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15.963 Management Accounting and Control  
Spring 2007

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# 15.963 Managerial Accounting and Control

Spring 2007

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# Product Costing

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- Cost of any cost object = direct costs + allocated indirect costs.
- Indirect costs are also called overhead, or common costs.
- There is an *arbitrariness* introduced by the allocation (or assignment) of common costs.
- A product costing system is essentially an overhead allocation system.
- Costs are allocated to
  - products,
  - customers, and
  - departments within (or subunits of) the firm.



# Product Costing

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- Reasons for allocating common costs:
  - long run pricing and decision making;
    - insource / outsource?
    - add an airline route?
  - motivation and control
    - e.g., product designers at Hitachi
    - preventing overconsumption;
  - cost-plus contracts;
  - financial reporting and tax purposes
    - inventory values have to be calculated at full cost;
  - for damage claims from insurance providers;
  - might be used in rate regulation (e.g., natural gas);
  - needed in calculating claims during litigation.



# Product Costing

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- Manufacturing overhead (MOH) includes
  - machine setup costs,
  - wages of forklift operator,
  - plant supervisor salaries,
  - manufacturing equipment depreciation, etc.
- Non-manufacturing overhead (NMOH) includes indirect
  - marketing costs,
  - non-manufacturing administrative costs.
- The costs allocated to a product will depend on the reason for the allocation:
  - under GAAP, only MOH is allocated in calculating inventory costs;
  - U.S. govt. cost-plus contracts explicitly exclude marketing overhead;
  - All overhead may be allocated for decision making (including pricing) and control.



# Calculating Manufacturing Costs

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- There are two basic costing systems: job costing and process costing.
- A job is a distinct product or service:
  - in the service sector - audit and consulting engagements, ad campaigns, legal cases;
  - in merchandising – individual mail orders at L.L. Bean;
  - in manufacturing – ship and aircraft manufacture, e.g., for Joint Strike Fighter project.
- Process costing is used for masses of indistinguishable products or services, e.g.:
  - Oil refining, chemical processing, beverage production.



# Job Costing

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- Cost allocation begins with collecting all overhead in one (or more) **cost pool(s)**.
- All costs in this pool are then assigned to the job at a rate of, for example, \$40 per direct labor hour (DLH) used on the job.
  - DLH is called the cost **allocation base**.
  - \$40 / DLH is the **allocation rate**.
- For example, if Job 83 uses \$15k of direct materials, and 200 DLH at \$20 per hour, then the total manufacturing cost of Job 83 is:
  - direct materials of \$15k +
  - direct labor of  $200 \times 20 = \$4k$  +
  - **allocated** or **applied** MOH of  $200 \times 40 = \$8k$
  - For a total of \$27k



# Cost Allocation

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- Examples of allocation rates and bases:
  - 200% of direct labor dollars;
    - This may be preferred over DLH if employee skill levels, and therefore cost, differ significantly.
  - \$30 per machine hour;
    - e.g., if product is machine, rather than labor, intensive.
  - \$10 per order;
    - e.g., costs of order taking and processing, if orders are homogeneous.
- How is the allocation rate calculated?
  - Under **normal costing**, this is calculated at the beginning of some period, by dividing **budgeted** overhead by the **budgeted** volume of the allocation base.
- **Applied** overhead = **budgeted** rate x **actual** volume of allocation base.





# Cost Allocation Example

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- California Bikes (CB) uses a job costing system at its Venice Beach plant.
- The plant has a machining department and a finishing department.
- Each department is an overhead cost pool.
- Machining department overhead is allocated based on machine hours, while finishing department overhead is allocated based on direct labor dollars.

# Cost Allocation Example

1. An overview of the job-costing system is :

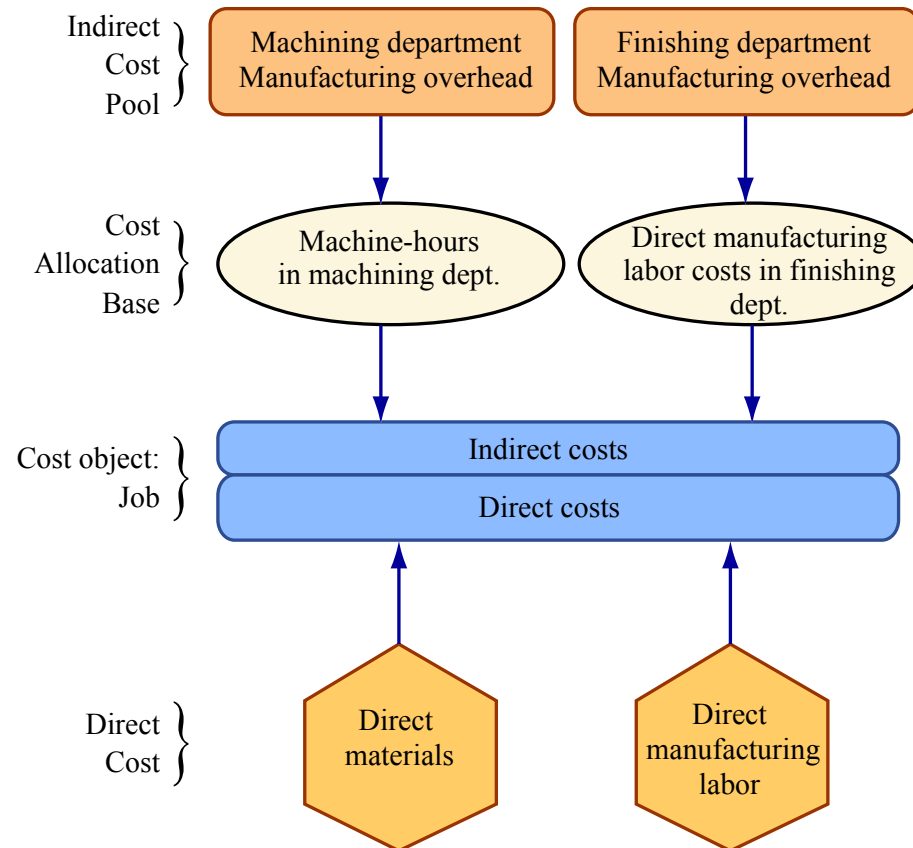


Figure by MIT OpenCourseWare.



# Cost Allocation Example

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- The following is the 2007 budget:

	<u>Machining</u>	<u>Finishing</u>
MOH (\$)	10000000	8000000
Direct labor (\$)	900000	4000000
Direct labor hours	30000	160000
Machine hours	200000	33000



# Cost Allocation Example

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- The budgeted overhead rate in the machining dept is  $10\text{m}/200\text{k} = \$50$  per machine hour.
- The budgeted overhead rate in the finishing dept is  $8\text{m}/4\text{m} = 200\%$  of direct labor dollars.
- The cost record for Job 431 in May is:

	<u>Machining</u>	<u>Finishing</u>
Direct materials	14000	3000
Direct labor (\$)	600	1250
Direct labor hours	30	50
Machine hours	130	10



# Cost Allocation Example

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- Total overhead allocated to Job 431 is:
  - machining -  $\$50 \times 130 = \$6500$  +
  - finishing – 200% of  $\$1250 = \$2500$
  - total =  $\$9000$
- Direct material cost for Job 431 is:
  - $\$14\text{k}$  in machining +  $\$3\text{k}$  in finishing =  $\$17\text{k}$
- Direct labor cost for Job 431 is:
  - $\$600$  in machining +  $\$1250$  in finishing =  $\$1850$
- Total manufacturing cost of Job 431 is:
  - $9000 + 17000 + 1850 =$   $\$27,850$



# Cost Allocation Example

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- This example:
  - illustrates the mechanics of cost allocation and calculation;
  - illustrates the use of multiple overhead cost pools.



# Cost Allocation Example

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- Continuing with the previous example, suppose CB has only one overhead cost pool, and allocates based on direct labor dollars.
- What is the new overhead allocation rate?
  - $\text{Total MOH} / \text{Total DL\$} = \$18\text{m} / 4.9\text{m} = 367\%$  of direct labor dollars.
- How much overhead is allocated to Job 431 now?
  - $367\%$  of  $\$1250 = \$6796$
  - this is  $\$2204$  less than previously allocated, so the cost of Job 431 is now over  $\$2000$  lower!
- This example illustrates that:
  - Overhead cost pools should be homogeneous – this will determine the number of cost pools;
  - There should be a strong cause and effect relation between the costs in a given pool and the allocation base for that pool.



# Cost Allocation

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- Returning to the previous example, suppose CB prepares a budget monthly. The budget for May (prepared in April) is as follows:

	<u>Machining</u>	<u>Finishing</u>
MOH (\$)	833333	666667
Direct labor (\$)	240000	1200000
Direct labor hours	8000	48000
Machine hours	50000	9000





# Job Costing

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- The new allocation rates are:
  - machining dept –  $833333/50k = \$16.67$  per machine hour
  - finishing dept –  $666667/1.2m = 56\%$  of direct labor dollars.
- The overhead allocated to Job 431 would now be:
  - machining –  $16.67 \times 130 = \$2167$  +
  - finishing –  $56\%$  of  $\$1250 = \$694$
  - total of  $\$2861$ !
- The cost of Job 431 is now  $\$6139$  lower than previously calculated.
- This occurs because MOH consumption is smooth across months, but productive activity is substantially higher in May (both labor costs and machine hours are disproportionately higher in May) due to seasonality in, e.g., demand.



# Job Costing

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- Smooth overhead consumption, when activity varies, suggests that it is mainly fixed overhead.
- We could also have allowed MOH to vary disproportionately in this case, e.g.,
  - air conditioning costs may be higher in summer months, heating costs higher in winter, employee vacation pay will be higher in summer months, etc.
- Takeaway: overhead rates should be calculated using longer period (e.g., annual) budgets, to reduce arbitrariness.
  - Identical jobs performed in different months should not differ in cost due to erratic costs or seasonal effects.



# Manufacturing Cost Flows

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- There are three inventory accounts through which manufacturing costs flow.
- The first is direct materials (DM) inventory:
  - materials purchases increase it;
  - materials requisitioned for manufacturing decrease it.
- The second is work in process (WIP) inventory:
  - outflows from DM increase WIP; direct labor costs from time cards increase it; applied overhead (based on direct labor or machine hours, for example) increases it;
  - it is reduced by the cost of finished or completed goods, since these are no longer a work in process.



# Manufacturing Cost Flows

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- The third is finished goods (FG) inventory:
  - outflows from WIP increase it;
  - it is decreased by the cost of goods sold (COGS).
- Finally, the COGS account (not an inventory account) is increased by outflows from FG.
- The ending balance of an inventory account is: beginning balance + inflows – outflows.



# Job Costing

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- Returning to CB example, applied overhead = budgeted rate x actual volume of base.
  - Overhead rate is \$50 / mach hr in machining, based on \$200k budgeted machine hours.
  - Assume machining is the only overhead cost pool. If exactly 200k machine hours are actually used in 2007, then applied overhead =  $200k \times 50 = \$10m$  = budgeted (or actual) overhead.
  - If 210k machine hours are actually used, then applied overhead =  $\$10.5m >$  actual overhead cost.
  - In this case, \$500k is over-applied overhead. We could similarly have under-applied overhead (if actual base usage is less than budgeted base usage).



# Job Costing

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- Over- or under-applied overhead requires an end-of-year adjustment.
- Typically, it is “written off” to COGS.
- In this case where \$500k is over-applied, COGS is reduced by this amount.
  - If it were under-applied, COGS would be increased by the amount.
- Overhead allocation and pricing:
  - cost plus contracts
    - shipyard work for US Navy
    - public utilities with commercial business interests
  - Product markets
    - Federal Reserve, competitiveness and the Monetary Control Act (1980)