COST ALLOCATION METHODS

Cost allocation methods are an interesting group of exercise. We will see different cuts. Basically the problem we have is very similar to the problem we have with overhead. We can figure out the direct costs of doing something are but the problem is trying to find a way to allocate fixed costs. How do we figure out how much lighting a product used, how much property tax? These are allocation issues, taking a pool of fixed costs and apportioning it to production units. We will look at different ways of doing this in different environments. This will open up the mindset of how allocations can be done.

In this particular chapter (15) we are given the example of 3 different kinds of departmental allocation methods. This company has two support departments and two operating departments (simple case). All the support departments do is provide support to the two production departments. The two operating (production) departments are producing the units. In order to find out what the true cost of the units they must allocate the costs of the support departments to the operating departments, fully load the cost of the production departments so we can figure out how much it is costing us per unit of production (based on fully loaded costs).

(Text page 537)

EXHIBIT 15-2	Data for Allocating Support-Department Costs at Castleford Engineering for 2007						
	A	B	C	D	E	F	G
1		SUPPORT DEPARTMENTS			OPERATING DEPARTMENTS		
2		Plant Maintenance	Information Systems		Machining	Assembly	Total
3	Budgeted manufacturing overhead costs						
4	before any interdepartment cost allocations	$600,000	$116,000		$400,000	$200,000	$1,316,000
5	Support work furnished:						
6	By Plant Maintenance						
7	Budgeted labor-hours	-	1,600		2,400	4,000	8,000
8	Percentage	-	20%		30%	50%	100%
9	By Information Systems						
10	Budgeted computer hours	200	-		1,600	200	2,000
11	Percentage	10%	-		80%	10%	100%

Here we see the budget manufacturing overhead costs for each of the support departments (these are the budgets before cost allocation). Support has Plant Maintenance at $600,000 and Information Systems at $116,000. Operating has Machining at $200,000 and Assembly at $200,000. The company wants to find out how much of plant maintenance and information systems time is expended on the operating departments so that they can properly allocate to those departments.
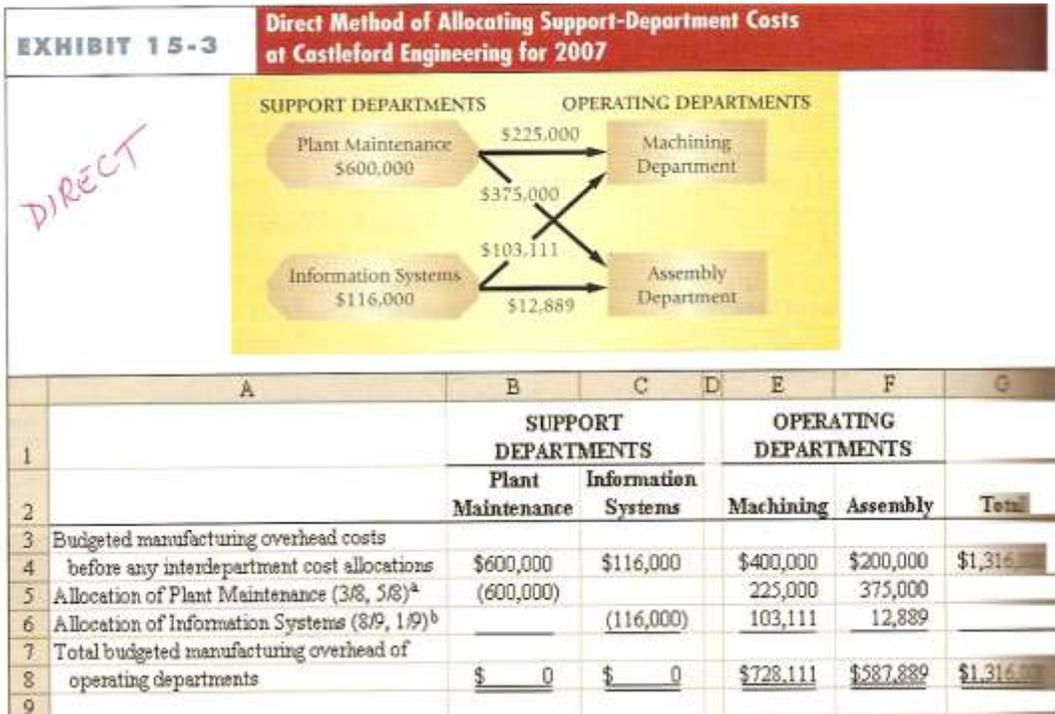
For plant maintenance the allocation driver is labor hours and for information systems the allocation driver is computer hours. Keep in mind the support departments do not count any hours they devote to themselves.

They find that Plant Maintenance devotes 20% of their time to information systems (support departments supporting each other), 30% to machining, and 50% to assembly.

Likewise, Information Systems devotes 10% of its computer hours to plant maintenance, 80% to machining, and 10% to assembly.

We will now learn 3 methods to allocate these costs, Direct, Step Down, and Reciprocal.

DIRECT METHOD

EXHIBIT 15-3 Direct Method of Allocating Support-Department Costs at Castleford Engineering for 2007

	A	B	C	D	E	F	G
1		SUPPORT DEPARTMENTS			OPERATING DEPARTMENTS		
2		Plant Maintenance	Information Systems		Machining	Assembly	Total
3	Budgeted manufacturing overhead costs						
4	before any interdepartment cost allocations	$600,000	$116,000		$400,000	$200,000	$1,316,0
5	Allocation of Plant Maintenance (3/8, 5/8)ᵃ	(600,000)			225,000	375,000	
6	Allocation of Information Systems (8/9, 1/9)ᵇ		(116,000)		103,111	12,889	
7	Total budgeted manufacturing overhead of						
8	operating departments	$ 0	$ 0		$728,111	$587,889	$1,316,0
9							

The direct method says that we are going to allocate each service department directly to the operating departments. **We are not going to allocate any funds to another service of support department**. All support departments will be allocated out directly to the operating departments. We can see here that they are closing out the plant maintenance department (an amount equal to but opposite from their budget). And notice that **no allocation is made to Information Systems even though we know they devoted time to information systems**. They are allocating their budget directly to machining and assembly. The problem with this is (see exhibit 15-2 above) that all the numbers that we looked, the percentages, were inclusive of the percent that was allocated to information systems. So we cannot use the 30 % and 50% numbers listed in exhibit 15-2 as the allocation percent because that would not equal 100%. What we have to do is reform our allocation percents. Here's how we do it:

In the two operating departments, the plant maintenance department allocated 30% and 50% to the two operating departments. Add the two together to get 80%, this will be the denominator in finding new percentages. Now…

Plant Maintenance

$$\text{Machining} = \frac{30\%}{30\% + 50\%} = \frac{3}{8} = 37.5\%$$

$$\text{Assembly} = \frac{50\%}{30\% + 50\%} = \frac{5}{8} = 62.5\%$$

Information Systems

$$\text{Machining} = \frac{80\%}{80\% + 10\%} = \frac{8}{9} = 88.8\%$$
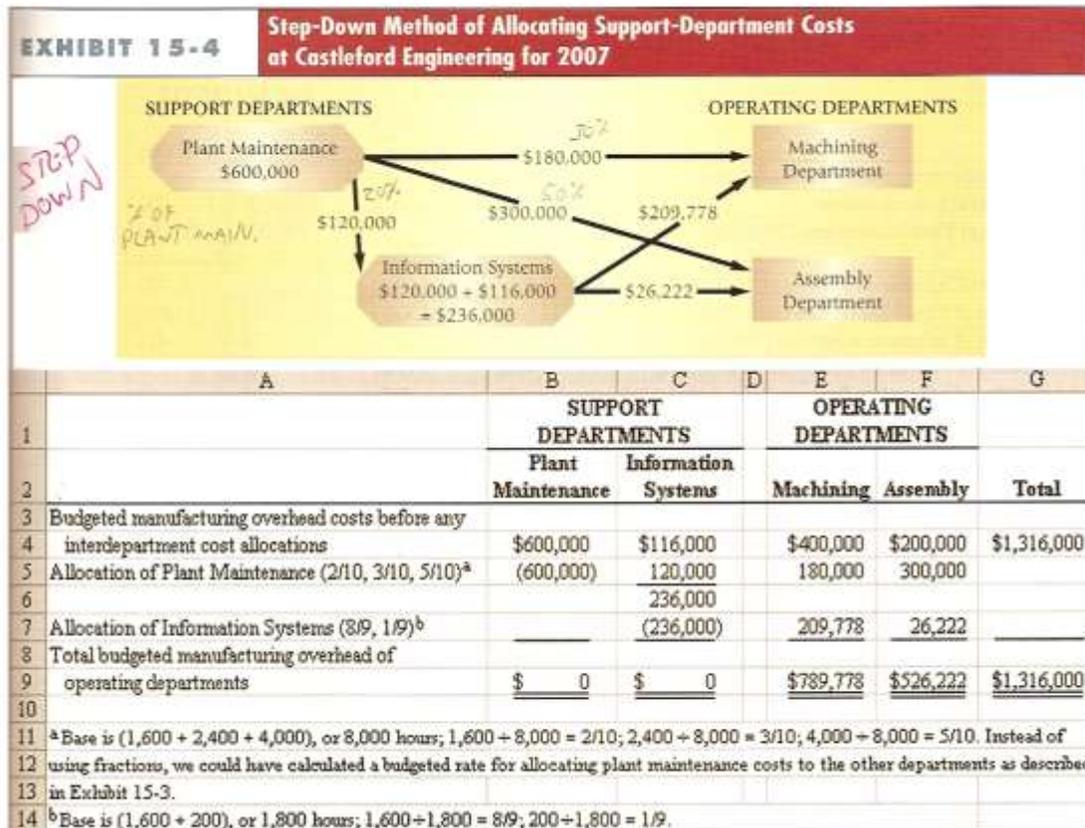
$$\text{Assembly} = \frac{10\%}{80\% + 10\%} = \frac{1}{9} = 11.1\%$$

These are the percentages of their budgets that each support department will send to each operating budget.

Key: In the Direct Method no allocation is made back to another support department, all allocations are made directly out to the production departments.

STEP DOWN METHOD

The Step Down method says that we will step down what we allocate out. In other words, the first service department that we allocate out will be allocated to all the open departments including the other service departments. But once we close that out, we will step down our allocation so that the next service department will not allocate back to the close out department, it will only allocate forward to the remaining open departments. So once we close out a department that's it, we are not going back. We are stepping down the number of departments that we allocate to.

EXHIBIT 15-4 Step-Down Method of Allocating Support-Department Costs at Castleford Engineering for 2007

	A	B	C	D	E	F	G
		SUPPORT DEPARTMENTS			OPERATING DEPARTMENTS		
1							
2		Plant Maintenance	Information Systems		Machining	Assembly	Total
3	Budgeted manufacturing overhead costs before any						
4	interdepartment cost allocations	$600,000	$116,000		$400,000	$200,000	$1,316,000
5	Allocation of Plant Maintenance (2/10, 3/10, 5/10)ᵃ	(600,000)	120,000		180,000	300,000	
6			236,000				
7	Allocation of Information Systems (8/9, 1/9)ᵇ		(236,000)		209,778	26,222	
8	Total budgeted manufacturing overhead of						
9	operating departments	$ 0	$ 0		$789,778	$526,222	$1,316,000
10							
11	ᵃBase is (1,600 + 2,400 + 4,000), or 8,000 hours; 1,600 ÷ 8,000 = 2/10; 2,400 ÷ 8,000 = 3/10; 4,000 ÷ 8,000 = 5/10. Instead of						
12	using fractions, we could have calculated a budgeted rate for allocating plant maintenance costs to the other departments as described						
13	in Exhibit 15-3.						
14	ᵇBase is (1,600 + 200), or 1,800 hours; 1,600÷1,800 = 8/9; 200÷1,800 = 1/9.						

In exhibit 15-4 we see the opening balance of the budgets, $600,000 and $116,000. Then they allocate out the first department, plant maintenance, $600,000. They use the original percentages, 20%, 30%, and 50% for plant maintenance. **For the first unit allocated out use the original percents**. That closes out the first department, all of it's budget has been allocated to other departments including other support departments. We will not allocate back to this department again. But notice that plant maintenance did allocate out to the other support department, Information Systems. **Now the other support department, Information Systems, is going to allocate out not only it's budget but also the amount allocated to it by the other service department.** In this case Information systems must allocate out it's budget of $116,000 AND the allocation from Plant Maintenance of $120,000 for a total to be allocated out of $236,000. But how much goes to each of the remaining departments (in this case the two operating departments)? We have to for our new percentages as we did in the Direct Method.

We form the denominator from the sum of the percentages going out to other percentages (operating in this case) and the numerator is the percent listed in the problem statement going to the other department.

Information Systems

$$\text{Machining} = \frac{80\%}{80\% + 10\%} = \frac{8}{9} = 88.8\% = \$209,778$$

$$\text{Assembly} = \frac{10\%}{80\% + 10\%} = \frac{1}{9} = 11.1\% = \$26,222$$

Consider the spreadsheet portion of exhibit 15-4 above. Notice that both support departments are closed out to $0.00. They have distributed their entire budgets to operating departments. The result is a full loading of the Operating Departments Machining and Assembly.

The point to all this is that the true cost of Machining is not $400,000, its $789,778 and the true cost of Assembly is not $200,000, its $526,222.

RECIPROCAL METHOD

The Reciprocal Method says that the two support departments are providing services to each other so why not fully load each support department so that when we do charge them out they are fully loaded for the other support departments activities in support of their department. In order to do this we must calculate what is known as Reciprocal Equations.

Alternatively we could do this using a methodology which allocates out the first one, then the second one, and so on (see the spreadsheet in exhibit 15-5).

EXHIBIT 15-5	Reciprocal Method of Allocating Support-Department Costs Using Repeated Iterations at Castleford Engineering for 2007						
	A	B	C	D	E	F	G
		SUPPORT DEPARTMENTS			OPERATING DEPARTMENTS		
1		Plant Maintenance	Information Systems		Machining	Assembly	Total
2							
3	Budgeted manufacturing overhead costs before any						
4	interdepartment cost allocations	$600,000	$116,000		$400,000	$200,000	$1,316,000
5	1st Allocation of Plant Maintenance (2/10, 3/10, 5/10) [a]	(600,000)	120,000		180,000	300,000	
6			236,000				
7	1st Allocation of Information Systems (1/10, 8/10, 1/10) [b]	23,600	(236,000)		188,800	23,600	
8	2nd Allocation of Plant Maintenance (2/10, 3/10, 5/10) [a]	(23,600)	4,720		7,080	11,800	
9	2nd Allocation of Information Systems (1/10, 8/10, 1/10) [b]	472	(4,720)		3,776	472	
10	3rd Allocation of Plant Maintenance (2/10, 3/10, 5/10) [a]	(472)	94		142	236	
11	3rd Allocation of Information Systems (1/10, 8/10, 1/10) [b]	9	(94)		75	10	
12	4th Allocation of Plant Maintenance (2/10, 3/10, 5/10) [a]	(9)	2		2	5	
13	4th Allocation of Information Systems (1/10, 8/10, 1/10) [b]	0	(2)		2	0	
14	Total budgeted manufacturing overhead of operating						
15	departments	$ 0	$ 0		$779,877	$536,123	$1,316,000
16							
17	Total support department amounts allocated and reallocated (the numbers in parentheses in first two columns)						
18	Plant Maintenance: $600,000 + $23,600 + $472 + $9 = $624,081						
19	Information Systems: $236,000 + $4,720 + $94 + $2 = $240,816						
20							
21	[a] Base is (1,600 + 2,400 + 4,000) or 8,000 hours; 1,600 ÷ 8,000 = 2/10; 2,400 ÷ 8,000 = 3/10; 4,000 ÷ 8,000 = 5/10.						
22	[b] Base is (200 + 1,600 + 200) or 2,000 hours; 200 ÷ 2,000 = 1/10; 1,600 ÷ 2,000 = 8/10; 200 ÷ 2,000 = 1/10.						

This method works but is tedious and takes a long time. Reciprocal Equations is easier, more direct, and gives the same answer.

When you really look at the two support departments, Plant Maintenance and Information Systems, plant maintenance's cost is really $600,000 plus some percentage of the information systems budget. Information Systems budget is $116,000 plus some percentage of plant maintenance (because the two support departments are providing services to each other).

That being the case we really have to find out what that percentage is. You may think that would be easy but depending on how they display the data you can get really confused with this.

Use this memory method: USER / PROVIDER. User is on the left side of the equation and Provider is on the right side of the equation.

USER   **PROVIDER**

$$PM = \$600,000 + \underline{\hspace{1cm}} IS$$
$$IS = \$116,000 + \underline{\hspace{1cm}} PM$$

What are these percentages? Go back to the problem statement. Exhibit 15-2 says that Plant Maintenance spends 10% of it's budget on Information Systems and Information Systems spends 20% of it's budget on Plant Maintenance.

$$PM = \$600,000 + .1IS$$
$$IS = \$116,000 + .2PM$$

(BE CAREFUL NOT TO MIX THESE PERCENTAGES UP)
(The equation comes from the column.)

Now we solve:

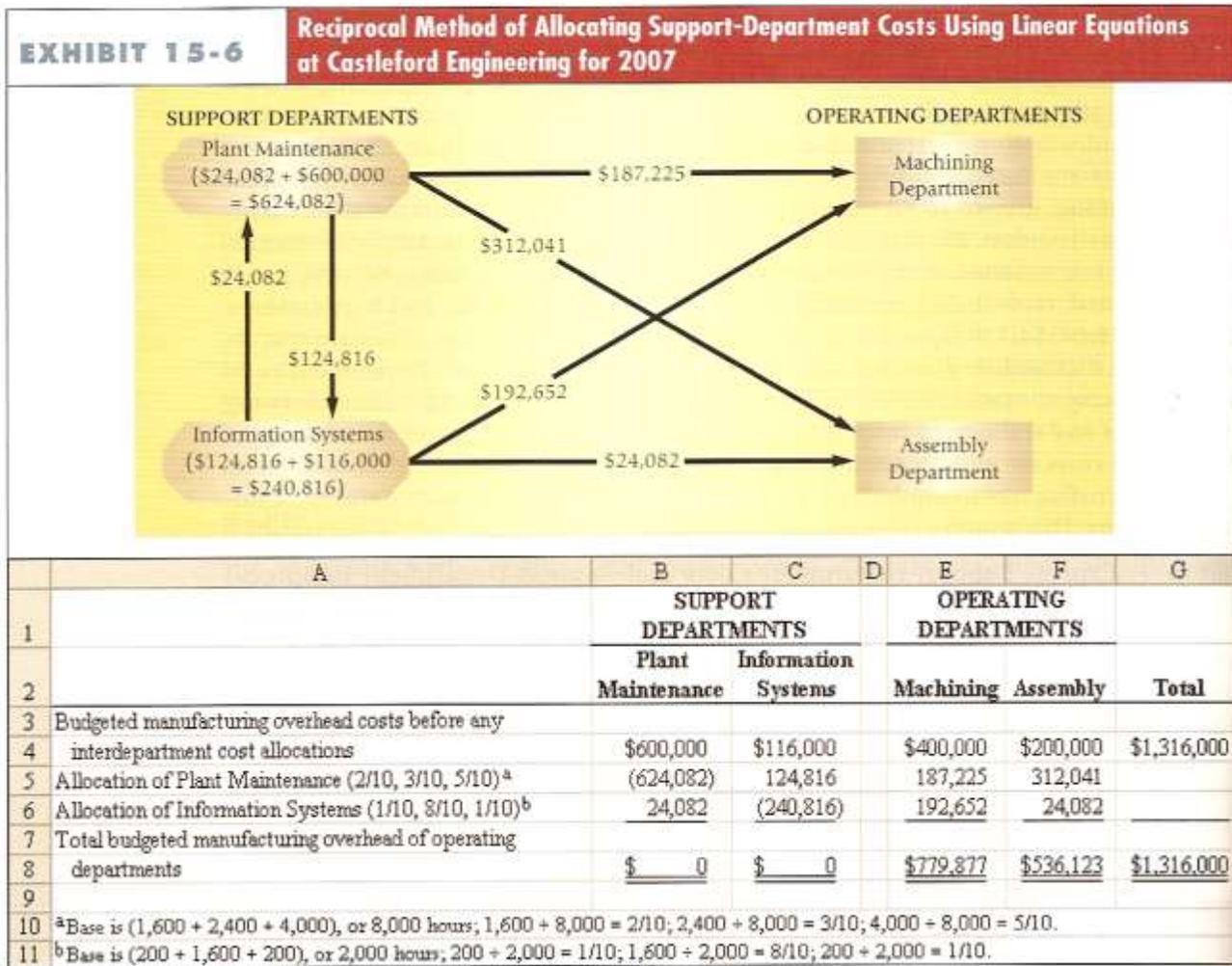$$PM = \$600,000 + .1(\$116,000 + .2PM)$$
$$PM = \$600,000 + \$11,600 + .02PM$$
$$.98PM = 611,600$$
$$PM = \$624,082$$
$$IS = \$116,000 + .2(\$624,082) = 240,816$$

PM = \$624,082
IS = \$240,816

EXHIBIT 15-6	Reciprocal Method of Allocating Support-Department Costs Using Linear Equations at Castleford Engineering for 2007

SUPPORT DEPARTMENTS   **OPERATING DEPARTMENTS**

Plant Maintenance
($24,082 + $600,000 = $624,082)

$187,225 → Machining Department

$312,041

$24,082

$124,816

$192,652

Information Systems
($124,816 + $116,000 = $240,816)

$24,082 → Assembly Department

	A	B	C	D	E	F	G
1		SUPPORT DEPARTMENTS			OPERATING DEPARTMENTS		
2		Plant Maintenance	Information Systems		Machining	Assembly	Total
3	Budgeted manufacturing overhead costs before any						
4	interdepartment cost allocations	$600,000	$116,000		$400,000	$200,000	$1,316,000
5	Allocation of Plant Maintenance (2/10, 3/10, 5/10)[a]	(624,082)	124,816		187,225	312,041	
6	Allocation of Information Systems (1/10, 8/10, 1/10)[b]	24,082	(240,816)		192,652	24,082	
7	Total budgeted manufacturing overhead of operating						
8	departments	$ 0	$ 0		$779,877	$536,123	$1,316,000
9							
10	[a]Base is (1,600 + 2,400 + 4,000), or 8,000 hours; 1,600 ÷ 8,000 = 2/10; 2,400 ÷ 8,000 = 3/10; 4,000 ÷ 8,000 = 5/10.						
11	[b]Base is (200 + 1,600 + 200), or 2,000 hours; 200 ÷ 2,000 = 1/10; 1,600 ÷ 2,000 = 8/10; 200 ÷ 2,000 = 1/10.						

In Exhibit 15-6 we notice that when they take out for plant maintenance they do not take it out for $600,000. They take it out for the reciprocated costs of $624,082. They will put an amount opposite to the reciprocated costs (negative) and they will **use the original percents to allocate to all of the remaining departments**. (Original percentages are from problem statement and applies to the exchange between support departments as well).

This is really the most accurate of the three methods because it fully loads as accurately as possible so we get two fully loaded support departments being allocated out to the operating departments. Having said that we know we want to weight COST vs BENEFIT. How are my costs for doing this going to relate to my benefits for doing this. Well it turns out that we did the reciprocated method for two departments. Imagine if there were 10 departments. The task becomes much more difficult (more simultaneous equations to solve). And the question is do we need that level of accuracy or can we simply go to the direct method and be done with it. We really have to determine what the value is going to be.

The question comes up: if the end results are the same between the three methods what is the purpose? If you have one method, such as the direct method, which is easier and is going to give you **roughly** the same answer as the reciprocal method which is more accurate then we may want to take advantage of the simpler method because it is easier to implement and results in roughly the same accuracy. But if there were a requirement (such as DOD requirement) then there is no choice.

Also, if it is a tight market and you need to have a sharp pencil on cost you may want to go with the reciprocal method. A couple of pennies can make a big difference.

HOMEWORK

Problem 15-32

We will have to do this by hand on the exam.

Support and Production. Only do first department first and second department second. Not going to do larger first. Do dept. A then dept. B. Do not have to do both allocations of the step down method.

Do not do second part about outside electrical provider.

Do A, B, and D. Do NOT do C. (from part 1)

Next Week: Joint Product Costing. Raw material and common process. Move through common process and in the end get split off process. How to take the cost of raw material and process and allocate to each different product.