

Chapter 6:

Product Costing: Job and Process Operations

Agenda

- Product vs. Period Costs
- Inventory
- Allocating Indirect Costs to Inventory
- Reconciling the factory to the Balance Sheet
- Statement of Goods Manufactured
- Income Statement Adjustments for Overhead Application
- Production Environments (Batch vs. Job Cost)

Remember Module 1?

- Expenses from financial reporting:
 - Product costs – cost of goods sold (tied to products)
 - Period costs – selling and administrative costs

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Inventory:

- Inventory has been referred to as a summary account in financial reporting.
- Does a service organization have inventory?
 - Supplies inventory
- Merchandising (the model most often studied in financial accounting):
 - Goods held for resale (Finished goods)
 - Supplies inventory

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Inventory :

- In manufacturing concerns, inventory is comprised of several subcategories:
 - Raw materials – direct materials used in production
 - Work-in-process – includes direct materials, direct labor, and manufacturing overhead (direct labor and manufacturing overhead are referred to as *conversion costs*)
 - Remember that manufacturing overhead is any production cost that is not direct materials or direct labor (i.e., depreciation on plant and equipment, production supervisors' salaries, plant maintenance, custodial services, plant insurance, plant property taxes, plant security, plant utilities, etc.)
 - Finished goods – once sold, finished goods are transferred to cost of goods sold

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What about the following costs?

- What about the following costs?
 - R&D
 - Marketing
 - Distribution
 - Customer Service
- They are all related to the products, but are *not* production (and thus *product*) costs

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How do we allocate production costs to individual products?

- Direct materials – we can track them because they have physical substance.
 - Does the cost of tracking specific materials ever outweigh the benefits?
 - Yes, especially when they are commodity-based goods or homogeneous in nature.
- Direct labor – we can require employees to record which products they work on or organize them by product line (still have to devise a way to allocate their time among individual units)
- Manufacturing overhead – how can we possibly allocate overhead to individual units?

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Traditional thinking

- It is not cost effective to allocate overhead costs based on actual usage.
 - Instead used units produced or dollar values of goods produced to allocate overhead.
 - Sometimes managers tied overhead to labor-hours if the manufacturing process varied by labor intensity across products.
 - Similarly, machine-hours were often used as an allocation driver.
- This is relatively harmless and cost-efficient if the entity produces only one product and most of it is sold each period.

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We don't use actual costs to assign overhead

- What happens if you use actual manufacturing costs to assign overhead to units?
 - Actual costs are not timely – must wait to be billed for things like utilities, supplies, etc.
 - Costs do not occur uniformly (i.e., property taxes and insurance are paid for periodically). This would cause extreme volatility in unit costs.
 - If production volume varies from month-to-month, this presents an allocation problem for assigning fixed overhead costs.
- For these reasons, firms usually developed ***predetermined manufacturing overhead rates***.

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Predetermined Overhead Rates:

- This rate is established at the beginning of the production period (usually annually) and is based on the predicted overhead costs and predicted production volume for the upcoming period:

$$\text{Predetermined overhead rate} = \frac{\text{Predicted overhead cost}}{\text{Predicted overhead cost driver activity}}$$

- Cost driver activity could be labor hours, machine hours, labor dollars, etc.

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Applying the Overhead

- Once the actual production takes place, then manufacturing overhead is ***applied*** for the period using the predetermined overhead rate.
- This is the amount of overhead that will be reflected in work-in-process (and ultimately finished goods) inventory.

Applied manufacturing overhead = Actual activity (i.e., labor hours, machine hours, etc.) x Predetermined overhead rate

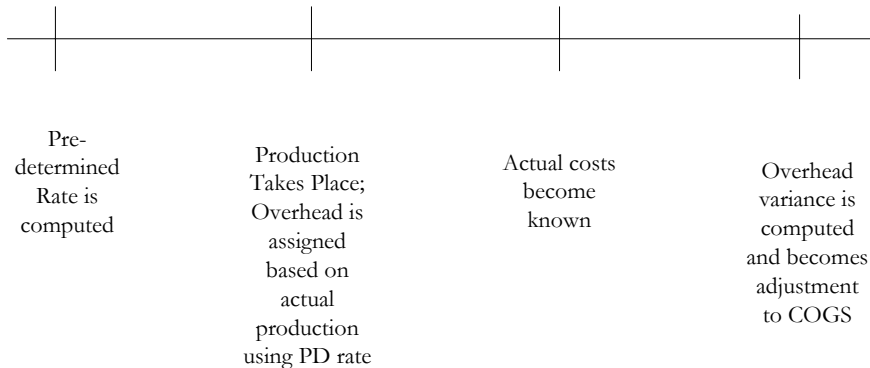
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Overhead Variance

- The overhead costs applied will not match the actual overhead costs (once known). The difference is called a ***variance*** and is used to control and evaluate production operations.
- However, if the amount over- or under-applied accumulates to excessive amounts during the year, then managers should revise the predetermined overhead rate to make sure the applied overhead costs better reflect the eventual, actual costs that will be incurred.

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Timeline



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(Which activity should we use for an overhead cost driver?)

- In the early part of the 20th century, labor was the predominant input into manufactured goods. For that reason, *labor-hours* were historically the most popular activity driver.
- However, as production processes became more automated, *machine-hours* gained in popularity as an activity driver.

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(Survey of 293 U.S. plant managers in 1985 showed:)

Activity Driver used to Allocated Overhead:*

| | |
|-----------------------|-----|
| Direct labor hours | 61% |
| Direct labor dollars | 36 |
| Machine hours | 25 |
| Units of production | 25 |
| Direct materials cost | 24 |

* Total percentage exceeds 100% because many companies use multiple drivers based on differing production processes.

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New School

- Information systems have become more sophisticated in the past several decades and this has allowed managers to use multiple activity drivers (i.e., ***activity-based costing***) to allocate overhead costs.
- We will expand our analysis to cover multiple drivers in the next few weeks.

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(So what is that inventory number that is on the Balance Sheet?)

- The accounting period ends at set-intervals (periodicity concept). The accounting period cutoff does not coincide with the completion of production. For that reason, at the end of each accounting period, there will be a balance in the inventory related accounts:
 - Raw materials
 - Work-in-process
 - Finished goods
- How do you determine ending balances?
 - Either rely on accounting records or confirm with a physical inventory count for the raw materials and finished goods.
 - What about work-in process?

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Reconciliation to Financial Reporting:

| | |
|--------------|------------|
| Sales | XXX |
| Less COGS | <u>XXX</u> |
| Gross profit | XXX |
| Less SGA Exp | <u>XXX</u> |
| Net Income | <u>XXX</u> |

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Reconciliation to Cost of Good Sold:

What is COGS really comprised of, now that we understand that inventory is not a single account?

Finished Goods

| | |
|----------------------------------|------------|
| Finished Goods Beg. Bal. | XXX |
| + Cost of Goods Manufactured | <u>XXX</u> |
| Cost of Goods Available for Sale | XXX |
| Less Finished Goods End. Bal. | <u>XXX</u> |
| Cost of Goods Sold | <u>XXX</u> |

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Cost of Goods Manufactured:

Cost of Goods Manufactured:

| | |
|--------------------------------|------------|
| Work-in-Process Beg. Bal. | XXX |
| + Current Manufacturing Costs | <u>XXX</u> |
| Total Costs-in-Process | XXX |
| Less Work-in-Process End. Bal. | <u>XXX</u> |
| Cost of Goods Manufactured | <u>XXX</u> |

- Current manufacturing costs are comprised of direct materials, direct labor, and manufacturing overhead.

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Direct (or Raw) Materials Inventory:

- Raw material inventory is treated in a way similar to regular inventory:

| | |
|-----------------------------------|------------|
| Raw materials Beg. Bal. | XXX |
| + Raw materials purchased | <u>XXX</u> |
| Raw materials available for prod. | XXX |
| Less raw materials End. Bal. | <u>XXX</u> |
| Direct material used | <u>XXX</u> |

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E6-15, p. 225

Determine cost of raw materials purchased:

a. Raw Materials Inventory:

| <u>Activity</u> | <u>Given Information</u> | <u>Solution</u> |
|-------------------------|--------------------------|------------------|
| Beginning balance | \$ 70,000 | \$ 70,000 |
| + Purchases | + _____? | +310,000 Answer |
| = Total available | \$ _____? | \$380,000 |
| - Raw materials used | (300,000) | (300,000) |
| = <u>Ending balance</u> | <u>\$ 80,000</u> | <u>\$ 80,000</u> |

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E6-15, p. 225

Determine cost of goods sold:

d. Finished Goods Inventory:

| <u>Activity</u> | <u>Given Information</u> | <u>Solution</u> |
|---------------------------------------|--------------------------|------------------|
| Beginning balance | \$ 90,000 | \$ 90,000 |
| + <u>Cost of goods mfg.</u> | + _____ ? | +736,000 |
| = Cost of goods available for sale | \$826,000 | \$826,000 |
| - <u>Cost of goods sold</u> | - _____ ? | (716,000) Answer |
| = <u>Ending balance</u> | <u>\$110,000</u> | <u>\$110,000</u> |

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Statement of Cost of Goods Manufactured

- Exhibit 6-10, p. 213
- Combines all the preceding analyses into one summary report
 - Order of presentation is not uniform among companies
 - Considered an internal report
- Manufacturing overhead is the amount *applied*, not the actual cost incurred.
 - The amount of under- or over-applied overhead is charged directly to COGS.

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Over- or under-applied manufacturing overhead:

The accumulated amount is removed at the end of the production period with the over- or under-applied amount treated as an adjustment to cost of goods sold (in the next period when the actual costs are known):

| | |
|---------------|----------------|
| Over-applied | Reduces COGS |
| Under-applied | Increases COGS |

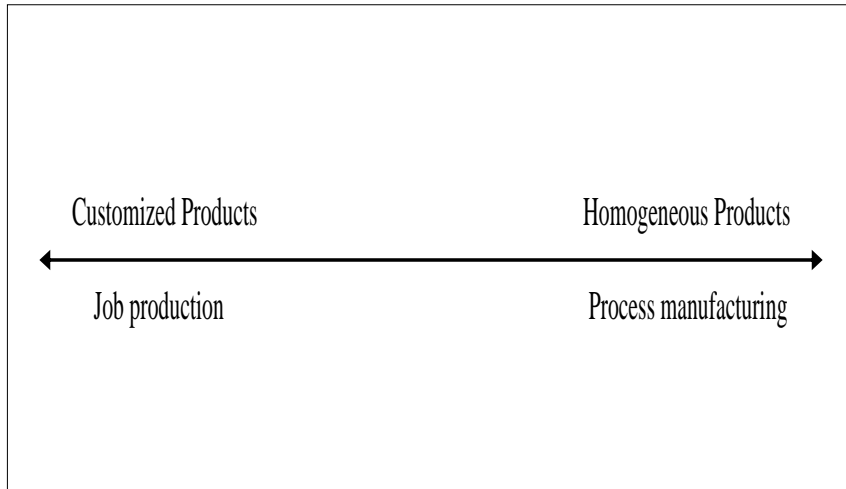
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Production Environment:

- Customized products – production occurs when customer places order (i.e., construction)
- Batch products – production occurs in batches of homogeneous products
- Homogeneous products – production likely occurs on a continuous basis (chemicals, commodity goods, food products, beverages)

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Production Environment:



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Job Cost or Process Cost Environment?

Pepsico

Process

Cray Computer Corp.

Job

Boeing Co.

Job

Starbucks Corp.

Process

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Job Cost or Process Cost Environment?

Revlon Consumer Products Corp.

Process

Chris Craft Boat Co.

Job

Goodyear Tire and Rubber Co.

Process

Anheuser-Busch Inc.

Process

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Job Production Environment:

- The job is often submitted as a bid to the customer and if won, the production is scheduled.
 - Costs are accumulated on a unique “job cost sheet” for each product.
 - Total cost is determined when the job is completed based on the accumulation of costs on the job cost sheet.
- These job cost sheets used to be prepared manually for each job but technology had led to integrated information systems that track each job and its inputs.
 - Bar-code and scanning technology have been invaluable to the automation of job production systems.
- Difficult to find production efficiencies in job-production environment because of lack of economies of scale.

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Process Costing Environment:

- In continuous manufacturing environment, unit costs are not tracked separately (difficult to define “a unit”).
 - Instead production costs are accumulated over a period of time (usually a month) and costs are determined by “amount” or “volume” produced.
- The difficulty in this environment is determining the value of work-in-process at the accounting period cutoff point.
 - Managers need to estimate the percentage of completion at each stage in the production process, and these percentages are used to assign a value to work-in-process inventory.
- The manager also needs to make assumption regarding when materials, labor and overhead enter into the production process.

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Process Costing Environment:

- Materials are often assumed to be added when the process is started, with labor and overhead being applied uniformly until completion. However, most large process costing firms will refine these assumptions to arrive at more accurate inventory costs.
- Further, cost flow assumptions (i.e., FIFO, LIFO, average cost) must be chosen and applied to the process due to changing prices of input costs.

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E6-31, p. 230

Determine cost of goods transferred to finished goods inventory:

| | |
|---|-----------------|
| a. Units completed | 8,500 |
| Cost per equivalent units | <u>× \$4.60</u> |
| Cost of goods transferred to finished goods inventory | <u>\$39,100</u> |

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E6-31, p. 230

Determine cost of ending WIP inventory:

| | |
|---|-----------------|
| b. Materials cost (3,500 units × \$3) | \$10,500 |
| Conversion cost (3,500 units × 0.10 × \$1.60) | <u>560</u> |
| Ending work-in-process inventory | <u>\$11,060</u> |

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E6-31, p. 230

Determine total cost of beginning WIP plus current manufacturing costs:

c. Beginning work-in-process plus current manufacturing costs equal total costs in process, which is also equal to the cost of goods transferred to finished goods plus ending work-in-process.

| | |
|--|-----------------|
| Cost of goods transferred to finished goods | \$39,100 |
| Plus cost of ending work-in-process | <u>11,060</u> |
| Total costs (beginning work-in-process, plus current manufacturing costs) | <u>\$50,160</u> |

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Batch Production Environment:

- A hybrid of the job cost and process cost environments. Costs are accumulated at the batch level (instead of the job level).
 - However, some processes within production operations may necessarily be accounted for as if it is a process environment.

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