

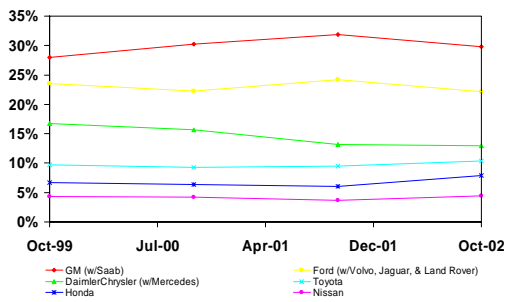
2.008

Cost

## For-Profit manufacturing firms Performance Measures

- Ownership:  
Market value = PV (Earning) + PV (Growth Opportunity)
- Management:  
Performance Targets

## Automotive Market Share in the U.S.



## GM Financials

\$ billions					
Income Statement	Dec-02	Dec-00	Dec-99	Dec-98	Dec-97
Revenue	177.3	184.5	197.4	154.0	166.4
Gross Profit Margin	26.1%	28.4%	21.0%	23.4%	21.9%
Operating Margin	5.7%	9.1%	5.6%	4.2%	2.2%
Total Net Income	0.6	4.5	6.0	3.0	6.7
Net Profit Margin	0.3%	2.4%	3.6%	1.9%	4.0%
Balance Sheet					
	Dec-02	Dec-00	Dec-99	Dec-98	Dec-97
Cash	18.6	10.3	10.4	10.9	11.3
Net Receivables	141.4	100.2	123.1	76.9	66.4
Inventories	10.0	10.9	10.6	12.2	12.1
Other Current Assets	23.9	24.8	19.8	37.4	11.7
Total Current Assets	193.8	146.3	164.0	137.3	101.4
Net Fixed Assets	34.9	34.0	32.8	37.2	34.6
Other Noncurrent Assets	95.2	122.8	77.9	82.9	92.9
Total Assets	324.0	303.1	274.7	257.4	228.9
Accounts Payable	26.2	25.7	21.5	20.0	15.8
Short-Term Debt	2.4	2.2	2.0	0.0	0.0
Other Current Liabilities	35.6	35.2	33.9	0.0	0.0
Total Current Liabilities	64.2	63.2	57.4	20.0	15.8
Long-Term Debt	163.9	142.4	129.7	114.2	93.0
Other Noncurrent Liabilities	75.4	65.5	59.6	97.7	98.7
Total Liabilities	304.3	272.9	254.1	242.4	211.4
Preferred Stock Equity	0.0	0.0	0.0	0.0	0.0
Common Stock Equity	19.7	30.2	20.6	15.0	17.5
Total Equity	19.7	30.2	20.6	15.0	17.5

## Toyota Financials

\$ billions					
Income Statement	Mar-02	Mar-02	Mar-00	Mar-99	Mar-98
Revenue	107.4	106.0	119.7	105.8	88.5
Gross Profit Margin	26.5%	24.9%	27.4%	27.8%	27.0%
Operating Margin	7.6%	6.0%	5.5%	5.9%	6.4%
Total Net Income	4.2	5.4	4.5	3.7	3.4
Net Profit Margin	3.9%	5.1%	3.8%	3.5%	3.9%
Balance Sheet					
	Mar-02	Mar-02	Mar-00	Mar-99	Mar-98
Cash	12.4	12.2	14.4	11.1	9.3
Net Receivables	29.9	26.3	26.2	21.8	8.9
Inventories	7.2	7.1	7.4	6.3	5.6
Other Current Assets	11.0	9.8	11.2	8.0	24.6
Total Current Assets	60.6	55.4	59.2	47.3	48.3
Net Fixed Assets	38.3	36.0	43.9	41.2	34.9
Other Noncurrent Assets	46.0	46.0	51.7	43.0	21.7
Total Assets	144.9	137.4	154.9	131.5	105.0
Accounts Payable	10.7	10.4	12.2	10.3	8.0
Short-Term Debt	22.4	17.6	20.5	14.8	11.5
Other Current Liabilities	17.0	16.8	15.9	17.4	14.6
Total Current Liabilities	50.1	44.8	48.6	42.5	34.1
Long-Term Debt	27.9	24.9	27.5	24.9	21.1
Other Noncurrent Liabilities	6.7	4.8	6.2	5.5	3.5
Total Liabilities	90.4	80.2	89.8	76.2	59.3
Preferred Stock Equity	0.0	0.0	0.0	0.0	0.0
Common Stock Equity	54.5	57.1	65.1	55.2	45.6
Total Equity	54.5	57.1	65.1	55.2	45.6

## Financial Comparison

	GM			TOYOTA		
	2001	2000	1999	2001	2000	1999
Current Ratio	3.02	2.32	2.86	1.21	1.24	1.22
Days Receivable	291	198	269	102	91	80
Asset Turnover	0.57	0.64	0.63	0.76	0.73	0.84
Inventory Turnover	16.90	17.11	14.65	15.04	14.61	17.35
ROA	0.2%	1.5%	2.2%	2.9%	4.0%	2.9%
ROE	3.0%	14.8%	29.1%	7.7%	9.5%	7.0%
Gross Margin	26.1%	28.4%	21.0%	26.5%	24.9%	27.4%
Operating Margin	5.7%	9.1%	5.6%	7.6%	6.0%	5.5%
Profit Margin	0.3%	2.4%	3.6%	3.9%	5.1%	3.8%

## Manufacturing Investment Decision

- NPV
- Payback Period
- Average Return on Book
- Internal Rate of Return
- Profitability Index

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## Time Value of Money

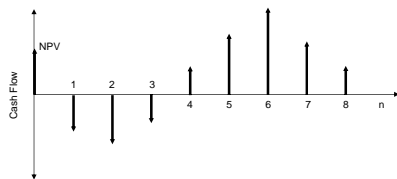
- \$1 today is worth more than \$1 tomorrow

Discount rate:  
Return foregone by investing in the project rather than in other opportunities

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## Cash Flow During Product Cycle



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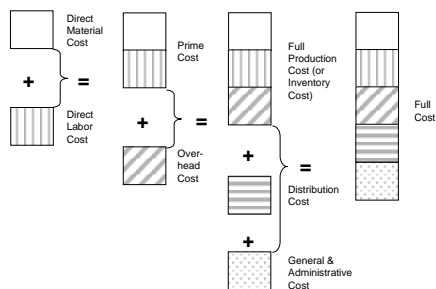
## Mfg Cost Example

Hobbed Gear	Percent of Total	P/M Gear	Percent of Hobbed Total
<b>Material:</b>			
SAE 1045, including 2% setup scrap and 46% chips	15.10	MPIF FC-0208-S (7.0 g/cm <sup>3</sup> density) 5% scrap	9.97
<b>Operations:</b>			
Bar chuck, cut off and bore	8.49	Operations:	
Broach keyway	3.17	Compact (100-ton press)	2.37
Hob teeth	47.50	Sinter	2.56
Harden	1.92	Harden	1.92
Grind ends perpendicular to pitch diameter	5.93	Grind ends perpendicular to pitch diameter	5.93
Deburr	0.53	Deburr	0.53
Inspect	0.26	Inspect	0.26
Perishable tools and gages, per piece	17.10	Perishable tools and gages, per piece	8.19
<b>Total</b>	<b>100.00</b>	<b>Total</b>	<b>31.73</b>

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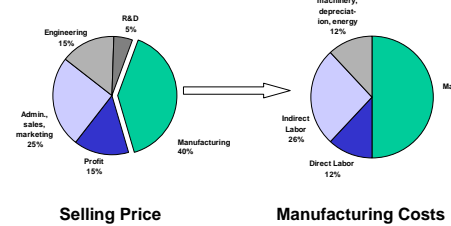
## Elements of Product Cost



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## Full cost (cont'd)



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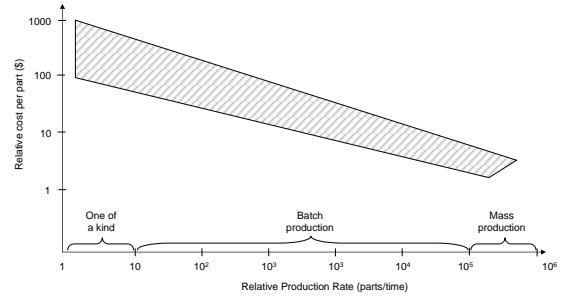
## Direct/Indirect vs. Fixed/Variable

- Traceability: Accountant
- Volume-dependence: Economist

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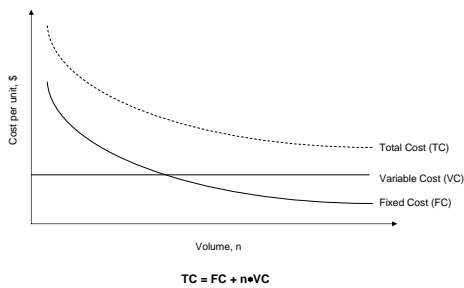
## Production Cost Relative to Volume



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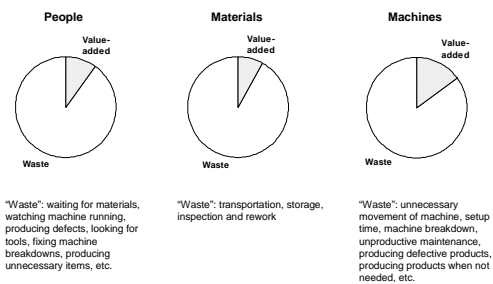
## Fixed and Variable Cost



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## How Man, Machine, and Material Spend Time in the Factory



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## Product cost by industry

Industry	Direct Materials	Direct Labor	Manufacturing overhead
Aerospace	51.7	19.3	29.0
Computers	69.9	7.5	22.5
Electronics	48.6	15.1	36.3
Industrial and farm equipment	46.0	12.8	41.2
Metal products	52.0	15.7	32.3
Motor vehicles and parts	63.8	7.8	28.4
Scientific and photographic equipment	52.3	11.3	36.5
<b>Average for seven industries</b>	<b>54.4</b>	<b>12.9</b>	<b>32.6</b>

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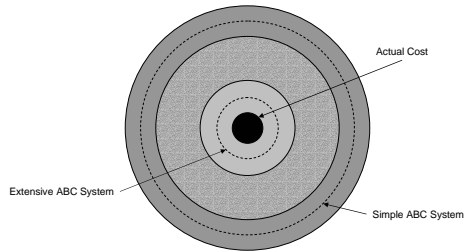
## Allocation Bases of Overhead

- Labor hours
- Machine hours
- Total direct cost
- Activity based

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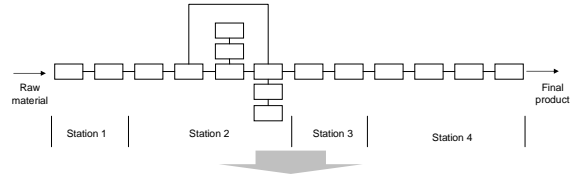
## ABC: Cost Accuracy Target



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## Allocation Bases of Overhead (cont'd)

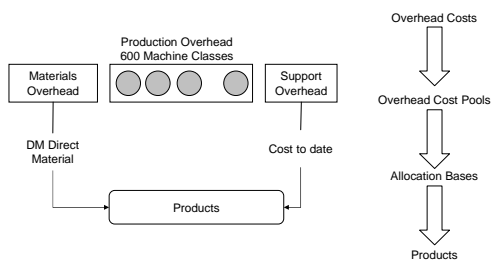


Unit Level Activity	Cost Driver	Quantity of Driver	Cost per Unit Driver	Total Cost
<b>Value-added Activities:</b>				
- Assembly	1 Person direct labor	8 hours per day	\$8.00 / hour	\$64.00 per day
<b>Non-value Added Activities:</b>				
- Machine setup	1 Person Direct labor	1 hour per day	\$8.00 / hour	\$8.00 per day
- Tool Load/Unload	Machine time	2 hours per day	\$60.00 / hour	\$120.00 per day
- Part Load/Unload	1 Person Direct labor	45 hours per day	\$8.00 / hour	\$6.00 per day
- Inspection	CMM Time	3 hours per day	\$35.00 / hour	\$105.00 per day
<b>Total</b>				<b>\$303.00</b>

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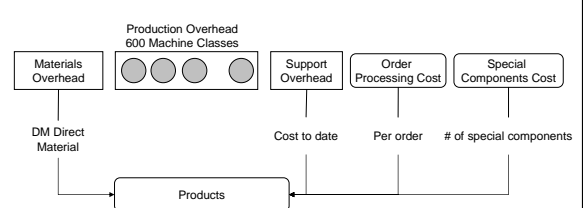
## Traditional Costing



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## Process Oriented Costing



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## Traditional and Activity-Based Costing

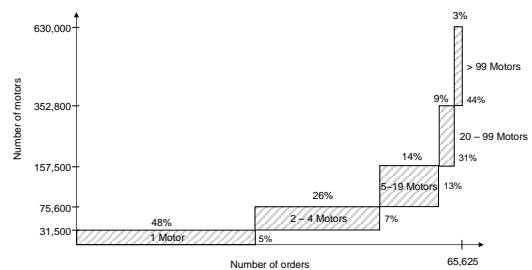
(\$ 000's)	Traditional	Transferred	Process Oriented
Material	\$105,000		\$105,000
Material related overhead	6,000		6,000
Labor	36,000		36,000
Production related overhead	120,000		120,000
<b>Manufacturing cost<sup>1</sup></b>	<b>267,000 (74%)</b>		<b>267,000 (74%)</b>
Engineering costs	12,000	6,300	5,700
Tooling costs	22,500	0	22,500
Administrative costs	60,000	27,000	33,000
<b>Support related cost</b>	<b>94,500 (26%)</b>	<b>33,300 (9%)</b>	<b>61,200 (17%)</b>
Order processing cost		13,800	13,800
Special components cost		19,500	19,500
<b>Total cost</b>	<b>\$361,500</b>	<b>0</b>	<b>\$361,500</b>

<sup>1</sup> Percent of Total Cost

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## Distribution of Orders



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## Cost Estimate: Example

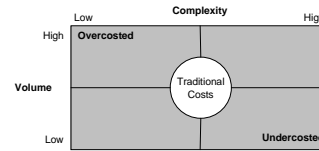
	A	B	C	D	E
<b>Pre-Support Related Overhead Cost</b>					
Base Motor	247.0	247.0	247.0	247.0	247.0
Components	32.2	64.4	96.6	161.0	322.0
Total	279.2	311.4	343.6	408.0	569.0
	1.35	x 1.35	x1.35	x1.35	x1.35
<b>Total</b>	<b>376.9</b>	<b>420.4</b>	<b>463.9</b>	<b>550.8</b>	<b>768.2</b>
Ratio to Traditional	1.62	1.69	1.75	1.83	1.96

<b>Revised Cost per Unit</b>	A	B	C	D	E
1 unit	613.6	713.2	812.8	1,012.0	1,510.0
10 units	370.6	416.2	461.8	553.0	781.0
20 units	357.1	399.7	442.3	527.5	740.5
100 units	346.3	386.5	426.7	507.1	708.1

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## Traditional Systems Distort Product and Customer Costs



### Product Complexity

- Small batch sizes
- Long set-up times
- Unique components
- Special inspection and tests
- Extensive material handling
- Special vendors

### Customer Complexity

- Customized products
- Short lead times
- Unpredictable orders
- Extensive technical support
- Extensive post-sales support
- Special test and requirements

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