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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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Bridgeton



- What is the competitive environment Bridgeton faces?
 - Contraction in demand being driven up the value chain.
 - Bridgeton sells exclusively to the big three domestic automakers.
 - In bad times for domestic automakers, Bridgeton shares the pain of reduced demand.
 - Even in good times for domestic automakers, Bridgeton's customers can squeeze it or appropriate its rents, so it may share more of the pain and less of the gain.

Bridgeton



- How has Bridgeton responded to these external pressures?
 - By outsourcing some products or discontinuing product lines.
 - By aggressively pursuing cost reduction.
 - But, it has not refined its product costing system!
 - Cost reduction efforts therefore appear blind, rather than being guided by an understanding of cost drivers.
- How many OH cost pools are there?
 - One.
 - Cost allocation base is DL\$.
 - Does this seem appropriate for manifolds?

Bridgeton



- How do errors in product cost estimates generally vary with the ratio of overhead to total costs?
 - Increasing, because fewer costs are traceable.
 - At Bridgeton, overhead is 49% of total costs.

- Consider profitability by product line and year from 1987 to 1990: Exhibits K1 to K5.

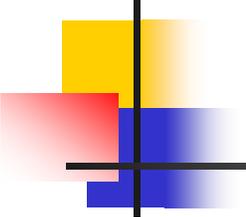
Exhibit K1**Fuel Tanks**

	Model Year			
	1987	1988	1989	1990
Sales	\$70,278	\$75,196	\$79,816	\$83,535
Direct Materials	\$15,125	\$15,756	\$16,312	\$16,996
Direct labor	\$4,169	\$4,238	\$4,415	\$4,599
1000	\$1,302.79	\$1,307.89	\$1,817.27	\$1,852.06
1500	\$1,138.95	\$1,143.36	\$1,918.70	\$1,933.26
2000	\$615.16	\$635.68	\$662.40	\$689.75
3000	\$410.11	\$423.73	\$441.60	\$459.83
4000	\$1,489.27	\$1,489.18	\$2,400.41	\$2,424.08
5000	\$4,084.38	\$4,098.26	\$6,543.41	\$6,611.84
8000	\$1,007.37	\$996.25	\$1,221.08	\$1,221.01
9000	\$1,133.04	\$1,134.48	\$1,939.90	\$1,952.50
11000	\$859.58	\$839.59	\$1,027.35	\$988.16
12000	\$4,549.72	\$4,704.21	\$4,900.95	\$5,114.60
14000	\$1,643.99	\$1,639.31	\$2,617.30	\$2,644.87
Total cost	\$37,528	\$38,406	\$46,217	\$47,487
Profit	\$32,750	\$36,790	\$33,599	\$36,048
Profit%	47%	49%	42%	43%
COL%	5.9%	5.6%	5.5%	5.5%

COL% is cost of labor as a percentage of sales

Exhibit K2**Manifolds**

	Model Year			
	1987	1988	1989	1990
Sales	79,459	84,776	89,323	93,120
materials	31,696	33,016	34,392	35,725
Labor	5,886	6,027	6,278	6,540
1000	\$1,839.35	\$1,860.00	\$2,584.10	\$2,633.72
1500	\$1,608.03	\$1,626.01	\$2,728.34	\$2,749.19
2000	\$868.52	\$904.03	\$941.91	\$980.86
3000	\$579.01	\$602.60	\$627.94	\$653.91
4000	\$2,102.62	\$2,117.81	\$3,413.32	\$3,447.16
5000	\$5,766.52	\$5,828.28	\$9,304.54	\$9,402.35
8000	\$1,422.26	\$1,416.80	\$1,736.34	\$1,736.33
9000	\$1,599.68	\$1,613.38	\$2,758.48	\$2,776.56
11000	\$1,213.59	\$1,194.01	\$1,460.86	\$1,405.20
12000	\$6,423.52	\$6,690.01	\$6,969.01	\$7,273.21
14000	\$2,321.06	\$2,331.31	\$3,721.72	\$3,761.13
Total cost	63,326	65,227	76,917	79,085
Profit	16,133	19,549	12,406	14,035
Profit%	20%	23%	14%	15%
COL%	7.4%	7.1%	7.0%	7.0%
COL% is cost of labor as a percentage of sales				

Exhibit K3**Doors**

	Model Year			
	1987	1988	1989	1990
Sales	41,845	45,174	47,199	49,887
Materials	14,886	15,506	16,252	16,825
Labor	2,621	2,731	2,844	2,963
1000	\$819.05	\$842.82	\$1,170.63	\$1,193.23
1500	\$716.04	\$736.79	\$1,235.96	\$1,245.54
2000	\$386.75	\$409.64	\$426.69	\$444.39
3000	\$257.83	\$273.06	\$284.46	\$296.26
4000	\$936.28	\$959.64	\$1,546.27	\$1,561.76
5000	\$2,567.80	\$2,640.95	\$4,215.05	\$4,259.81
8000	\$633.32	\$641.99	\$786.58	\$786.66
9000	\$712.33	\$731.07	\$1,249.62	\$1,257.94
11000	\$540.40	\$541.04	\$661.79	\$636.64
12000	\$2,860.35	\$3,031.43	\$3,157.04	\$3,295.19
14000	\$1,033.55	\$1,056.38	\$1,685.98	\$1,704.01
Total cost	<u>28,971</u>	<u>30,102</u>	<u>35,516</u>	<u>36,469</u>
Profit	12,874	15,072	11,683	13,418
Profit%	31%	33%	25%	27%
COL%	6.3%	6.0%	6.0%	5.9%

COL% is cost of labor as a percentage of sales

Exhibit K4**Mufflers**

	Model Year			
	1987	1988	1989	1990
Sales	62,986	66,266	0	0
Materials	28,440	29,525	0	0
Labor	5,635	5,766	0	0
1000	\$1,760.91	\$1,779.45		
1500	\$1,539.45	\$1,555.59		
2000	\$831.48	\$864.88		
3000	\$554.32	\$576.51		
4000	\$2,012.96	\$2,026.10		
5000	\$5,520.62	\$5,575.88		
8000	\$1,361.61	\$1,355.45		
9000	\$1,531.46	\$1,543.51		
11000	\$1,161.84	\$1,142.30		
12000	\$6,149.60	\$6,400.30		
14000	\$2,222.08	\$2,230.35		
Total cost	<u>58,721</u>	<u>60,341</u>		
Profit	4,265	5,925		
Profit%	7%	9%		
COL%	8.9%	8.7%		
COL% is cost of labor as a percentage of sales				

Exhibit K5**Oil Pans**

	Model Year			
	1987	1988	1989	1990
Sales	75,586	79,658	0	0
Materials	32,218	33,560	0	0
Labor	6,371	6,532	0	0
1000	\$1,990.91	\$2,015.85		
1500	\$1,740.53	\$1,762.25		
2000	\$940.09	\$979.77		
3000	\$626.72	\$653.10		
4000	\$2,275.87	\$2,295.26		
5000	\$6,241.68	\$6,316.63		
8000	\$1,539.45	\$1,535.51		
9000	\$1,731.49	\$1,748.56		
11000	\$1,313.59	\$1,294.06		
12000	\$6,952.81	\$7,250.56		
14000	\$2,512.31	\$2,526.65		
Total cost	<u>66,454</u>	<u>68,470</u>		
Profit	9,132	11,188		
Profit%	12%	14%		
COL%	8.4%	8.2%		

COL% is cost of labor as a percentage of sales

Bridgeton



- Despite cost cuts, why has profitability decreased after 1988 for the remaining products?
- Is there a distinction between fixed costs and unavoidable costs?
 - Some fixed costs may be avoidable under the outsourcing alternative.
 - All variable costs should be avoidable.
 - Costs may be unavoidable because of resource lumpiness.
- We need information on avoidable and unavoidable costs.
 - Does the cost accounting system at Bridgeton provide this information?
 - No, this requires managerial judgment.

Bridgeton



- Can we characterize individual OH cost categories in Exhibit 2?
 - Consider what happens to each overhead category after mufflers and oil pans are dropped.
 - Unavoidable overhead should be fairly constant, or decrease very little, after the 1988 outsourcing.
- What does this imply for the overhead allocation rate for each overhead account?
 - A large increase in the allocation rate indicates the presence of largely unavoidable costs.
 - Very small changes in the allocation rate suggest the presence of largely avoidable costs.

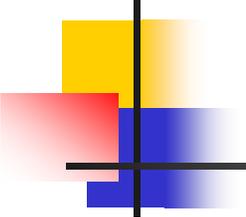


Exhibit K6: Comparison of Overhead Rates for 1988 and 1989

	Model Year		
	1989	1988	1989/1988
Overhead by Account Number			
1000	\$0.412	\$0.309	1.33
1500	0.435	0.270	1.61
2000	0.150	0.150	1.00
3000	0.100	0.100	1.00
4000	0.544	0.351	1.55
5000	1.482	0.967	1.53
8000	0.277	0.235	1.18
9000	0.439	0.268	1.64
11000	0.233	0.198	1.17
12000	1.110	1.110	1.00
14000	0.593	0.387	1.53

Bridgeton



- I assume that accounts 2000, 3000, 8000, 11000 and 12000 are avoidable.
- Given this information, should manifolds be outsourced?
 - We need to examine profitability with and without manifolds.
 - This requires a forecast for 1991.
 - Extrapolate the growth from 1989 to 1990, to forecast 1991.
- Exhibits K7 and K8 examine product line profitability in 1991, with and without manifolds.

Exhibit K7 Product profitability **keeping Manifolds**

	<u>Fuel tanks</u>	<u>Manifolds</u>	<u>Doors</u>	<u>Total</u>
Sales	87427.29	97078.41	52728.08	237233.77
Direct Materials	17708.68	37109.67	17418.20	72236.55
Direct Labor	4790.67	6812.93	3086.98	14690.58
Total Direct Costs	22499.35	43922.60	20505.18	86927.13
1000 Non Skilled wages	1887.48	2684.27	1216.24	5788.00
1500 Salaried personnel wages	1947.91	2770.20	1255.18	5973.28
2000 supplies	718.23	1021.42	462.81	2202.45
3000 tools	478.82	680.95	308.54	1468.30
4000 utilities	2447.94	3481.32	1577.39	7506.65
5000 non production wages	6680.88	9501.15	4304.98	20487.01
8000 depreciation	1220.92	1736.32	786.73	3743.96
9000 personnel expenses	1965.16	2794.74	1266.30	6026.20
11000 Special project expenses	950.44	1351.66	612.44	2914.54
12000 benefits and overtime (Unskilled)	5337.49	7590.66	3439.33	16367.47
14000 Benefits and overtime (skilled)	2672.68	3800.93	1722.20	8195.82
Total indirect costs	26307.95	37413.60	16952.13	80673.69
Overhead burden rate				549%
Total expenses	48807.30	81336.20	37457.31	167600.82
Operating income	38619.98	15742.20	15270.77	69632.95
	44%	16%	29%	29%

Exhibit K8 1991 Product profitability **NOT** keeping Manifolds

	<u>Fuel tanks</u>	<u>Manifolds</u>	<u>Doors</u>	<u>Total</u>
Sales	87427.29	0.00	52728.08	140155.37
Direct Materials	17708.68		17418.20	35126.88
Direct Labor	4790.67		3086.98	7877.65
Total Direct Costs	22499.35		20505.18	43004.53
1000 Non Skilled wages	3519.88		2268.12	5788.00
1500 Salaried personnel wages	3632.56		2340.72	5973.28
2000 supplies	718.23		462.81	1181.03
3000 tools	478.82		308.54	787.36
4000 utilities	4565.05		2941.60	7506.65
5000 non production wages	12458.86		8028.16	20487.01
8000 depreciation	1220.92		786.73	2007.65
9000 personnel expenses	3664.74		2361.46	6026.20
11000 Special project expenses	950.44		612.44	1562.88
12000 benefits and overtime (Unskilled)	5337.49		3439.33	8776.82
14000 Benefits and overtime (skilled)	4984.16		3211.66	8195.82
Total indirect costs	41531.13		26761.56	68292.69
Overhead burden rate				867%
Total expenses	64030.48		47266.74	111297.22
Operating income	23396.80		5461.35	28858.15
	27%		10%	21%

Bridgeton



- Why does the profitability of doors drop from 29% to 10% if manifolds are outsourced?
- Why does the profitability of fuel tanks drop from 44% to 27% if manifolds are outsourced?
- Why does overall profitability decline if manifolds are outsourced?
 - All revenues are foregone, and direct costs and avoidable indirect costs are avoided.
 - But there are significant unavoidable costs that drag down profits further.
- Assume manifolds are outsourced. What will the prospect for the doors product line be next year?

Bridgeton



- What you are witnessing is..
- The death spiral!
- In the presence of significant unavoidable costs, outsourcing increases the overhead allocation rate, or burden rate.
- This leads to previously profitable products becoming less profitable and new candidates for outsourcing.
- This can become a vicious cycle, or death spiral.

Bridgeton

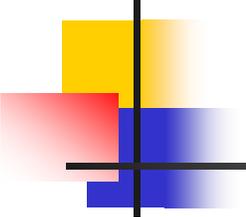


- At Bridgeton, managers are misinterpreting / misunderstanding the signal being emitted by the product costing system.
- Managers should have been able to identify the unavoidable costs ex ante, and should have factored them into the product-drop decision.
- In multi-product firms, the profitability of products with high usage of the allocation base is particularly sensitive to changes in the allocation rate.



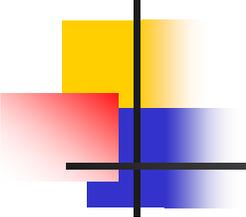
Bridgeton

	Allocation = 4 x DL\$		Allocation = 6 x DL\$	
	<u>Product A</u>	<u>Product B</u>	<u>Product A</u>	<u>Product B</u>
Revenues	62	54	62	54
Direct materials	16	27	16	27
Direct labor	6	3	6	3
Allocated overhead	<u>24</u>	<u>12</u>	<u>36</u>	<u>18</u>
Operating Income	16	12	4	6
Op. Inc. %	26%	22%	6%	11%



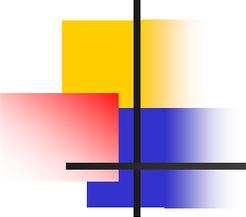
Bridgeton

- In this example, only the overhead allocation rate varies. Revenues, direct materials and direct labor costs do not vary.
 - The allocation base is direct labor cost.
- The product profitability ranking changes as the allocation rate increases.
 - B becomes more profitable than A after the increase.
 - A uses much more direct labor as a percentage of sales.
- Profit % = (sales – direct costs – allocated indirect costs) / sales = (sales – DM – DL – a*DL) / sales
- $\partial/\partial a = -DL/sales = -COL\%$



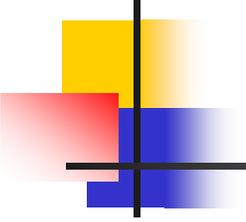
Bridgeton

- Returning to exhibits K1 through K5, COL% was highest for mufflers and oil pans, which were the first to be outsourced.
- COL% is second highest for manifolds, which are the next candidates for outsourcing.
- This pattern is predictable given the previous example.
- Assigning higher overhead to products with high allocation base usage is not itself a problem – the problem is when the allocation base is inappropriate or the costing system is unsophisticated.



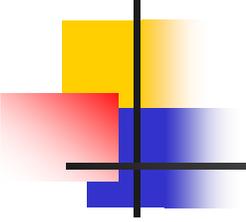
Bridgeton

- Many companies grow through product or service proliferation.
- Typically, this results in a few high volume products and several low volume products.
- In these settings, overhead typically rises dramatically.
- Unsophisticated costing systems will typically under- (over-) cost the low (high) volume products.
- If these costs are used in pricing decisions, the low (high) volume products will be under- (over-) priced.
- This will lead to increased (decreased) demand for the unprofitable (profitable) low (high) volume products.
- Over time (years), this will create a death spiral.



Bridgeton

- The death spiral can also occur in single product firms:
 - When demand declines, excess capacity is freed up. Allocating this to the remaining units will lead to an increase in prices, at exactly the wrong time!
 - Even when demand is increasing, adding (lumpy) extra capacity and raising prices will not work in a competitive market. This could lead to divesting capacity that may be needed in the future.



Bridgeton

- Takeaways:
 - For decision making, we need information on avoidable and unavoidable costs.
 - When product costs are critical, refining the costing system and understanding cost drivers is critical.
 - Profits of products with high usage of the allocation base are especially sensitive to changes in the allocation rate.
 - Beware of the death spiral
 - in multi-product firms, with both high and low volume products, under an unsophisticated costing system,
 - in the presence of excess capacity freed up by declining demand, or
 - in the presence of excess capacity acquired in response to increasing demand.