the allocation of costs to products. The total product costs are the same under either approach, but the individual product costs differ. This can affect the decisions managers make regarding individual products.

**9-4. Give examples of cost drivers commonly used to allocate overhead costs to products and services.**

Most companies produce multiple products and simply adding them up does not account for differences in complexity of the use of resources. As an extreme example, suppose a company produced airplanes and staplers. Allocating overhead on the basis of units would assign the same overhead cost to a stapler and a plane.

**9-5. Give examples of cost drivers commonly used to allocate overhead costs to products and services.**

The costs include the systems and the software, but the most important cost is managers' time. Managers need to make many decisions about the activities and the cost drivers and managers need to make many of the first-stage allocations. The benefits come from having better information about the use of resources and better information for decisions.

**9-6. Give examples of cost drivers commonly used to allocate overhead costs to products and services.**

1. Identify activities that consume resources.
2. Identify the cost driver associated with each activity.
3. Compute a cost rate per activity unit (e.g., rate per setup, rate per part, rate per machine-hour).
4. Allocate costs to products by multiplying the activity rate times the volume of activity consumed by the product.

**9-7. Give examples of cost drivers commonly used to allocate overhead costs to products and services.**

The cost hierarchy is a classification of costs into general levels of activity. Costs assigned to the different levels of the hierarchy tend to be related to the volume of the activity volume.

**9-8. Give examples of cost drivers commonly used to allocate overhead costs to products and services.**

False. While the total cost allocated is the same, the reported costs for individual products will differ. Because managers make decisions at the product level, it is important that the reported costs reflect, to the extent possible, the use of resources by the products.

**9-9. Give examples of cost drivers commonly used to allocate overhead costs to products and services.**

Activity-based costing will benefit most companies with high overhead costs and diverse products and processes. If there is little overhead or if there is a single product, the allocation process will not result in significantly different product costs. (Even if there are only a few, relatively homogeneous products, activity-based costing may be useful for cost management. See chapter 10 for a discussion.)

**9-10. In what ways is implementing an activity-based costing system in a manufacturing firm's personnel department the same as implementing it in the plant? In what ways is it different?**

A personnel department provides its services by completing a set of activities using resources. In this way, implementing activity-based costing in an administrative function is the same as implementing it in a manufacturing firm. However, the products and activities may be much harder to define, making it less like a manufacturing environment.

**9-11. How does complexity lead to higher costs? Why is it important for the cost system design to consider complexity?**

Complexity adds costs by requiring additional resources for overhead (support) activities for the same volume. It is important to include complexity in cost system designs to avoid spreading the cost of complexity across both simple and complex products.

**9-12. What two questions must a manager answer if a company is implementing time-driven activity-based costing?**

The two questions a manager must answer when implementing time-driven activity-based costing are (1) what is the cost of the resources supplied to a department and (2) how much time it takes to complete the various activities of the department.

**9-13. In the context of time-driven ABC, what are *time equations*?**

Time equations allow managers to adjust the time required for activities for selected characteristics of products or services.

## Chapter 9 Outline

### LO 9-1 Understand the potential effects of using reported product costs for decision making.

#### REPORTED PRODUCT COSTS AND DECISION MAKING

- Dropping a Product
  - Managers may consider dropping a product if the reported costs of producing it have risen more rapidly than the price charged for it, and the product line margins have fallen to unacceptable levels.
    - The decision will be based on the impact it has on reported product costs.
  - Product costs are used primarily for developing inventory balances and cost of goods sold amounts for financial reporting.
    - The basic approach to product costing involves assigning direct costs to products and allocating manufacturing overhead costs to products.
  - If managers rely on the cost accounting system to make the decision to keep or drop a product, the cost system provides potentially inaccurate unit costs.
    - Exhibit 9.1 shows the assignment of costs to two products using an allocation base of direct labor hours; management is considering dropping the C-27s; the cost savings appear to be \$198,400.
      - The reported unit costs of C-20s will increase from \$6,920 to \$9,260, an increase of about 34 percent.
      - If the managers attempt to increase the price of the C-20s by an equivalent amount, the market is unlikely to accommodate it.
        - As a result, they face two equally unappealing choices: Remain in business and lose money, or shut down.
    - Exhibit 9.2 shows the assignment of costs assuming that the C-27 is dropped and only the remaining product (C-20) is produced; the cost estimate for the C-20s increases from \$207,600 to \$277,800.
    - Exhibit 9.3 provides the total product estimates with (totaling \$406,000) and without the C-27s (totaling \$277,800); the cost savings are only \$128,200 (= \$406,000 – \$277,800).
  - Once a predetermined overhead rate is calculated, it is applied as if all overhead costs were variable with respect to the allocation base, which is not true in most cases for two reasons:

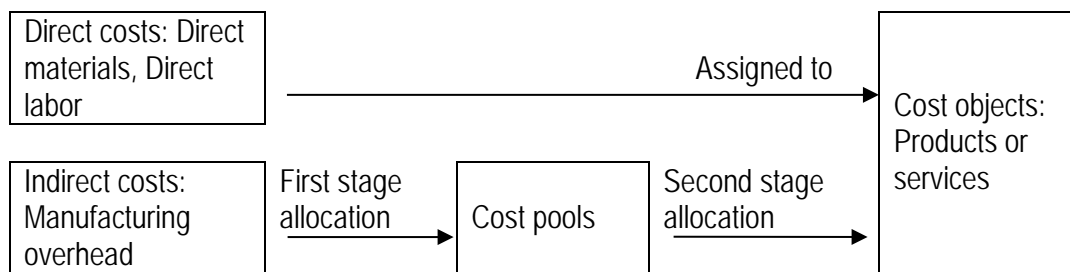
- Some of the overhead items could be fixed, and reducing the number of units produced does not result in lower fixed costs. Examples of such fixed costs include cost of supervision, machine and plant depreciation, and miscellaneous items that do not vary with the allocation base.
  - Some of the overhead items could vary, but with cost drivers other than those traditionally chosen ones.
- The Death Spiral
    - If managers attempt to recover the costs with a smaller number of units, they are likely to meet resistance in the market, resulting in demand for even fewer units. With the smaller production, the reported product costs increase even more.
    - The death spiral is a process that begins by attempting to increase price to meet higher reported product costs, losing market, reporting still higher costs, and so on, until the firm is out of business.
      - Death spiral may occur when the demand for a product falls for some reason or a major customer leaves.
        - The decline in demand will lead to higher reported costs.
        - If the firm attempts to recover the production costs from the remaining customers, they too will reduce or eliminate their demand.
      - The death spiral can occur even in firms with increasing demand.
        - For example, a firm is likely to add capacity with increasing demand. This can be in the form of new plant and equipment. An increase in capacity is accompanied by an increase in fixed (overhead) costs without a similar increase in output, at least not immediately.
    - If the accounting system computes product costs based on relatively short-term demand estimates (for example, for the next year), it will include the costs of the excess capacity that exists for growth in the product costs.

- Using reported product costs, managers will attempt to recover the excess capacity costs from current customers, who are unlikely to be willing to pay, assuming there are competitors without the excess capacity.
  - In this case, the death spiral can lead companies to build new plants only to see them idle because of reduced demand.

**LO 9-2 Explain how a two-stage product costing system works.**

**TWO-STAGE COST ALLOCATION**

- The basic approach in product costing is to allocate costs in the cost pools to the individual cost objects, which are the products or services of interest.
  - We assign (or allocate) these costs to the individual cost objects by using appropriate cost allocation bases or cost drivers.
    - Exhibit 9.4 illustrates a cost flow diagram for a two-stage cost allocation system.
      - The first-stage cost objects are the overhead accounts, such as supplies, depreciation, and so on.
      - The two-stage approach allowed us to separate plant, or manufacturing, overhead into two or more cost pools based on the account in which the costs were recorded.
      - The allocation in the first stage, although simple, allowed us then to select multiple cost drivers—direct labor costs and machine-hours, for example—that were used to allocate costs to products.
      - An alternative view of the two-stage cost allocation process is as follows:



- Another common choice for first-stage cost objects is to use production departments or product lines within the plant, as shown in Exhibit 9.5.
  - The allocation of overhead costs to departments is not as simple as it is when overhead accounts are used because the costs are not necessarily recorded at the department level.

- Two-Stage Cost Allocation and the Choice of Cost Drivers
  - Complexity and special handling required during production may distort the product costs reported when the traditional costing method is used. The two-stage system, on the other hand, allows the firm to develop product costing systems that more closely align the allocation of costs with the use of resources.
    - The Port Arthur manufacturing facility of Joplin Industries makes two types of digital cameras.
      - The J25P is a simple, point-and-shoot digital camera with few features. It is often sold in large quantities to discount stores, convenience stores, and other outlets that rely on impulse purchases.
      - The J40X is a sophisticated, digital camera with many features that can use multiple lenses; it is sold mostly online and in camera stores.
    - Exhibit 9.6 shows the data on the operations of the Port Arthur manufacturing facility for the third quarter by product line and in total.
      - The facility's cost system is a traditional product costing system that allocates manufacturing overhead to products based on direct labor costs.
      - The overhead allocation rate at the Port Arthur facility is 90%.
    - Exhibit 9.7 shows the unit product cost report.
      - When the production managers they studied the cost report, they were surprised that the J40X was only about twice as costly to produce as the J25P. That seemed too low.
        - The production managers explained that the J40X requires much more complex equipment and special handling in Assembly.
        - In addition, the J40X requires much shorter production runs, requiring more setups.
    - Company policies called for initial price guidelines for products to include a 30 percent markup over full cost.
      - The marketing managers complained that, although the J40X was selling very well even with prices quoted above the guidelines, the J25P was meeting very heavy price resistance and was being discounted well below the guidelines to sell.

- Janis decided to experiment with a two-stage cost allocation system.
  - In the first stage, the overhead costs would be allocated to the two buildings (departments).
  - In the second stage, the overhead costs in each building would be allocated to products using different cost drivers.
    - Because of the use of production cells and the importance of equipment cost in the Assembly building, the cost accounting manager decided to use machine-hours to allocate overhead costs in Assembly.
    - The cost accounting manager decided that Packaging's direct labor costs were still appropriate as an allocation base in the Packaging building.
  - See Exhibit 9.8 for the cost flow diagram that the cost accounting manager developed for the cost system.
  - Exhibit 9.9 shows the data on the operations of the Port Arthur manufacturing facility for the third quarter by product line and in total using the new two-stage cost allocation system.
    - The overhead allocation rate for the Assembly building is \$45 per machine hour.
    - The overhead allocation rate for the Packing building is 60% of direct labor cost.
      - Based on the new costing approach, it appeared that the sophisticated, low-volume J40X model was about three times more costly to produce.
- This example illustrates that one advantage of the two-stage system is that it allows the firm to develop product costing systems that more closely align the allocation of costs with the use of resources.

<b>LO 9-3 Compare and contrast plantwide and departmental allocation methods.</b>
---

- Plantwide Versus Department-Specific Rates
  - The plantwide allocation method is an allocation method that uses one cost pool for the entire plant; it uses one overhead allocation rate, or one set of rates, for all of a plant's departments.
    - Although it is called plantwide allocation, this allocation concept can be used in both manufacturing and nonmanufacturing organizations.



- Plantwide allocation is the single-stage approach first described in Chapter 6.
  - Accounting for overhead is simple.
    - All actual overhead costs are recorded in one cost pool in the Manufacturing Overhead Control account for the plant without regard to the department or activity that caused them.
    - A single overhead rate is used to apply overhead to products, crediting Applied Manufacturing Overhead.
      - For example, if overhead is applied using a predetermined rate per machine-hour, the amount of the credit to the Applied Manufacturing Overhead account and the amount of the debit to Work in Process for overhead costs equal the rate per machine-hour times the total number of machine-hours worked.
  - Companies using a single plantwide rate generally use an allocation base related to the volume of output, such as direct labor-hours, machine-hours, units of output, or materials costs.
    - Example 1: A company estimated its annual overhead costs to be \$240,000. The company uses the plantwide allocation method to assign overhead costs to its two products, AA and BB, using machine hours, budgeted to be 12,000 for the coming year. Then the single plantwide rate would be \$20 ( $= \$240,000 \div 12,000$  machine hours).

In March, 400 units of product AA were produced using 800 machine hours; 100 units of product BB were produced using 400 machine hours. The overhead allocation would be:

- To AA:  $\$20$  per machine hour  $\times$  800 machine hours = \$16,000 (or  $\$16,000 \div 400$  units = \$40 per unit)
- To BB:  $\$20$  per machine hour  $\times$  400 machine hours = \$8,000 (or  $\$8,000 \div 100$  units = \$80 per unit)

The journal entry would be:

<i>Work-in-Process Inventory (AA)</i>	<i>16,000</i>	
<i>Work-in-Process Inventory (BB)</i>	<i>8,000</i>	
<i>Applied Manufacturing Overhead</i>		<i>24,000</i>

- Companies using a single plantwide rate generally use an allocation base related to the *volume* of output, such as direct labor hours, machine hours, units of output, or materials costs.
  - Using the department allocation method, a company has a separate cost pool for each department. The company establishes a separate overhead allocation rate for each department.
    - The department allocation method is an allocation method that has a separate cost pool for each department, which has its own overhead allocation rate or set of rates.
- Choice of Cost Allocation Methods: A Cost-Benefit Decision
  - The choice of whether to use a plantwide rate or departmental rates depends on the products and the production process.
    - If the company manufactures products that are quite similar and that use the same set of resources, the plantwide rate is probably sufficient.
    - If multiple products use the manufacturing facilities in many different ways, departmental rates provide a better picture of the use of manufacturing resources by the different products.
  - Managers need to make a decision about plantwide versus departmental rates based on the costs and benefits of the information inherent in each system.
    - Selecting more complex allocation methods requires more time and skill to collect and process accounting information.
    - Such incremental costs of additional information must be justified by an increase in benefits from improved decisions.

**LO 9-4 Explain how activity-based costing and a two-stage product system are related.**

#### ACTIVITY-BASED COSTING

- Activity-based costing (ABC) is a two-stage product costing method that first assigns costs to activities and then allocates them to products based on the each product's consumption of activities.
  - An *activity* is any discrete task that an organization undertakes to make or deliver a product or service.

- Activity-based costing can be used by any organization that wants a better understanding of the costs of the goods and services it provides, including manufacturing, service, and even nonprofit organizations. (See Business Application box “Activity-Based Costing in a Not-for-Profit.”)
- Developing Activity-Based Costs
  - Activity-based costing involves the following four steps:
    - Identify the activities that consume resources and assign costs to them.
    - Identify the cost driver(s) associated with each activity. A cost driver is any factor that causes, or “drives,” an activity’s costs.
    - Compute a cost rate per cost driver unit or transaction. Each activity could have multiple cost drivers.
    - Assign costs to products by multiplying the cost driver rate by the volume of cost driver units consumed by the product.
  - Identifying Activities that Use Resources
    - Often the most interesting and challenging part of the exercise is identifying activities that use resources because doing so requires understanding all the activities required to make a product.
      - When managers step back and analyze the processes (activities) they follow to produce a good or service, they often uncover many nonvalue-added steps that they can eliminate
  - Choosing Cost Drivers
    - Exhibit 9.10 provides several examples of the types of cost drivers that most companies use.
      - Most of the cost drivers are related either to the volume of production or to the complexity of the production or marketing process.
    - The best cost driver is one that is causally related to the cost being allocated.
      - With an ABC system, the selection of an allocation base, or cost driver, is often easier because we can use a measure of the activity volume

- Cost drivers are selected based on three criteria:
  - Causal relation. Ideally, choose a cost driver that causes the cost. This is the best cost driver available.
  - Benefits received. Choose a cost driver to assign costs in proportion to benefits received.
  - Reasonableness or fairness. When the first two criteria fail, assign costs on the basis of fairness or reasonableness.
- Computing a Cost Rate per Cost Driver
  - For any indirect cost, a predetermined rate can be computed as follows:

$$\text{Predetermined rate} = \frac{\text{Estimated indirect cost}}{\text{Estimated volume of allocation base}}$$

- For activity-based costing, the first stage consists of activities. Each activity has an associated cost pool and requires a cost driver rate using the formula above.
- Assigning Costs to Products
  - The final step in the activity-based costing system is to assign the activity costs to products.
    - We do this just as we have done for the other product costing systems we have considered. We multiply the cost driver rates by the number of units of the cost driver in each product.
    - Exhibit 9.11 illustrates the four steps of developing activity-based costs graphically.
      - Identify the activities.
      - Identify the cost driver(s) associated with each activity.
      - Compute a cost rate per cost driver unit or transaction.
      - Assign costs to products by multiplying the cost driver rate by the volume of cost driver units consumed by the product.

## COST HIERARCHIES

- A cost hierarchy classifies cost drivers by general dimensions or levels of activity
  - A cost hierarchy represents a classification of cost drivers into general levels of activity, volume, batch, product, etc.
    - Four possible levels of cost hierarchy are:
      - Volume-related
      - Batch-related
      - Product-related
      - Facility-related
  - An activity-based costing system can have fewer than four levels in the hierarchy or it can have more than four.
    - The important factor is whether the cost drivers for the activities reflect the cost incurred by the activity. (See Business Application box “The ABC Cost Hierarchy—Maintenance Costs for an Airline.”)
  - Exhibit 9.11 illustrates a cost hierarchy.
  - Exhibit 9.12 provides example of costs and cost drivers associated with each of the four levels.

<b>LO 9-5 Compute product costs using activity-based costing.</b>
---

## ACTIVITY-BASED COSTING ILLUSTRATED

In this section, the reported product costs under activity-based costing are computed in a comprehensive example.

- Step 1: Identify the Activities
  - A cost accountant interviewed the production manager to determine the major activities used in the manufacturing process.
- Step 2: Identify the Cost Drivers
  - The cost accountant interviewed production supervisors, who in turn discussed with line employees, to determine the cost drivers and the expected volume of each driver.

- The information is presented in Exhibit 9.13.
- Step 3: Compute the Cost Driver Rates
  - Once the overhead costs incurred in the facility were determined, the cost accountant calculated the cost driver rates by dividing overhead cost by the estimated volume for each activity identified in Step 1.
    - Exhibit 9.14 shows the calculation.
- Step 4: Assign Costs Using Activity-Based Costing
  - Based on these interviews, the cost accountant develops a cost flow diagram, which includes the first-stage assignment of costs to activity pools and the second-stage allocation of activity costs to products noting the cost drivers for each activity.
    - Exhibit 9.15 shows the cost flow diagram that assigns overhead costs to activity pools in the first stage and allocates activity costs to products in the second stage.
  - For each product, the direct costs (direct materials and direct labor) are the same regardless of the costing methods used. The difference is in the assignment of overhead costs.
    - There are two ways to calculate unit cost for each product.
      - The total cost of production for each product is calculated first. Then the total cost is divided by the number of units produced to arrive at the unit cost.
        - This approach is shown in Exhibit 9.16.
      - The cost driver rate per unit of product for each of the cost drivers can be calculated first, which then is multiplied by the volume of activity consumption per unit of product. The resulting sum across the cost drivers will also determine the unit cost.

**LO 9-6 Compare activity-based product costing to traditional department product costing methods.**

- Unit Costs Compared
  - As summarized in Exhibit 9.17, both the plantwide rate and the department rate systems assumed that overhead was incurred proportionally with the volume of output. The activity-based costing system recognized that overhead was related to activity usage, not necessarily to the volume of output.

- Important points about activity-based costing:
  - Different cost allocation methods result in different estimates of how much it costs to make a product.
  - Activity-based costing provides more detailed measures of costs than do plantwide or department allocation methods.
  - Production also benefits because activity-based costing provides better information about how much each activity costs. It helps identify cost drivers that previously were unknown.
  - Activity-based costing provides more information about product costs but requires more record keeping.
  - Installing activity-based costing requires teamwork between accounting, production, marketing, management, and other non-accounting personnel.

**LO 9-7 Demonstrate the flow of costs through accounts using activity-based costing.**

#### COST FLOW THROUGH ACCOUNTS

- Exhibit 9.18 shows the flow of costs through accounts using activity-based costing. The overhead accounts (both incurred and applied) are grouped by activities.

#### CHOICE OF ACTIVITY BASES IN MODERN PRODUCTION SETTINGS

- Early industries were labor intensive, and much of the overhead cost was related to the support of labor. At that time, it made sense to allocate overhead to products based on the amount of labor component in the products.
- Nowadays, labor is still a major product cost in many companies, especially service organizations such as consulting, law, and public accounting firms. In those cases, overhead is often allocated to products (jobs) on the basis of the amount of labor in the product.
  - When the labor component drops in the products and overhead cost increases, companies that continue to allocate overhead to products based on direct labor are experiencing substantial overhead rate increases.
    - Even small errors in cost allocation can be magnified many times.
    - It also sends the wrong signal that direct labor is more expensive than it really is and drives managers to reduce the already slim labor content of products.

- The magnitude of the overhead rate based on direct labor is of less concern when all resources are used proportionally.
  - In modern manufacturing settings, proportionality between machine hours and direct labor hours is much less so.
- Complexity as a Resource-Consuming Activity
  - Costs are a function of both volume and complexity.
    - When overhead is applied based on the volume of output, high-volume products are allocated relatively more overhead than are low-volume products. High-volume products “subsidize” low-volume products in this case.
  - Volume-based allocation methods hide the cost effects of keeping a large number of low-volume products. This has led many companies to continue producing or selling products without realizing how costly they are. (See Business Application box “Evidence on the Benefits of Activity-Based Costing.”)

**LO 9-8 Apply activity-based costing to marketing and administrative services.**

ACTIVITY-BASED COSTING IN ADMINISTRATION

- Activity-based costing can be applied to administrative activities. The principles and methods are the same as those discussed earlier.
  - Activity-based costing in administration involves these steps:
    - Identify the activities that consume resources.
    - Identify the cost driver associated with each activity.
    - Compute a cost rate per cost driver for each unit or transaction.
    - Assign costs to the marketing or administration activity by multiplying the cost driver rate by the volume of cost driver units consumed for that activity.
  - Instead of computing the cost of a product, accountants compute the cost of performing an administrative service.
    - Time-related factors (and therefore cost drivers) are common for an administrative function or a service business.
      - Exhibit 9.19 shows other common cost drivers in a typical purchasing department.



## WHO USES ABC?

- Exhibit 9.20 lists some of the organizations that have been cited as using ABC for at least some of their operations.
- There are three problems with identifying users of ABC:
  - ABC means different things to different observers.
  - ABC can be applied in parts of an organization but not everywhere.
  - While firms may publicly announce the adoption of ABC, they are less likely to announce its discontinuance.
- All organizations are interested in getting better cost information for decision making.

## TIME-DRIVEN ACTIVITY-BASED COSTING

- A modified version of ABC that addresses the costs of maintaining an ABC system has been developed.
  - This modified approach to ABC is called time-driven activity-based costing (TDABC).
  - The development of a TDABC system is illustrated by showing how it has been implemented in the Receiving Department at the Port Arthur Facility of Joplin Industries.
- Developing Time-Driven Activity-Based Costs
  - With TDABC, the manager only needs to determine:
    - The cost of the resources supplied to a department
    - The time it takes to complete the various activities of the department.
      - This approach avoids the need to conduct surveys or interviews of multiple managers and employees. This means that it is not as costly to maintain as the unmodified ABC system.
  - The Costs of Resources Supplied
    - The number of people in the department are identified as are the activities that they perform.
    - The costs of the resources supplied to this department, cost of the department manager, and the costs of the technology and facilities are totaled.

- The Time Required for Each Activity
  - The manager is asked to estimate how much time each activity takes for a single transaction.
- Calculating the Costs of the Activities
  - We start by calculating a cost driver rate.
 

Cost driver rate = Total cost of department ÷ Minutes available
  - For each activity, the activity costs are determined by multiplying the cost driver rate by the time required for the activity.
  - The total cost of activity for the department is determined by adding together the individual activity costs.
    - The difference between the actual departmental cost and the total cost of activity for the department is due to idle time and represents the excess capacity in the department.
  - How can these calculations help the cost accountant and other managers?
    - The reported costs can be used when considering the demands placed on Receiving by the characteristics of different products.
      - For example, if some products are produced in small quantities, they might still require the same number of shipments as those products with larger volumes.
    - These costs can help managers make better decisions about whether they should keep or drop these products by giving better information about support costs.
- Extensions of TDABC
  - TDABC is all based on a single measure for each activity: time. We can modify this somewhat without adding all of the complications of a regular ABC system.
  - Cost Drivers other than Time
    - Although TDABC is based primarily on time estimates for different activities, we can easily extend this to accommodate a particular case.

- For example, when Receiving stores the material, it stores it in the warehouse, which is a part of the resources included in Receiving. We can think of an additional activity (storage, for example). The cost of storage might be more related to the space required instead of time. It is a simple extension of the model to compute the cost per square foot and apply it to materials that stored in the warehouse.
  - We would also recompute the time-based cost driver rate to account for the lower remaining costs in Receiving after splitting out the warehouse cost.
- Time Equations
- The TDABC system that we have developed so far assumes all orders that go through any one of the activities take the same amount of time. We can extend the TDABC system to allow for differences among orders by using what are called time equations.
    - Time equations allow managers to adjust the times for orders with different characteristics.
    - Time equations can also be written if there is a maximum size of an order that can be inspected or transported to the warehouse.
  - TDABC provides an alternative to an unmodified ABC system that might be too costly to maintain given the benefits the ABC system provides.
    - Most likely, a combination of the two systems might be used depending on the size of the department and the need for improved cost information.

# 11

## Service Department and Joint Cost Allocation

### Solutions to Review Questions

#### **11-1. Why do companies allocate costs? What are some of the advantages and disadvantages to doing so?**

Companies allocate costs to estimate or assess the costs of their activities (products, processes, etc.). It is an estimate and subject to the problem that cost allocation contains an arbitrary element. Not allocating costs, however, is also an estimate—an estimate of zero. This may be appropriate for some decisions, but not for others.

Some of the disadvantages (costs) include:

- (1) Additional bookkeeping;
- (2) Additional management costs in selecting allocation methods and allocation bases;
- (3) Costs of making the wrong decision if the allocations provide misleading information.

Some of the advantages (benefits) of cost allocation include:

- (1) Instilling responsibility for all costs of the company in the division managers;
- (2) Relating indirect costs to contracts, jobs, and products;
- (3) Constructing performance measures ("net profit") for a division that may be more meaningful to management than contribution margins.

#### **11-2. What are the three methods of allocating service department costs?**

The three methods of allocating service department costs are the (1) direct method, (2) step method, and (3) reciprocal method.

#### **11-3. What are the similarities and differences among the direct method, the step method, and the reciprocal method of allocating costs?**

The essential difference is the allocation of costs among service departments. The direct method makes no inter-service-department allocation, the step method makes a partial inter-service-department allocation, while the reciprocal solution method fully recognizes inter-service-department activities. All three methods allocate costs to the production departments based on the production department's relative use.

#### **11-4. What criterion should be used to determine the order of allocation from service departments when the step method is used? Explain why.**

Allocations usually begin from the service department that has provided the greatest proportion of its services to other service departments, or that services the greatest number of other service departments. This criterion is used to minimize the unrecognized portion of reciprocal service department costs. (Recall

that the amount of service received by the first department to allocate in the step allocation sequence is ignored.)

Another criterion employed is the amount of cost incurred by the service department. As with other allocation problems, it is a combination of the diversity (the proportion of resources used by other service departments) and the costs involved that are important in making this choice.

**11-5. What is a limitation of the direct method of allocating service department costs?**

The direct method ignores any use of one service department by another.

**11-6. What is a limitation of the step method of allocating service department costs?**

The step method ignores any reciprocal (simultaneous) use of two or more service departments.

**11-7. What is the objective of joint cost allocation?**

Joint cost allocations are usually made to assign a cost to a product after the split-off point. This is usually done for external reporting, tax, or rate-making purposes or to satisfy contract requirements. Because the joint costs are common to the outputs, it is not possible to find a direct way of relating the costs. Rather, the costs are related to economic benefits on the basis of some measure of relative outputs.

**11-8. Why would a number of accountants express a preference for the net realizable value method of joint cost allocation over the physical quantities method?**

Because net realizable values of the output provide a measure of the economic benefit received from each output from the production process, this method is usually preferred when it can be implemented. Further, the physical quantities may be difficult to compare (e.g., weights versus volumes).

**11-9. When would a physical quantities method for allocation be preferred?**

It could be preferable to use a physical quantities measure if it reflects the economic benefit ultimately obtainable from the production process, particularly if there is no objective selling price for joint products. Some examples include public utility rate setting, energy price regulation, new market setting, and new product price setting. In all of these cases, it is not possible to use the relative sales value method. Of course, the physical quantity measure used must make sense. Thus, ounces of lead should not be added to ounces of silver for joint cost allocation purposes.

**11-10. What is the basic difference between the allocation of joint costs to (a) joint products and (b) by-products?**

For joint products, costs of the inputs up to the split-off point are allocated to each of the products. Costs prior to split-off are not allocated to by-products in the same way as to the main (joint) products. Either joint costs (costs incurred prior to split-off) equal to the sales value of the by-product are allocated to the by-product, reducing the costs allocated to the main products (Method 1 in the text) or no joint costs are allocated to the by-product and it is credited with its sales value (Method 2).

**11-11. What costs are irrelevant for the decision of whether to sell a joint product or process it further?**

The joint costs of the product are irrelevant to this decision. Using the principle of differential costs, the joint costs are not differential in this decision. They are sunk costs, because they must be incurred under either decision.

## Chapter 11 Cost Allocation Outline

LO 11-1	Explain why service costs are allocated.
---------	--

### SERVICE DEPARTMENT COST ALLOCATION

- The cost allocation process has other roles, two of which are explored in this chapter.
  - In our discussion of two-stage cost allocation, we took the first-stage allocation process as given and concentrated on allocating the cost pools in the second stage.
    - In the first stage of the two-stage cost allocation, part of the overhead costs is incurred for departments that do not produce the service or product directly.
    - We will consider service department cost allocation, which is the process used to allocate the costs of these “service” departments.
- **Service departments** provide services to other departments in the organization.
  - Examples of service departments and what they do:
    - Personnel, accounting, and purchasing departments provide services to production departments.
    - An information systems department provides support for information technology support to other departments.
    - A human resources department provides hiring and training services to other departments.
- **User departments** use the functions of service departments. For example, the production department uses the services provided by the information systems and human resources departments.
  - User departments could be other service departments or production or marketing departments that produce or market the organization’s products.
- Our focus in this chapter is on allocating the costs of service departments to production departments.
  - We also discuss how the allocation process can help managers make decisions about keeping or eliminating the service departments. (See Business Application box “Outsourcing Information Services—Managed Service Providers.”)

- As shown in Exhibit 11.1, most user departments make use of all service departments. Depending on the situation, the service departments also provide service to each other.
  - An **intermediate cost center** is any cost center whose costs are charged to other departments in the organization.
  - A **final cost center** is a cost center, such as a production or marketing department, whose costs are not allocated to another cost center.
  - All organizations (service, merchandising, and manufacturing) have production or marketing departments and service departments.

### METHODS OF ALLOCATING SERVICE DEPARTMENT COSTS

- Three methods to allocate service department overhead costs are:
  - Direct method
  - Step method
  - Reciprocal method
- Service department costs are allocated for two purposes:
  - To determine the cost to produce and market products or services.
  - To encourage operating department managers to monitor service department costs (cross-department monitoring).
    - Each service department is an intermediate cost center whose costs are recorded as incurred and then distributed to other cost centers.
- Allocation Bases
  - An important decision in cost allocation is to choose which allocation base to use. The usual criteria (cause and effect, reasonableness, and fairness) are still important here.

<b>LO 11-2</b>	<b>Allocate service department costs using the direct method.</b>
----------------	---

- Direct Method
  - The **direct method** is a cost allocation method that charges costs of service departments to user departments without making allocations between or among service departments.
    - The direct method allocates costs directly to the final users of a service, ignoring intermediate users.



- Allocate Information Systems Department Costs
  - Exhibit 11.4 is the cost flow diagram that illustrates the direct method.
  - Using the direct method, there are no allocations between service departments. It ignores the costs that the service departments themselves incur when they use services from other departments. Cross-department monitoring is lost in that regard.
  - The application of the direct method of cost allocation is shown in Exhibit 11.3.
- Allocate Administration Department Costs
  - Exhibit 11.5 shows the flow of costs in T-accounts and the allocations to be recognized for the departments when the direct method is used.
    - The direct costs of service departments are first recorded in those service departments and shown on the debit side of the service department accounts.
    - Then, the service department costs are allocated to the user departments.
    - The user departments also have direct costs (indicated as the direct overhead costs) that do not have to be allocated to the user departments because they are debited to the department accounts when incurred.

*See Demonstration Problem 1*

- Limitations of the Direct Method
  - Some people have criticized the direct method because it ignores services provided by one service department to another.
  - If one purpose of cost allocation is to encourage cross-departmental monitoring, the direct method falls short because it ignores the costs that service departments themselves incur when they use other service departments.
    - This criticism has led some companies to use other methods of service department cost allocation, which is described next.

- Step Method
  - The **step method** is the method of service department cost allocation that allocates some service department costs to other service departments.
    - The step method recognizes that some services are provided by one service department to others.
      - The sequence of allocation is determined so that the allocation begins with the service department that has provided the largest proportion of its total services to other service departments, or the service department with the largest cost.
      - The percentage of service costs ignored in the step allocation process is minimized by choosing either of the allocation orders suggested.
      - Once an allocation is made from a service department, no further allocations are made back to that department.
    - Allocate Service Department Costs
      - A service department that provides services to, and receives services from, another service department has only one of these two relationships recognized.
        - Exhibit 11.6 shows the computation of the step method.
        - Exhibit 11.7 is the cost flow diagram for the step method example.
        - The flow of costs through the accounts is shown in Exhibit 11.8.
      - The step method may result in more reasonable allocations than the direct method because it recognizes that some service departments use other service departments for support. (See Business Application box “Step Method at Stanford University.”)
  - Limitations of the Step Method
    - The step method does not recognize reciprocal services.
    - The step method is not necessarily better than the direct method when both the costs and benefits of using cost allocation are considered. A company already uses the direct method can find it uneconomical to switch methods.

*See Demonstration Problem 2*

- Reciprocal Method
  - The **reciprocal method** is the method to allocate service department costs that recognizes all services provided by any service department, including services provided to other service departments.
    - The reciprocal method is identical to the actual process by which services are exchanged among departments within organizations.
    - Allocating Service Department Costs
      - With the reciprocal method, the costs of each service department are written in equation form:

$$\begin{array}{rcccl} \text{Total service} & & \text{Direct costs of the} & & \text{Cost allocated to the} \\ \text{department costs} & = & \text{service department} & + & \text{service department} \end{array}$$

- There is a single equation for each of the service departments and there is a single unknown (the total cost of the service department) for each service department in the organization.
      - The system of equations is solved simultaneously using matrix algebra. (For this reason, the reciprocal method is also called the *simultaneous solution method*.)
- In the case with two service departments, define the unknowns S1 and S2 to be the total service department costs for the two service departments. Then the simultaneous equations can be set up as:
  - $S1 = \text{Direct costs of the first service department} + \alpha \times S2$ , and  
 $S2 = \text{Direct costs of the second service department} + \beta \times S1$ , where:  
 $\alpha = \text{Proportion of services provided by the second service department to the first.}$   
 $\beta = \text{Proportion of services provided by the first service department to the second.}$
  - Exhibit 11.9 shows the computation of the reciprocal method
  - Exhibit 11.10 is the cost flow diagram for the reciprocal method.
  - The flow of costs through the accounts is shown in Exhibit 11.11.

- The reciprocal method accounts for cost flows in both directions among service departments that provide services to each other.
- Both the step method and the direct method could understate the cost of running service departments because these methods omit costs of certain services consumed by one service department that were provided by other service departments.

*See Demonstration Problem 3*

- Comparison of Direct, Step, and Reciprocal Methods
  - The three service department allocation methods can be compared in two ways.
    - The first is to examine how each allocates costs to departments receiving services. As shown in Exhibit 11.12, only the reciprocal method allocates costs to all departments receiving services from other departments.
    - The second way is to examine the costs each ultimately allocates to manufacturing and marketing departments, as shown in Exhibit 11.13.
    - Each method allocates the same total cost.
  - The direct method results sometimes are closer to the reciprocal method results than the results using the step method.
  - All three allocation methods are arbitrary. If one production department stops using the service of a service department, the costs saved by the firm are unlikely to be equal to the costs allocated by any of the methods.

<b>LO 11-5</b>	<b>Use the reciprocal method for outsourcing decisions.</b>
----------------	---

- The Reciprocal Method and Decision Making
  - The primary purpose of allocating service department costs to the production departments is to obtain the manufacturing costs for each of the production departments for product costing and inventory valuation.
    - The cost information is also developed to assist managers in making decisions, such as whether to outsource some or all of the activities of the service departments.

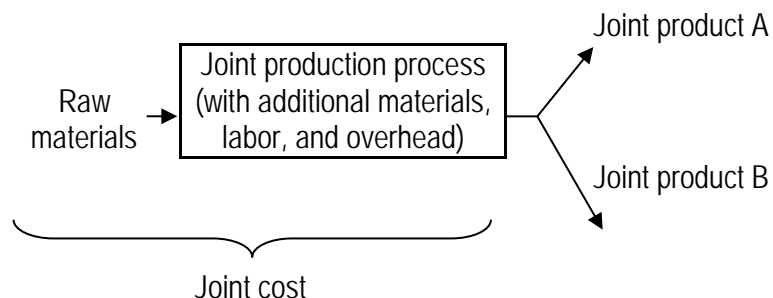
- The cost savings will depend on how much an outside vendor will charge and how much cost in the service departments can be eliminated if outsourced.
  - If there are no reciprocal services among the service departments, the cost savings are the cost of the eliminated service department that is avoidable (= variable costs + any avoidable fixed costs).
  - If there are reciprocal services, the manager has to consider the effect of eliminating one of the service departments on the service requirements of the remaining service departments.
- Because the reciprocal method explicitly recognizes the use of one service department by another, it provides an estimate of what one department costs when reciprocal service costs are included.

*See Demonstration Problem 4*

**LO 11-6 Explain why joint costs are allocated.**

### ALLOCATION OF JOINT COSTS

- **Joint cost** is a cost of a manufacturing process with two or more different outputs. **Joint products** are such outputs from a common input and common production process.
  - The problem is whether and how to allocate the joint cost of the input to the joint products.
- Joint Costing Defined
  - Exhibit 11.14 shows a diagram of joint cost flows.
    - Example 1: The following shows a joint production process and its joint costs. After the split-off point, two discernable joint products, A and B, emerge from the process. The costs before the split-off point are joint; any costs spent afterwards are separable.



- Reasons for Allocating Joint Costs
  - Cost allocations are often used to determine departmental or division costs for measuring executive performance.
    - When a single raw material is converted into products sold by two or more departments, the cost of the raw material must be allocated to the products involved.
      - Manufacturing companies must allocate joint costs to measure the inventory value of the products that result from the joint process.
    - When companies are subject to rate regulation, the allocation of joint costs can be a significant factor in determining the regulated rates.
    - Any cost allocation method contains an element of arbitrariness and must be clearly stated before being implemented.

<b>LO 11-7</b> <b>Allocate joint costs using the net realizable value method.</b>
---

#### JOINT COST ALLOCATION METHODS

- The two major methods of allocating joint costs are the:
  - Net realizable value method.
  - Physical quantities method.
- Net Realizable Value Method
  - The **net realizable value method** allocates joint costs based on the proportional net realizable value of the joint products at the split-off point.
    - The *net realizable value* is the estimated sales value of each product at the split-off point.
      - If the joint products can be sold at the split-off point, the market value or sales price should be used for this allocation.
      - If the products require further processing before they are marketable, it could be necessary to estimate the net realizable value at the split-off point. This approach is called the **estimated net realizable value**, sometimes referred to as the *netback* or *work-back* method.

- The **estimated net realizable value** is the sales price of a final product minus additional processing costs necessary to prepare a product for sale.

$$\begin{array}{rcl} \text{Estimated net} & & \text{Sales price of a} \\ \text{realizable value} & = & \text{final product after} \\ & & \text{further processing} \end{array} \quad - \quad \begin{array}{l} \text{Additional processing costs} \\ \text{necessary to prepare a product} \\ \text{for sale} \end{array}$$

- Normally, when a market value is available at the split-off point, it is preferable to use that value rather than the estimated net realizable value method.
- If the market value is not available, the *net realizable value* at the split-off point is estimated by taking the sales value after further processing and deducting the additional processing costs. Joint costs are then allocated to the products in proportion to their net realizable values at the split-off point.
- The terms “net realizable value” and “estimated net realizable value” are used to emphasize that we are attempting to determine the value of the products at the split-off point.
  - The difference is that in the former case (net realizable value), we can sell the product at the split-off point, so we do not have to estimate a value.
- See Exhibit 11.15 for a condensed statement of gross margins at the split-off point. Note that the gross margin as a percentage of sales is the same for both products.
  - This demonstrates an important concept of the net realizable value method, namely, that revenue dollars from any joint product are assumed to make the same percentage contribution at the split-off point as the revenue dollars from any other joint product.
  - The net realizable value approach implies a matching of input costs with revenues generated by each output.

*See Demonstration Problem 5*

○ Estimation of Net Realizable Value

- See Exhibit 11.16 for a diagram of the process used by Carlyle Coal Company.
- See Exhibit 11.17 for the allocation of the joint cost to the two products using the estimated net realizable value method.

*See Demonstration Problem 6*

- Physical Quantities Method
  - The **physical quantities method** allocates joint costs based on measurement of the volume, weight, or other physical measure of the joint products at the split-off point.
    - The physical quantities method is used when:
      - Output product prices are highly volatile.
      - Significant processing occurs between the split-off point and the first point of marketability.
      - Product prices are not set by the market.
    - Using the physical quantities method, joint costs are assigned to products based on a physical measure.
      - This could be volume, weight, or any other common measure of physical characteristics.
    - See Exhibit 11.18 for the allocation of joint costs using the physical quantities method.

*See Demonstration Problem 7*

- Evaluation of Joint Cost Methods
  - The “jointness” of the joint production process makes it impossible to separate the portion of joint costs attributable to one product from another on a cause-and-effect basis.
  - Accountants and managers realize that no one allocation method is appropriate for all situations.
  - If allocated joint costs are used for decision-making purposes, they should be used only with full recognition of their limitations.



**LO 11-9****Explain how cost data are used in the sell-or-process-further.****DECIDING WHETHER TO SELL GOODS NOW OR PROCESS THEM FURTHER**

- Managers must decide whether it is more profitable to sell the output at an intermediate stage or to process it further.
  - The relevant data to be considered are the:
    - Additional revenue after further processing.
    - Additional costs of processing further.
  - The decision rules about whether to process further are as follows.
    - Sell at split-off point if:  
Sales value at split-off > (Sales value after process – Additional processing cost)
    - Process further if:  
Sales value at split-off < (Sales value after process – Additional processing cost)
      - This decision is illustrated in Exhibit 11.19.
  - It is important to note that the allocation of the joint costs is irrelevant for the current decision. The only costs and revenues relevant to the decision are those that result from it.
    - See Business Application box “Different Demands for Different Parts”

*See Demonstration Problem 8*

**LO 11-10 Account for by-products.****DECIDING WHAT TO DO WITH BY-PRODUCTS**

- **By-products** are outputs from a joint production process that are relatively minor in quantity and/or value when compared to the main products.
  - By-product accounting attempts to reflect the economic relationship between the by-products and the main products with a minimum of recordkeeping for inventory valuation purposes.

- Two common methods of accounting for by-products are:
  - Method 1: The net realizable value from sale of the by-products is deducted from the joint cost of the main product(s). The remaining joint costs are allocated to the main products.
    - See Panel A of Exhibit 11.20 for the computation of the gross margin for the two joint products when the net realizable value of the by-product is used to reduce the joint cost (method 1).
  - Method 2: The proceeds from sale of the by-products are treated as other revenue. All joint costs are allocated to the main products.
- A complication can arise under both methods if the cost of processing by-products occurs in one period but they are not sold until the next period. Companies may find it necessary to keep an inventory of the by-product processing cost in the Additional by-product cost account until the by-products are sold.
- Some companies expense the by-products' costs in the period they are incurred and then record the total revenue from by-products when they are sold, a simple approach that technically violates the matching principle.

*See Demonstration Problem 9*

## REVIEW QUESTIONS

13

### Planning and Budgeting

#### Solutions to Review Questions

**13-1. Which has more detail, the budget for the coming period or a long-range forecast? Why?**

Next period's budget has more detail because it is closer in time than the longer-range forecasts. The budget plan is a blueprint for operations in the coming period. It must be sufficiently detailed so that it provides adequate direction to the various people responsible for operations.

**13-2. What is the purpose of the cash budget if the budgeted income statement will indicate whether the firm expects to be profitable?**

Cash receipts and disbursements often take place in different time periods from when items are recognized in the income statement and balance sheet. Thus, a company needs to prepare a cash budget to ensure that cash needs will be met.

**13-3. Describe four methods used to estimate sales for budgeting purposes.**

Answers will vary, but examples include:

- a. Econometric methods—using economic data to forecast using statistical models;
- b. Delphi technique—collecting and synthesizing the opinion of experts;
- c. Estimates from salespeople and other knowledgeable personnel;
- d. Trend analysis—statistical analysis of historical data;
- e. Market research—collecting information on the macroeconomic trends in the industry and in the local markets.

**13-4. What role does the master budget play in the planning and budgeting exercise?**

The master budget links long-term objectives and short-term, tactical plans. Organization goals are broad-based statements of purpose. Strategic plans take the broad-based statements and expresses them in terms of detailed steps needed to attain those goals. Budgets are the short-term plans used to implement the steps included in the strategic plans.

For example, a company might have a goal of "Becoming the number 1 company in the industry." The strategic plans would include such statements as: "Increase sales volume by 20% per year." The master budget would state the number of units that are needed to be produced and sold in the coming period to meet the 20% volume increase as well as the production and marketing costs necessary to attain that objective. The master budget would also include estimates of the levels of cash, accounts receivable, inventories, and fixed assets needed to support the budgeted level of activity.

**13-5. What problems might arise if a firm relies solely on management estimates in preparing the master budget?**

Because middle management has better knowledge about operations at lower levels in the organization, and because budgets are usually used to evaluate performance or compute bonuses for middle management, middle management might have a tendency to underestimate revenues and overestimate costs. This bias arises because if the biased plans are adopted, middle management will find it easier to meet targets and to achieve bonus awards. Of course, if upper management always "tightens" the budget plans suggested by middle management, gaming might result. The disadvantage of this gaming is that the planning effectiveness might be reduced.

**13-6. What is the coordinating role of budgeting?**

Budgeting aids in coordination in a number of ways. By relating sales forecasts to production activities it is possible to reduce the likelihood of over- or under-production. It coordinates production so that plants making subassemblies are making the appropriate number at the right time as needed by the plant making the final assemblies. In addition, the budget process is used to make certain that adequate cash is on hand to finance company activities for the coming period. Guidelines are set for administrative and selling departments so that their costs are commensurate with the company's income and output goals.

**13-7. What is participative budgeting? What are some advantages of participative budgeting? What are some disadvantages?**

Participative budgeting is a process that uses inputs from lower- or middle-management employees. The advantages include enhanced motivation, acceptance of goals, increased information. The primary disadvantage is the time taken away from other activities.

**13-8. Write out the inventory equation that is used to determine required production in the production budget for a manufacturing firm.**

$$\begin{array}{rcccl} \text{Required} & & \text{Budgeted} & & \text{Ending} & & \text{Beginning} \\ \text{production} & = & \text{sales} & + & \text{inventory} & - & \text{inventory (units)} \\ \text{(units)} & & \text{(units)} & & \text{(units)} & & \end{array}$$

**13-9. What makes creating budgets for marketing and administration more difficult than creating, for example, the production cost budget?**

It is often more difficult to create the marketing and administration budget, because the managers have more discretion about both the amount and timing of the spending.

**13-10. What does the phrase, "use it or lose it," mean in the context of budgeting?**

"Use it or lose it" in the context of budgeting refers to the incentive managers have to spend any unused funds prior to the end of the budget year. If they fail to do this, they will lose the money and, possibly, see reduced budgets in the future.

## Chapter Outline

### LO 13-1 Understand the role of budgets in overall organization plans.

- The budget is a financial plan of the resources needed to carry out activities and meet financial goals.
  - A recent study shows that small businesses rely on budgets to help manage cash flow, among things. (See Business Application box “Using the Budget to Help Manage Cash Flow.”)
  - The budgeting process is widely used and necessary for success. The usual problems with budgeting are the use of budgets as targets and the dysfunctional effects caused by that use.

#### HOW STRATEGIC PLANNING INCREASES COMPETITIVENESS

- Critical success factors are strengths of a company that enable it to outperform competitors.
  - By identifying critical success factors and ensuring that they are incorporated into the strategic plan, companies are able to maintain an edge over competitors.
  - Important critical success factors can be exploited to improve the company’s overall competitiveness.

#### OVERALL PLAN

- A master budget is made up of three components:
  - The organization goals
  - The strategic long-range profit plan
  - The master budget (i.e., the tactical short-range profit plan)

- Organization Goals
  - Organization goals are a company's broad objectives established by management that employees work to achieve.
  
- Strategic Long-Range Profit Plan
  - The strategic long-range profit plan is a statement detailing steps to take to achieve a company's organization goals. The plan provides a general framework for guiding management's operating decisions.
  - Strategic plans discuss the major capital investments required to maintain present facilities, increase capacity, diversify products and/or processes, and develop particular markets.
  
- Master Budget (Tactical Short-Range Profit Plan): Tying the Strategic Plan to the Operating Plan
  - The master budget (also known as the *static budget*, the *budget plan*, or the *planning budget*) is the financial plan of an organization for the coming year or other planning period.
    - The profit plan is the income statement portion of the master budget.
    - The master budget indicates the sales levels, production and cost levels, income, and cash flows anticipated for the coming year. In addition, these budget data are used to construct a budgeted balance sheet.
  - Budgeting is a dynamic process that ties together goals, plans, decision making, and employee performance evaluation.
  - Exhibit 13.1 shows the master budget and its relationship to other plans, accounting reports, and management decision-making processes.
    - The master budget is derived from the long-range plan in consideration of conditions expected during the coming period. Such plans are subject to change as the events of the year unfold.
  - Benchmarking is the continuous process of measuring products, services, or activities against competitors' performance.
    - Competitive intelligence can be part of a benchmarking activity in which some companies gather information by speaking to their competitors, customers, and suppliers.

**LO 13-2 Understand the importance of people in the budgeting process.**

**HUMAN ELEMENT IN BUDGETING**

- Although budgets are often viewed in purely quantitative, technical terms, managers' personal goals and values will affect their beliefs about the coming period.
  - Budget preparation rests on human estimates of an unknown future. People's forecasts are likely to be greatly influenced by their experiences with various segments of the company.
  - One challenge of budgeting is to identify who in the organization is best able to provide the most accurate information about particular topics.
- Value of Employee Participation
  - Participative budgeting (also called *grass roots budgeting*) is the use of input from lower- and middle-management employees for budget preparation.
    - Participative budgeting is time consuming, yet it enhances employee motivation and acceptance of goals, and provides information that enables employees to associate rewards and penalties with performance. It also serves a training or development role for managers.
    - Studies have found that managers often provide inaccurate data when asked to give budget estimates. Managers who believe that the budget will be used as a norm for evaluating their performance could provide an estimate that will not be too hard to achieve.
    - Ideally, the budget will motivate people and facilitate their activities so that the organization can achieve its goals.

**DEVELOPING THE MASTER BUDGET: WHERE TO START?**

- All budgeting processes share some common elements.



- After organization goals, strategies, and long-range plans have been developed, work begins on the master budget, a detailed budget for the coming fiscal year with some less-detailed figures for subsequent years.
- The bulk of the work preparing the master budget is usually done in the six months immediately preceding the beginning of the coming fiscal year.
- Final budget approvals by the chief executive and board of directors are made one month to six weeks before the beginning of the coming fiscal year.

<b>LO 13-3</b> <b>Estimate sales.</b>
---------------------------------------

- Sales Forecasting
  - Beginning with a sales forecast, the firm can plan the activities over which it has more control. As better information about sales becomes available, it is reasonably easy to adjust the rest of the budget.
    - In most firms, forecasting sales is the most difficult aspect of budgeting because it is most uncertain.
    - If, on the other hand, production is more uncertain than sales because of unpredictable supply of materials, the firm may want to begin with a raw material and production forecast.
  - Sales Staff
    - Salespeople are in the unique position of being close to the customers, and they may possess the best information and the best local knowledge in the company about customers' immediate and near-term needs.
    - Salespeople realize that they will be evaluated based, in part, on the budget. As a result, they have an incentive to bias their sales forecasts.
      - Incentive compensation plans can be designed to motivate different behaviors, each with their own strengths and weaknesses.

- Market Researchers
  - Market researchers do not have the same incentives that sales personnel have to bias the budget.
  - Market researchers have a different perspective on the market. That is, they can predict long-term trends in attitudes and the effects of social and economic changes on the company's sales, potential markets, and products.
  
- Delphi Technique
  - The Delphi technique is a forecasting method in which individual forecasts of group members are submitted anonymously and evaluated by the group as a whole.
    - Each group member obtains a copy of all forecasts but is unaware of their sources.
  - Differences among individual forecasts can be addressed and reconciled without involving the personality or position of individual forecasters.
    - After the differences are discussed, the process is repeated until the forecasts converge on a single best estimate of the coming year's sales level.
  
- Trend Analysis
  - Trend analysis is a forecasting method that ranges from simple visual extrapolation of points on a graph to highly sophisticated computerized time series analysis.
    - Time series techniques use only past observations of the data series to be forecasted.
    - This approach is relatively economical.
    - Forecasting techniques based on trend analysis often requires long series of past data to derive a suitable solution. When used in accounting applications, monthly data are required to obtain an adequate number of observations.
  
- Econometric Model

- Econometric models are statistical methods of forecasting economic data using regression models.
  - Econometric models can include many relevant predictors. Manipulating the assumed values of the predictors makes it possible to examine a variety of hypothetical conditions and relate them to the sales forecast.
  - No model removes the uncertainty surrounding sales forecasts. Cost-benefit tests should be used to determine which methods are most appropriate.

### COMPREHENSIVE ILLUSTRATION

- To illustrate the discussion of the budgeting process, the budget for Santiago Pants, a manufacturer, is developed.
  - A manufacturing example because it includes most aspects of a firm's operations.
  - The methods we discuss also apply to nonmanufacturing and not-for-profit organizations.

**LO 13-4    Develop production and cost budgets.**

- Forecasting Production
  - The **production budget** is the production plan of resources needed to meet current sales demand and ensure that inventory levels are sufficient for future sales.
  - It is necessary to determine the required inventory level for the beginning and end of the budget period.
    - The basic cost flow equation (also known as the *basic inventory formula*) can be adapted for inventories, production, and sales to solve for the required production. Recall from Chapter 6 the inventory equation:

$$\text{Beginning balance (BB)} + \text{Transfer in (TI)} - \text{Transfer out (TO)} = \text{Ending balance (EB)}$$

- Rearranging the terms, this revised equation states that production equals the sales demand plus or minus an inventory adjustment.

$$\begin{array}{ccccccc} \text{Required production} & = & \text{Budgeted} & & \text{Units in ending} & & \text{Units in beginning} \\ \text{(units)} & & \text{sales (units)} & + & \text{inventory} & - & \text{inventory} \end{array}$$

- Another way to solve the required production is to go through the following T-account:

Finished Goods Inventory	
Units in beginning inventory	
Required production (?)	Budgeted sales (from sales forecast)
Units in ending inventory	

- Production and inventory are stated in equivalent finished units.
- Exhibit 13.2 presents a production budget example.
- Management of the production facilities reviews the production budget to ascertain whether the budgeted level of production can be reached with the capacity available.
- One benefit of the budgeting process is that it facilitates the coordination of activities.
- Forecasting Production Costs
  - Direct Materials
    - Once the sales and production budgets have been developed and the efforts of the sales and production groups have been coordinated, the next step is to estimate costs of direct materials, direct labor, and manufacturing overhead at budgeted levels of production so the budgeted cost of goods sold can be prepared.
    - Direct materials purchases needed for the budget period are derived from the equation:

$$\text{Required material purchases} = \text{Materials to be used in production} + \text{Estimated ending materials inventory} - \text{Estimated beginning materials inventory}$$

- Another way to solve the required materials purchases is to go through the following T-account:

Materials Inventory	
Estimated beginning inventory	Required usage
Required purchases (?)	(converted from production budget)
Estimated ending inventory	

- Required usage = Required production × Materials needed per unit of output.
  - Cost of materials to be purchased = Required purchases × Cost of materials per unit.
  - Exhibit 13.3 shows the direct materials budget.
- Direct Labor
- Estimates of direct labor costs often are obtained from engineering and production management.
    - Direct labor usage = Required production × Labor hours needed per unit of output.
    - Direct labor cost = Direct labor usage × Direct labor cost per hour.
  - Exhibit 13.4 shows a direct labor budget.

- Overhead
  - Overhead is composed of many different types of costs with varying cost behaviors.
  - Budgeting overhead requires an estimate based on production levels, management discretion, long-range capacity and other corporate policies, and external factors such as increases in property taxes.
    - To simplify the budgeting process, overhead costs are usually divided into fixed and variable components, with discretionary and semi-fixed costs treated as fixed costs within the relevant range.
  - Exhibit 13.5 presents a sample schedule of budgeted manufacturing overhead.
- The total manufacturing costs can be determined by adding materials, labor, and overhead together. Exhibit 13.6 shows the calculation for the budgeted statement of cost of goods sold.
  - In most companies, estimates of work-in-process inventories are omitted from the budget because they have a minimal impact on the budget.
- Completing the Budgeted Cost of Goods Sold
  - The calculation of the cost of goods sold follows the equation:

$$\begin{array}{rcccl}
 \text{Estimated cost} & & \text{Estimated beginning} & & \text{Estimated cost of} & & \text{Estimated ending} \\
 \text{of} & = & \text{finished goods} & + & \text{goods} & - & \text{finished goods} \\
 \text{goods sold} & & \text{inventory} & & \text{manufactured} & & \text{inventory}
 \end{array}$$

- Another way to determine the estimated cost of goods sold is to go through the finished goods T-account:

Finished goods Inventory	
Beginning inventory	
Cost of goods manufactured	Cost of goods sold (?)

---

Ending inventory

- This part of the budgeting effort can be extremely complex for manufacturing companies. It can be very difficult to coordinate production schedules among numerous plants; it is also difficult to coordinate production schedules with sales forecasts.
- Revising the Initial Budget
  - The budget usually undergoes a good deal of coordinating and revising before it is considered final.
    - **Not part of the budget is really formally adopted until the board of directors finally approves the master budget.**

## MARKETING AND ADMINISTRATIVE BUDGET

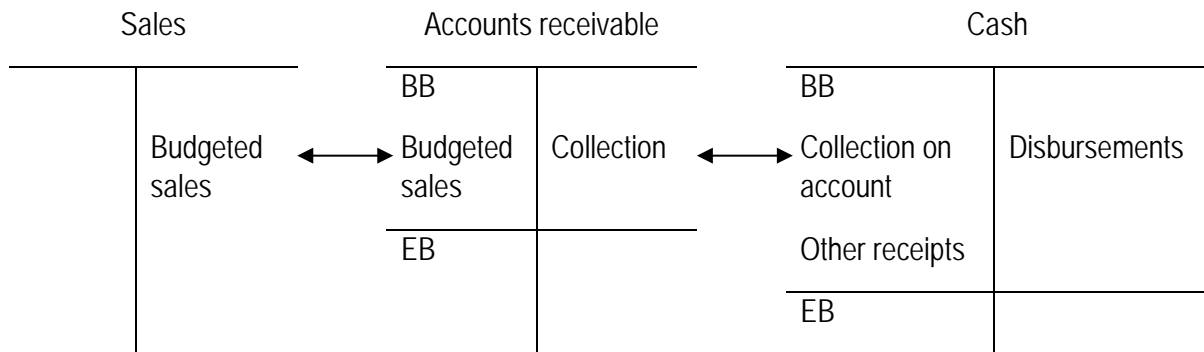
- Budgeting marketing and administrative costs is very difficult because managers have discretion about how much money is spent and the timing of the expenditures.
  - The budgeting objective is to estimate the amount of marketing and administrative costs required to operate the company at its projected level of sales and production, and to achieve long-term company goals.
    - **An easy and inexpensive way is to start with a previous period's actual or budgeted amounts and make adjustments for inflation, changes in operations, and similar changes between periods.**
  - Exhibit 13.7 shows a schedule of budgeted marketing and administrative costs.
    - **Variable marketing costs vary with sales.**
    - **Fixed marketing costs are usually those that can be changed at management's discretion.**

## PULLING IT TOGETHER INTO THE INCOME STATEMENT

- The budgeting process culminates in the projected operating profits reported in the budgeted income statement, as shown in Exhibit 13.8.
  - The budgeted income statement also includes estimated federal and other income taxes.
- The process will be repeated to see if sales revenue can be increased, or costs cut, until the desired financial results can be reached.

### KEY RELATIONSHIPS: THE SALES CYCLE

- The master budget is rooted in some key relations among sales, accounts receivable, and cash flows in the sales cycle. That is,



- BB and EB refer to beginning and ending balances, respectively. All sales are assumed to be on account.
  - If an amount in the sales cycle is unknown, the basic accounting equation ( $BB + TI - TO = EB$ ) can be used to find it.

**LO 13-5 Estimate cash flows.**

### USING CASH FLOW BUDGETS TO ESTIMATE CASH NEEDS

- The **cash budget** refers to a statement of cash on hand at the start of the budget period, expected cash receipts, expected cash disbursements, and the resulting cash balance at the end of the budget period.



- Cash budgeting is important to ensure company solvency, maximize interest earned on cash balances, and determine whether the company is generating enough cash for present and future operations.
- Preparing a cash budget requires that all revenues, costs, and other transactions be examined in terms of their effects on cash.
  - **Cash receipts come from the collection of accounts receivable, cash sales, sale of assets, borrowing, issuing stock, and other cash-generating activities.**
  - **Cash disbursements are used to pay for materials purchases, manufacturing and other operations, federal income taxes, and stockholder dividends.**
- A cash budget is shown in Exhibit 13.9.
- Multiperiod Cash Flows
  - A more detailed analysis looks at multiperiod cash receipts (Exhibit 13.10) and cash disbursements (Exhibit 13.11) to ensure that the company will not run out of cash during the year. (See Business Application box “The Curse of Growth.”)

<b>LO 13-6      Develop budgeted financial statements.</b>
--

#### PLANNING FOR THE ASSETS AND LIABILITIES ON THE BUDGETED BALANCE SHEETS

- **Budgeted balance sheets** are statements of budgeted financial position.
  - Budgeted balance sheets combine an estimate of financial position at the beginning of the budget period with the estimated results of operations for the period and estimated changes in assets and liabilities.
    - **Decision making in these areas is, for the most part, the treasurer’s function.**
  - Exhibit 13.12 presents budgeted balance sheets at the beginning and end of the budget period.

#### BIG PICTURE: HOW IT ALL FITS TOGETHER

- A model of the budgeting process for a manufacturing firm is presented in Exhibit 13.13.
  - Assembling a master budget is a complex process requiring careful coordination of many different organization segments.

**LO 13-7 Explain budgeting in merchandising and service organizations.**

### BUDGETING IN SERVICE ORGANIZATIONS

- Budgeting is used extensively in different types of organizations.
  - As in manufacturing, the sales budget in retail and wholesale (often called merchandising) businesses drives the rest of the budgeted income statement.
    - A merchandiser has no production budget but a merchandise purchases budget, which is much like the direct materials purchases budget in manufacturing.
      - Exhibit 13.14 presents a merchandise purchases budget.
    - Because of the critical importance of timing and seasonality in merchandising, special attention is usually given to short-term budgets. The budget helps formalize an ongoing process of coordinating buying and selling.
      - A key difference in the master budget of a service enterprise is the absence of product or material inventories. Neither a production budget (for manufacturing firms) nor a merchandise purchases budget (for merchandising firms) is needed.
      - Service businesses need to carefully coordinate sales with the necessary labor. Managers must ensure that personnel with the right skills are available at the right times.
        - Example: Revenue projections for a consulting firm may be based on estimates of the number and types of clients to be served in the budget year and the amount of services requested. The forecasts stem primarily from services provided in previous years with adjustments for new clients, new services to existing clients, loss of clients, and changes in the rates charged for services.

Once the amount of services is forecast, the firm develops its budget for personnel. The firm faces a trade-off between not having the staff to do the work and having costly staff who are underemployed.

- In governmental organizations, the budget serves as an expression of the legislature's desires and is a legally binding authorization. (See Business Application box "Budget Is the Law in Government.")

**LO 13-8 Explain why ethical issues arise in budgeting.**

**ETHICAL PROBLEMS IN BUDGETING**

- Budgeting creates serious ethical issues for many people.
- Managers and employees provide much of the information for the budget. Their performance then is compared with the budget they help develop.
  - Part of the problem is the form of the merit pay schedule that creates strong incentives right around the target.
- The company must recognize the trade-off between encouraging unbiased reporting by local managers and the use of this information in performance evaluation and reward.
  - While the conflict cannot be avoided, managers who are aware of the potential problems are in a position to take steps to mitigate the consequences.

**LO 13-9 Explain how to use sensitivity analysis to budget under uncertainty.**

**BUDGETING UNDER UNCERTAINTY**

- Formal planning models allow many alternatives and options to be explored in the planning process.

- Any projection of the future is uncertain.
  - Managers often perform sensitivity analysis on their projections.
    - By asking and answering hypothetical questions during the planning phase, management can determine the risk of various phases of its operations and can develop contingency plans.
      - Local managers can be asked to provide three forecasts of prices and quantities: a best estimate, an optimistic estimate (an estimate so high that there is only a 10 percent or less chance that conditions will be better than the optimistic estimate), and a pessimistic estimate (an estimate so low that there is only a 10 percent or less chance that conditions will be worse than the pessimistic estimate). Nine possible scenarios can be defined by selling prices and sales quantity combinations.
- The incorporation of uncertainty into budget estimates can be quite useful.
  - Spreadsheets are extremely useful in preparing budgets, which require considerable what-if thinking.
    - Exhibit 13.15 shows a spreadsheet analysis of alternative budgeting scenarios.

## REVIEW QUESTIONS

# 16

## Fundamentals of Variance Analysis

### Solutions to Review Questions

#### **16-1. What are the advantages of the contribution margin format based on variable costing compared to the traditional format based on full absorption costing?**

For performance evaluation purposes, the costing format should identify the actual costs for comparison with expected costs during the relevant period. Under absorption costing, the manufacturing fixed costs are allocated on a per unit basis. An increase in production results in a lower per unit cost. If all of the production is sold, all of the fixed cost will be charged against profit. However, if some of the costs are assigned to inventory, the result can be a deferral of costs that should be evaluated at this time. This problem is highlighted by the suggestion that one can increase production in times of declining sales in order to "help the bottom line by spreading fixed costs over more units." Because variable costing excludes fixed overhead for inventory valuation (fixed overhead is treated as a period expense), there is no motivation to produce goods for inventory.

#### **16-2. How can a budget be used for performance evaluation?**

The budget can be used as a benchmark against which to evaluate actual results. It can be used in the same way that actual results of competitors or the actual results from previous years can be used.

#### **16-3. "The flexible budget for costs is computed by multiplying average total cost at the master budget activity level by the activity at some other level." Is this true or false? Explain.**

False. Only variable costs and revenues "flex" with changes in activity. Fixed costs are expected to remain the same when operations are in the relevant range.

#### **16-4. A flexible budget is:**

- a) Appropriate for control of factory overhead but not for control of direct materials and direct labor.
- b) Appropriate for control of direct materials and direct labor but not for control of factory overhead.
- c) Not appropriate when costs and expenses are affected by fluctuations in volume.
- d) Appropriate for any level of activity.

*(CPA adapted)*

Answer:

- (d) Appropriate for any level of activity.

### 16-5. What is the standard cost sheet?

The standard cost sheet provides the quantities of each input required to produce a unit output along with the budgeted unit prices for each input.

### 16-6. What is the basic difference between a master budget and a flexible budget?

- a) A flexible budget considers only variable costs; a master budget considers all costs.
- b) A master budget is based on a predicted level of activity; a flexible budget is based on the actual level of activity.
- c) A master budget is for an entire production facility; a flexible budget is applicable only to individual departments.
- d) A flexible budget allows management latitude in meeting goals; a master budget is based on a fixed standard.

Answer:

- (b) A master budget is based on a predicted level of activity, while a flexible budget is based on the actual level of activity.

### 16-7. Standards and budgets are the same thing. True or false?

False. A standard is related to a cost per unit. Budgets focus on totals.

### 16-8. Actual direct materials costs differ from the master budget amount. What are the three primary reasons for the difference?

The three primary sources of variances are:

- a. price variances, which arise because actual material prices differ from standards;
- b. efficiency variances which occur when the relationship between the usage of input factors (labor, materials, variable overhead) differs from that which would be expected to produce a given level of output; and
- c. activity variances, which represent differences between, planned (master budget) output levels and the output levels actually attained during the period.

### 16-9. Fixed cost variances are computed differently from the variances for variable costs. Why?

The fixed cost variances differ from variable cost variances because fixed costs do not vary with the level of production activity. Therefore, the fixed costs in the flexible budget will be the same as in the master budget (within the relevant range). Additionally, there are no efficiency variances for fixed costs because there is no input-output relationship that can be applied.

## Chapter Outline

LO 16-1      Use budgets for performance evaluation.
--

### USING BUDGETS FOR PERFORMANCE EVALUATION

- The development of the master budget is the first step in the budgetary planning and control cycle.
  - The budgeting process provides a means to coordinate activities among units of the organization, to communicate the organization's goals to individual units, and to ensure that adequate resources are available to carry out the planned activities.
  - In the control and evaluation activity, the performance of units and managers is evaluated and actions are taken in an attempt to improve performance.
  - The budget serves as the benchmark for units of the firm or for organizations that do not routinely prepare public reports.
  - The budget is management's plan for financial performance.
- The master budget includes:
  - **Operating budgets** (such as the budgeted income statement, production budget, budgeted cost of goods sold, and supporting budgets)
  - **Financial budgets** (budgets of financial resources—for example, the cash budget and the budgeted balance sheet)
    - When management uses the master budget for control purposes, it focuses on the key items that must be controlled to ensure the company's success.
    - The income statement is the most important financial statement that managers use to control operations.
- **Variance** is the difference between planned result and actual outcome. That is:

Variance = Actual result – Budgeted performance.

  - Variance analysis is used to:
    - Evaluate the performance of individuals and business units.
    - Identify possible sources of deviations between budgeted and actual performance.

## PROFIT VARIANCE

- The simplest measure of performance is the variance between actual income and budgeted income.
  - A **favorable variance** is the variance that, taken alone, results in an addition to operating profit.
    - When discussing revenue, income, or contribution margin, a favorable variance means the actual result is better than the budgeted result.
    - When discussing costs, a favorable variance indicates that actual costs are less than budgeted costs.
  - An **unfavorable variance** is the variance that, taken alone, reduces operating profit.
  - The labels “favorable” and “unfavorable” should not be considered as evaluations of performance without additional investigation. (See Business Application box “When a Favorable Variance Might Not Mean “Good” News.”)
    - Although a simple comparison of planned and actual profit suggests that performance was better (or worse) than planned, the additional data (such as those in Exhibit 16.2) provide information on the impact on profit performance from each of the revenue and cost line items.
    - The additional information is useful for two reasons:
      - It allows the manager to investigate more efficiently the causes of off-budget performance, and
      - It allows the manager to evaluate subordinate managers responsible for various aspects of the firm’s operations.
- Why are Actual and Budgeted Results Different?
  - An important part of variance analysis is to understand:
    - What might cause a difference between actual and budgeted results.
    - What portion of the total profit variance is due to each cause.



- The following table summarizes the variance analysis between actual results and the master budget for line items comprising the operating profit:

	(1) <u>Actual</u>	(3) = (1) – (2) <u>Variance<sup>a</sup></u>	(2) <u>Master Budget</u>
Units	xxx	xxx F or U	xxx
Sales revenue	\$ xxx	\$xxx F or U	\$ xxx
Less: Variable costs <sup>b</sup>	<u>(xxx)</u>	<u>(xxx) F or U</u>	<u>(xxx)</u>
Contribution margin	\$xxx	\$xxx F or U	\$xxx
Less: Fixed costs <sup>c</sup>	<u>(xxx)</u>	<u>(xxx) F or U</u>	<u>(xxx)</u>
Operating profit	<u>\$ xxx</u>	<u>\$xxx F or U</u>	<u>\$ xxx</u>

<sup>a</sup> For revenue, income, or contribution margin, a favorable (F) variance results when (3) > 0. For cost items, a favorable (F) variance results when (3) < 0.

<sup>b</sup> Including variable manufacturing costs and variable selling and administrative costs.

<sup>c</sup> Including fixed manufacturing overhead and fixed selling and administrative costs.

*See Demonstration Problem 1*

<b>LO 16-2     Develop and use flexible budgets.</b>
--

### FLEXIBLE BUDGETING

- One obvious reason that actual results might differ from budgeted results is that the actual activity itself differed from the budgeted or expected activity.
  - A **static budget** is developed in detail for one level of anticipated activity, such as a master budget.
  - A **flexible budget** indicates budgeted revenues, costs, and profits for virtually all feasible levels of activities.
    - Because variable costs and revenues change with changes in activity levels, these amounts are budgeted to be different at each activity level in the flexible budget.
    - **Flexible budget line** is the expected costs at different output levels and can be represented by the following formula:

$$\text{Total Budgeted Costs} = \text{Budgeted Fixed Cost} + \text{Budgeted Unit Variable Cost} \times \text{Activity Level (Units Produced and Sold)}$$

- The flexible budget line (see Exhibit 16.3) is an estimated cost-volume line because it shows the budgeted costs allowed for each level of activity.

- The master budget is based on an ex ante (before-the-fact) prediction of the activity level.
- The flexible budget is based on ex post (after-the-fact) knowledge of the actual activity level.

**LO 16-3      Compute and interpret the sales activity variance.**

**COMPARING BUDGETS AND RESULTS**

- A comparison of the master budget with the flexible budget and with actual results is the basis for analyzing differences between plans and actual performance.
- Sales Activity Variance
  - **Sales activity variance** (also known as *sales volume variance*) is the difference between operating profit in the master budget and operating profit in flexible budget that arises because the actual number of units sold is different from the budgeted number.

- That is:

Sales Activity Variance	=	Flexible Budget (Based on Actual Activity)	-	Master Budget (Based on Planned Activity).
For Sales Revenue:		Budgeted Unit Price × Actual Units	-	Budgeted Unit Price × Budgeted Units
For Variable Costs:		Budgeted Unit Cost × Actual Units	-	Budgeted Unit Cost × Budgeted Units

- The budgeted unit price and budgeted unit cost are used in the flexible budget instead of the actual unit price and actual unit cost in order to isolate the effects of volume alone.
- The sales activity variance, as shown in Exhibit 16.4, is useful for management because:
  - It isolates the change in operating profits caused by the actual activity being different from the master budget level.
  - The resulting flexible budget shows budgeted sales, costs, and operating profits after considering the activity change but before considering differences in unit selling prices, variable costs, and fixed costs from the master budget.

o Interpreting Variances

- Holding everything else constant, a decrease in sales creates an unfavorable sales activity variance as shown in Exhibit 16.4. Does this indicate poor performance?
  - Perhaps it does not. Economic conditions could have been worse than planned, decreasing the volume demanded by the market. Hence, perhaps, the 20,000 unit decrease in sales volume could have been even greater, taking everything into account.
  - Note that both variable cost variances are labeled *favorable*, but this doesn't mean that they are good for the company. Variable costs are expected to decrease when volume is lower than planned.

**LO 16-4 Prepare and use a profit variance analysis.**

**PROFIT VARIANCE ANALYSIS AS A KEY TOOL FOR MANAGERS**

- **Profit variance analysis** shows the causes of differences between budgeted profits and the actual profits earned.
  - o The actual results can be compared with both the flexible budget and the master budget in a profit variance analysis, as shown in Exhibit 16.5.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Actual (Based on Actual Activity) \$xxx	Manufacturing Variances	Marketing And Administrative Variance	Sales Price Variance \$xx U or F	Flexible Budget (Based on Actual Activity) \$xxx	Sales Activity Variance \$xxx U or F	Master Budget (Based on Planned Activity) \$xxx
Sales revenue	\$xxx				\$xxx	\$xxx U or F	\$xxx
Less:							
Variable costs							
Variable manufacturing cost	(xxx)	\$xxx U or F			(xxx)	(xxx) U or F	(xxx)
Variable marketing and administrative cost	(xxx)		\$xxx U or F		(xxx)	(xxx) U or F	(xxx)
Contribution margin	<hr/> \$xxx				<hr/> \$xxx	\$xxx U or F	<hr/> \$xxx
Less:							
Fixed costs							
Fixed manufacturing cost	(xxx)	xxx U or F			(xxx)	0	(xxx)
Fixed marketing and administrative cost	(xxx)		xxx U or F		(xxx)	0	(xxx)
Operating profit	<hr/> \$xxx	\$xxx U or F	\$xxx U or F	\$xxx U or F	<hr/> \$xxx	\$xxx U or F	<hr/> \$xxx
		↑ Total variance from flexible budget ↑					
		↑ Total variance from master budget ↑					

- Column (1) is the reported income statement based on the actual sales.
- Column (2) summarizes production variances.
- Column (3) shows marketing and administrative variances.

- Cost variances result from deviations in costs and efficiencies in operating the company. They are important for measuring productivity and for helping to control costs.
  - Variable cost variances in Columns (2) and (3) are input variances
  - Variable cost variances in Column (6) are part of the sales activity variance.
- Sales Price Variance
  - Column (4) shows the **sales price variance** as derived from the difference between the actual revenue and budgeted selling price multiplied by the actual number of units sold.

- That is:

$$\begin{array}{rclclcl}
 \text{Sales Price} & = & \text{Actual Revenue} & - & \text{Budgeted} & \times & \text{Actual} \\
 \text{Variance} & & & & \text{Selling Price} & & \text{Units Sold} \\
 & & & & & & \\
 & = & (\text{Actual} & - & \text{Budgeted} & \times & \text{Actual} \\
 & & \text{Selling Price} & & \text{Selling Price}) & & \text{Units Sold}
 \end{array}$$

- Variable Production Cost Variances
  - Variable costs in Column (5) represent what should have been spent given the actual sales volume.
- Fixed Production Cost Variance
  - The fixed production cost variance is the difference between actual and budgeted costs because the flexible budget's fixed costs equal the master budget's fixed costs.
- Marketing and Administrative Variances
  - Marketing and administrative costs are treated like production costs.
    - Variable costs are expected to change as activity changes.
    - Fixed marketing and administrative costs do not change as volume changes.

*See Demonstration Problem 2*

## PERFORMANCE MEASUREMENT AND CONTROL IN A COST CENTER

- For cost centers whose production managers typically do not control what they are asked to produce, the actual unit production (not sales) should be used as a baseline.
- Variable Production Costs
  - For any unit variable cost (such as direct materials), the variable cost in the budget is determined by multiplying the budgeted amount of the direct material in each unit of output by the expected price of each unit of direct material.
  - The **standard cost sheet** is a form that provides standard quantities of inputs (direct material, direct labor, and variable production overhead) required to produce a unit of output and the standard (budgeted) unit prices for the inputs. See Exhibit 16.6 for an example.

- For each input:

$$\begin{array}{r} \text{Standard Cost} \\ \text{per Unit of Output} \end{array} = \begin{array}{r} \text{Standard Input Price or Rate} \\ \text{per Unit of Input} \end{array} \times \begin{array}{r} \text{Standard Quantity} \\ \text{of Input per Unit of Output} \end{array}$$

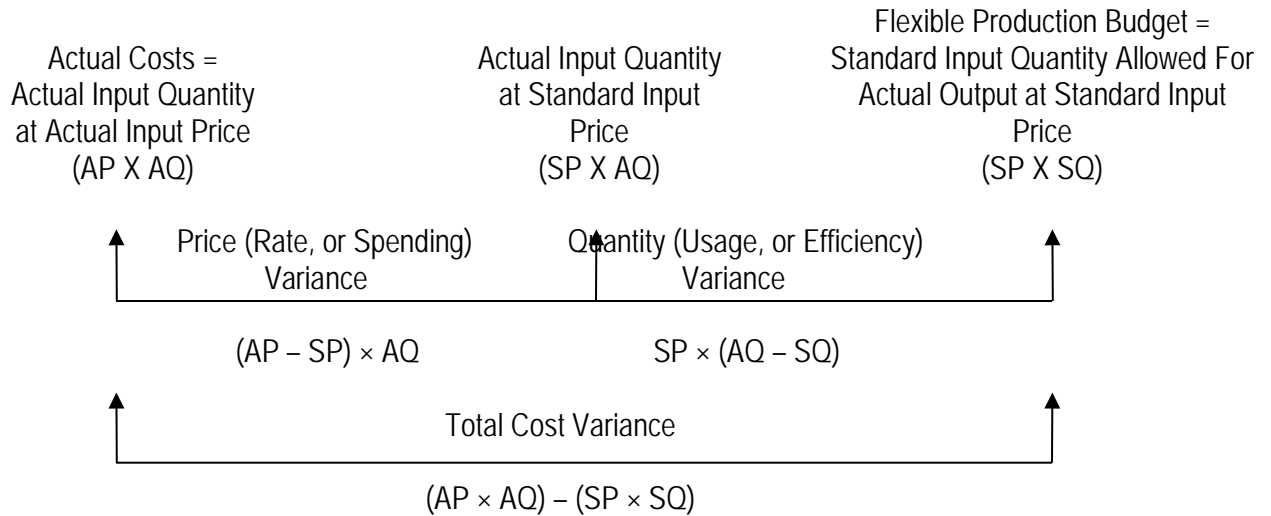
- Direct Materials
  - The purchasing manager estimates the cost of direct materials with the correct specification and quality.
- Direct Labor
  - The standard labor rate includes wages earned as well as fringe benefits. Most companies develop one standard for each labor category.
- Variable Production Overhead
  - The overhead "quantity" is expressed in terms of the units of the cost driver chosen (such as direct labor hours) because that is what is being used to apply the overhead.
    - To determine the variable production overhead rate:
      - Management reviews prior period activities and costs,
      - Estimates how costs will change in the future, and
      - Performs a regression analysis in which overhead cost is the dependent variable and certain cost driver (such as direct labor hours) the independent variable.

<b>LO 16-5      Compute and use variable cost variances.</b>
--

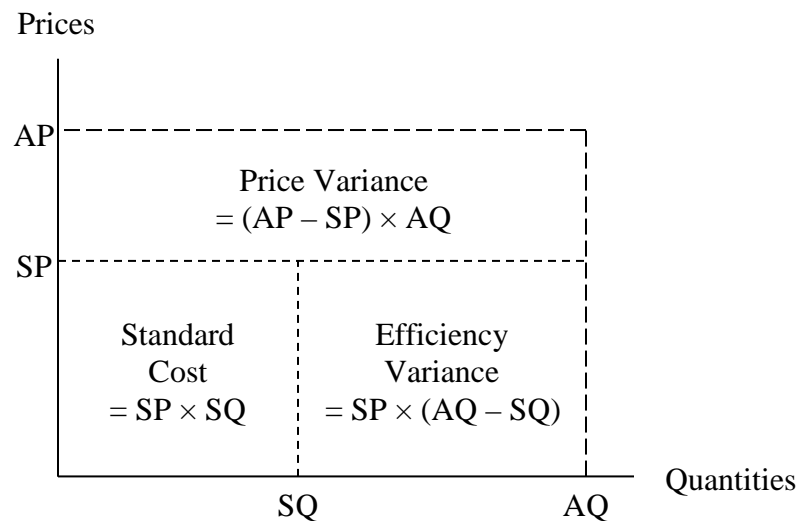
### VARIABLE COST VARIANCE ANALYSIS

- General Model
  - Comparing the budget (based on standard costing) to actual results identifies production cost variances.
    - **Cost variance analysis** uses a conceptual model that compares actual input amounts and prices with standard input amounts and prices.
  - Both the actual and standard input quantities are for the actual output attained.
    - A **price variance** is the difference between actual costs and budgeted costs arising from changes in the cost of inputs to a production process or other activity.
      - Price variance =  $(AP \times AQ) - (SP \times AQ) = (AP - SP) \times AQ$ .
    - An **efficiency variance** is the difference between budgeted and actual results arising from differences between the inputs that were budgeted per unit of output and the inputs actually used.
      - Efficiency variance =  $(SP \times AQ) - (SP \times SQ) = SP \times (AQ - SQ)$ .
  - Managers who are responsible for price variances would not be held responsible for efficiency variances and vice versa.
    - The **total cost variance** is the difference between budgeted and actual results (equal to the sum of the price and efficiency variances).
      - Total cost variance =  $(AP \times AQ) - (SP \times SQ)$ .
  - The general model is applied to each variable cost incurred and is outlined in Exhibit 16.7.

- That is,



- The comprehensive cost variance analysis will ultimately explain, in detail, the variable manufacturing cost variance calculated earlier.
- Direct Materials
  - A **flexible production budget** is calculated as standard input price times standard quantity of input allowed for actual good output. It is based on actual production volume.
  - An alternative way to view these variances graphically is shown below. Quantities are presented on the horizontal axis and prices on the vertical axis. The three areas are standard cost ( $SP \times SQ$ ), price variance ( $(AP - SP) \times AQ$ ), and efficiency variance ( $SP \times (AQ - SQ)$ ), respectively.



- Exhibit 16.8 applies the general model to direct materials variances.
- Responsibility for Direct Materials Variances
  - Responsibility for the direct materials price variance is usually assigned to the purchasing department.
    - Explanations for a materials price variance include failure to take purchase discounts, higher transportation costs than expected, different grade of direct materials purchased, or changes in the market price of direct materials.
  - Direct materials efficiency variances are typically the responsibility of production departments.
    - Explanations for a materials efficiency variance include defects in direct materials, inexperienced workers, poor supervision, and so on.

*See Demonstration Problem 3*

- Direct Labor
  - Exhibit 16.9 applies the general model to direct labor variances.
  - Direct Labor Price Variance
    - The direct labor price variance may be caused by hiring less experienced employees.
      - If the wage rates used in setting standards are the same as those in the union contract, labor price variances will not occur.
  - Labor Efficiency Variance
    - The labor efficiency variance is a measure of labor productivity and is usually controlled by production managers.
      - Unfavorable labor efficiency variances may be due to poorly motivated or trained workers, poor materials or faulty equipment, poor supervision and scheduling problems.
  - One event, such as hiring inexperienced employees, can affect more than one variance.

*See Demonstration Problem 4*



- Variable Production Overhead
  - Exhibit 16.10 applies the general model to variable overhead variances. The variable overhead standard rate is derived from a two-stage estimation of:
    - Costs at various levels of activity, and
    - The relationship between those estimated costs and the basis.
  - Variable Production Overhead Price Variance
    - The variable overhead price variance could have occurred because
      - Actual costs are different from those expected, and
      - The relationship between variable production overhead costs and the basis chosen is not perfect.
  - Variable Overhead Efficiency Variance
    - The variable overhead price variance actually contains some efficiency items as well as price items. Some companies separate those components.
    - The variable overhead efficiency variance is not related to the use (or efficiency) of variable overhead. Instead, it is related to efficiency in using the base on which variable overhead is applied.
    - Managers who are responsible for controlling the base will probably be held responsible for the variable overhead efficiency variance as well.

***See Demonstration Problem 5***

- Variable Cost Variances Summarized in Graphic Form
  - Exhibit 16.11 summarizes the variable production cost variances.
    - A summary of this nature is useful for reporting variances to high-level managers. It provides both an overview of variances and their sources.
      - Management could want more detailed information about some of the variances by extending each variance branch to show variances by product line, department, or other categories.



o Developing the Standard Unit Cost for Fixed Production Costs

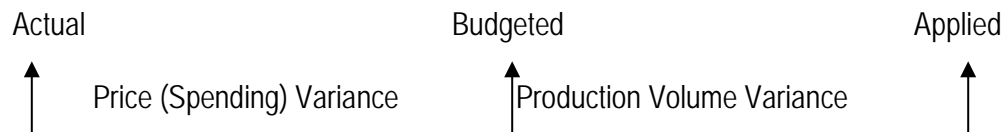
- The fixed manufacturing standard cost is determined before the start of the production period using the following formula from Chapter 7:

$$\text{Standard (or Predetermined) Fixed Production Overhead Cost} = \frac{\text{Budgeted Fixed Manufacturing Overhead}}{\text{Budgeted Activity Level}}$$

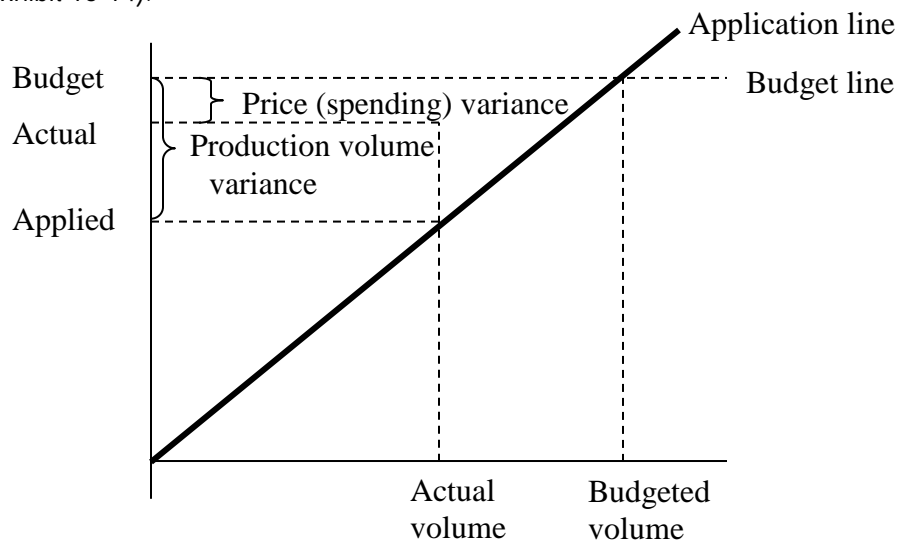
- A **production volume variance** (also called capacity variance, idle capacity variance, or denominator variance) is the difference between the applied fixed overhead and the budgeted fixed overhead.
  - Production volume variances arise because the volume used to apply fixed overhead differs from the estimated volume used to calculate fixed overhead per unit.

o Compare with the Fixed Production Cost Price Variance

- Exhibit 16.13 demonstrates the variance analysis for fixed overhead under absorption costing.
  - That is:



- An alternative way to present fixed overhead variances graphically is shown below (see also Exhibit 16-14).



- Since fixed overhead is unitized through the calculation of predetermined fixed overhead rate, fixed overhead is applied as if it were variable cost, as seen in the application line.
- At the budgeted volume, the applied fixed overhead coincides with budgeted fixed overhead, as seen in the budget line.
- Since actual volume is less than the budgeted volume in this graph, the applied fixed overhead is less than the budgeted fixed overhead; the difference between the two represents the production volume variance.
- The difference between actual and budgeted fixed overhead becomes the price (or spending) variance.
- The production volume variance applies only to fixed costs as a result of allocating a fixed period cost to units on a predetermined basis. It does not represent resources spent or saved, and is unique to full-absorption costing.
- The benefits of calculating the production volume variance for control purposes are questionable.
- The price (spending) variance is used for control purposes because it is a measure of difference between actual and budgeted period costs.

*See Demonstration Problem 6*

## SUMMARY OF OVERHEAD VARIANCES

- The method of computing overhead variances described is known as the four-way analysis of overhead variances because it computes the following four variances:
  - Price and efficiency for variable overhead
  - Price and production volume for fixed overhead.
- Key Points
  - Exhibit 16.15 summarizes the four-way analysis of variable and fixed overhead variances.
    - The variable overhead efficiency variance measures the efficiency in using the allocation base.
    - The production volume variance occurs only when fixed production cost is unitized. The budgeted fixed overhead might not equal the amount applied to units produced.

- There is no efficiency variance for fixed production costs.
- Managers evaluated by variances that include production volume variance do have an incentive to overproduce. (See Business Application box “Does Standard Costing Lead to Waste?”)

# Appendix

## Capital Investment Decisions: An Overview

### Solutions to Review Questions

#### REVIEW QUESTIONS

A-1. What are the two most important factors an accountant must estimate in the capital investment decision?

The *timing* is important because cash received earlier has a greater economic value than cash received later. There is an opportunity cost and risk involved by having funds tied up in capital investment projects. Determining the *amount* is important in estimating the future cash flows. The timing and amount together are used to determine the economic value of the project.

A-2. What does the *time value of money* mean?

The time value of money merely states that cash received earlier has a greater value than cash received later because the dollar received today can be earning interest between now and later.

A-3. What is the difference between revenues and cash inflows?

Revenues represent the accounting measure of inflows to the firm. Revenues might be recognized when, before, or after cash is received. Revenues are recognized based on generally accepted accounting principles.

A-4. What is the difference between expenses and cash outflows?

Expenses represent the accounting measure of outflows from the firm. Expenses are matched with revenues and, therefore, might be recognized when, before, or after cash is spent.

A-5. What is the difference between depreciation and the tax shield on depreciation?

Depreciation is an accounting measure of the use of a capital asset and is not a cash flow. The tax shield on depreciation is the savings in taxes associated with the depreciation expense recorded for tax purposes and is a cash flow.

#### CRITICAL ANALYSIS AND DISCUSSION QUESTIONS

A-6. Given two projects with equal cash flows but different timing, how can we determine which (if either) project should be selected for investment?

To determine which, if either, project should be approved, the net present value of each project should be determined. Once the timing and amount of cash flows has been determined, they should be discounted to the present by determining and applying appropriate discount rates. Any project with a positive net present value could be justified and the project with the greater net present value should be approved under normal circumstances.

**A-7.**What are the four types of cash flows related to a capital investment project and why do we consider them separately?

The four types of cash flows are:

- (1) investment cash flows,
- (2) periodic operating flows,
- (3) depreciation tax shield, and
- (4) disinvestment flows.

We consider them separately because each type of flow results from different activities and gives rise to different tax consequences.

**A-8.**Is depreciation included in the computation of net present value? Explain.

No. Depreciation is not a cash flow item. However, the tax shield which arises from depreciation deductions for tax purposes is a cash flow item and is included.

**A-9.**"The total tax deduction for depreciation is the same over the life of the project regardless of depreciation method. Why then would one be concerned about the depreciation method for capital investment analysis?" Comment.

The total amount depreciated over the life of the machine (and, therefore, often the tax savings associated with that depreciation) is the same regardless of the depreciation method used. However, for capital investment decisions, the timing of the savings is important because it affects the net present value of the depreciation tax shield.

**A-10.**"Working capital is just the temporary use of money during the life of the project. What is initially contributed is returned at the end, so it can be ignored in evaluating a project." Comment.

Although the working capital might be assumed to be returned to the firm at the end of the project, the firm does not have the use of those funds during that time. Therefore, the present value of the working capital returned is less than the present value of the working capital contributed.

**A-11.**In Chapter 14, we discussed performance measurement in investment centers, where the managers have decision authority over asset usage (for example, adding new plants). The financial performance measures discussed in Chapter 14 (ROI, residual income, and EVA) were based on accounting income, which measures plant cost by depreciation. Why is it possible that a project to build a new plant can have a negative residual income in the first year, but have a positive net present value?

The net present value analysis for a new plant considered in this appendix considers the cash flows from the entire life of the plant and compares the present value of those cash flows to the initial investment in the plant. Accounting measures of income use a measure of plant cost (depreciation), which is an allocation of the plant cost to the individual years. This allocation often does not depend on the actual usage of the plant. Therefore, plants that are built with the intention of growing output to future demand will have insufficient cash inflows in the first year to cover the depreciation cost. Accounting income, therefore will be low (or negative).