

Cost and Price of Products

ME 4054W
Spring 2013



Ref: Ulrich & Eppinger text:
Chapter 11 (Design for Manufacturing), Chapter 15 (Product Development Economics)

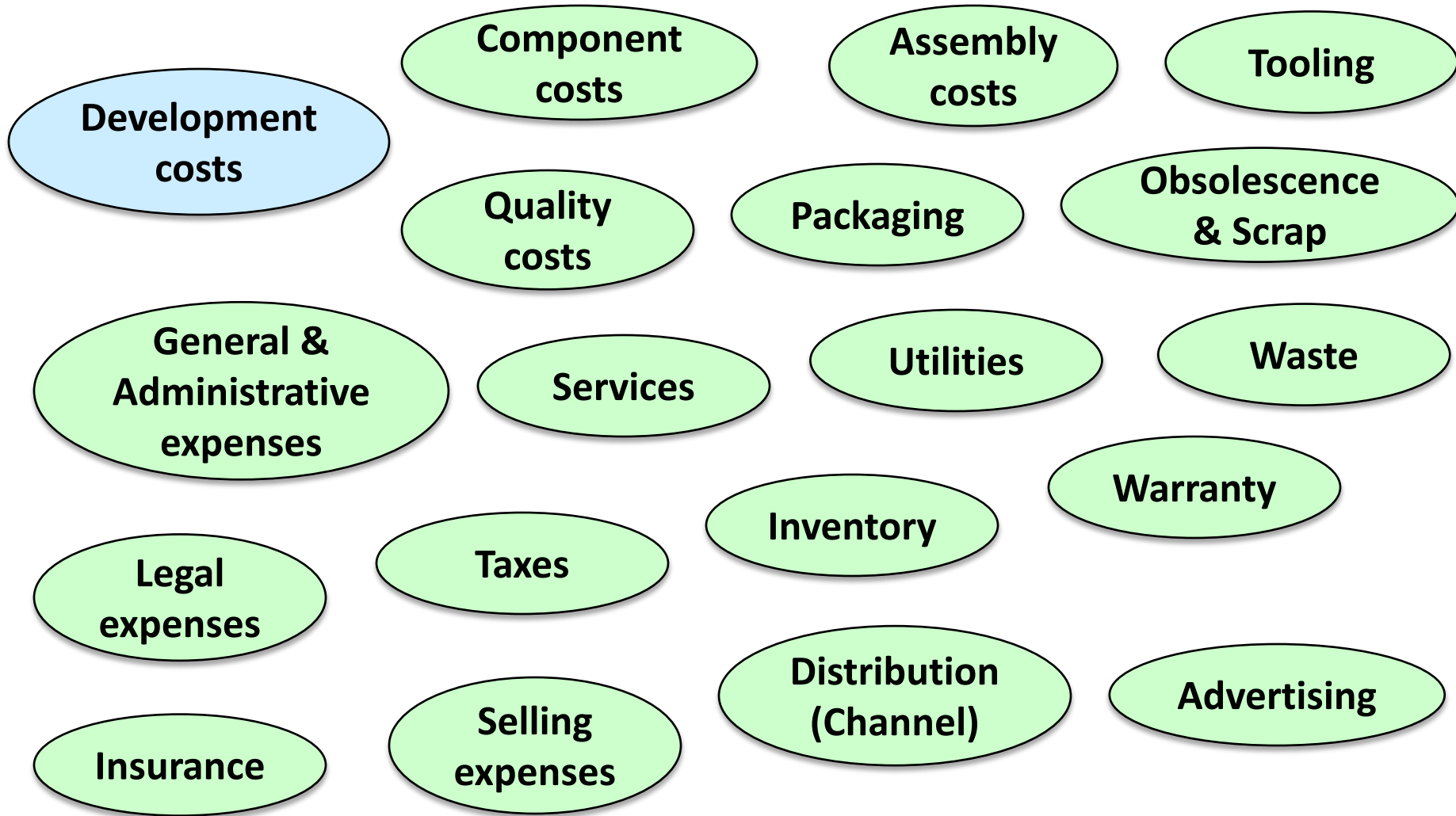
A friend said...

“Wow, the price at Home Depot for this gadget is \$50. I can build one for 10 bucks. I should go into business. I’ll make a ton of money!”

What are they potentially overlooking?

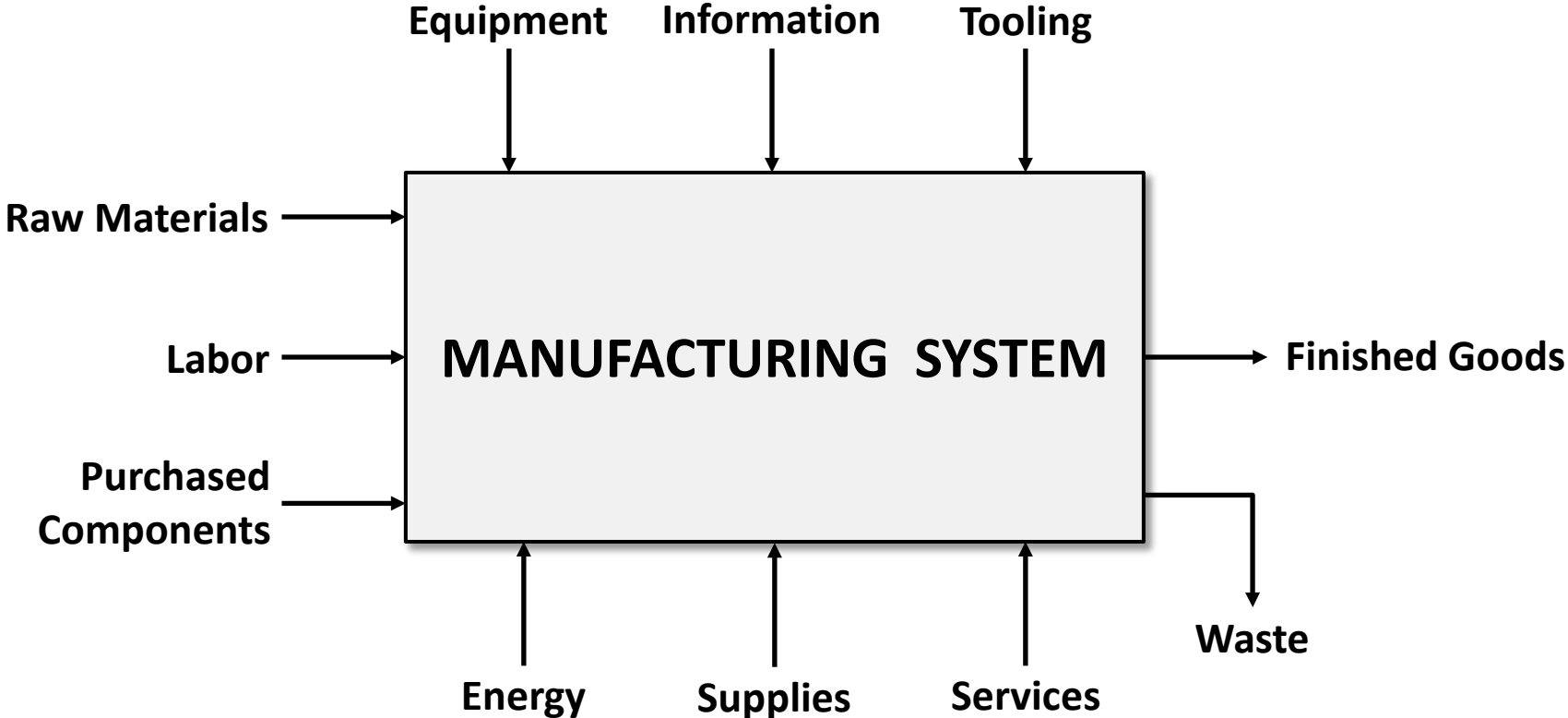
What are the attributes that determine the cost of a product?

Attributes related to the **cost** of a product*



* Representative attributes, not all inclusive

Manufacturing System Model



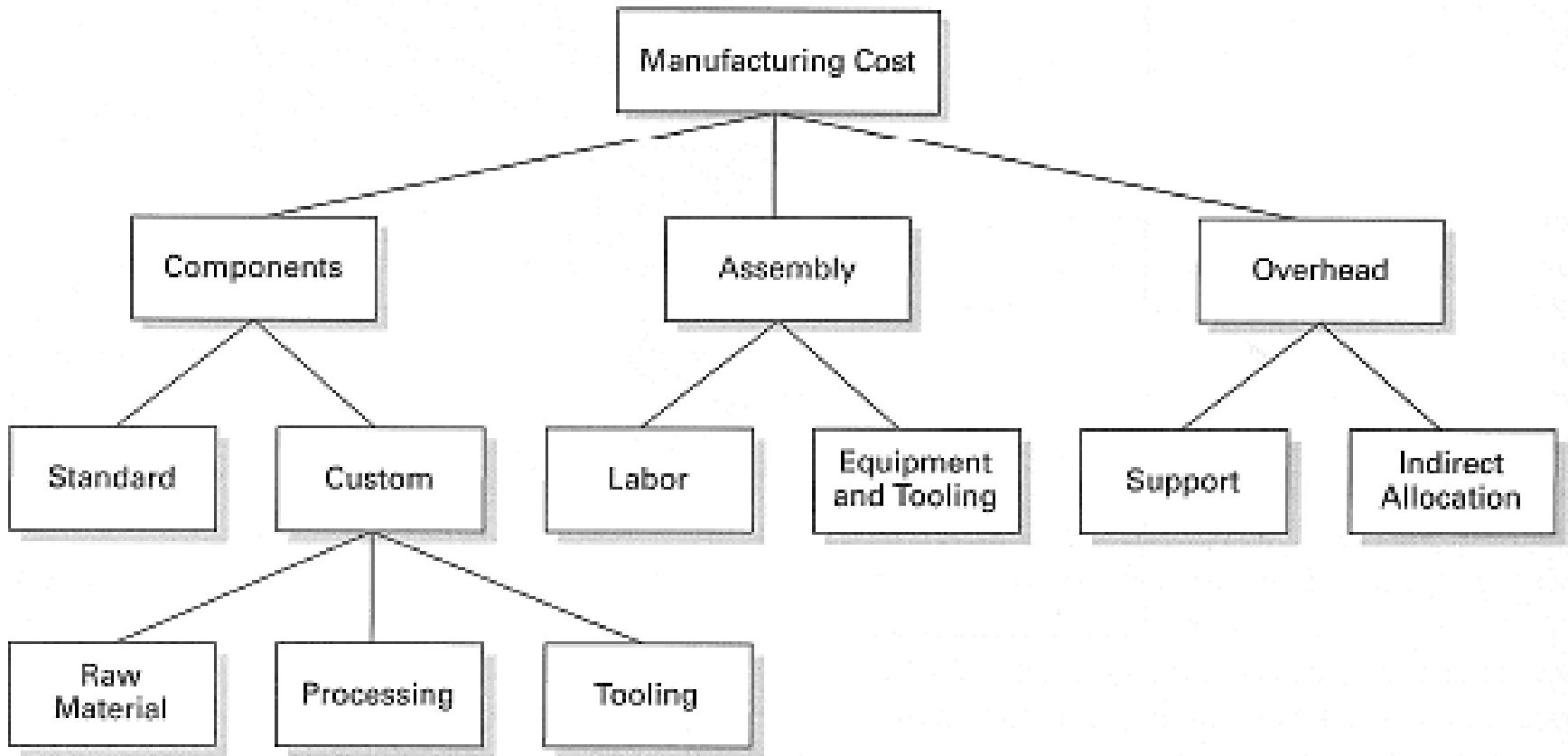
Manufacturing Costs

- Manufacturing cost is the sum of all expenditures for the inputs of the manufacturing system and for the waste produced by the system.
- Manufacturing cost is divided into three broad categories:
 - Materials cost
 - Assembly cost
 - Manufacturing overhead cost
- The metric used is generally unit manufacturing cost. This is the total manufacturing cost divided by the number of units produced over some time period.

Manufacturing Costs

- Manufacturing costs are further sub-divided as fixed and variable costs. Fixed costs are incurred in a predetermined amount, regardless of the number of units produced. Variable costs are incurred in direct proportion to the number of units produced.

Elements of Manufacturing Cost



Which of these costs are fixed and which are variable?

Non-Manufacturing Costs

- Non-manufacturing costs are those costs that are not directly related to the manufacturing of a product. In general, they are divided into two categories:
 - Selling and distribution costs
 - Examples include sales and marketing costs
 - General & Administrative (G&A) costs
 - Management salaries
 - Back office functions (accounting, IT, HR, finance, etc.)
 - Research & Development
 - and others

Development Costs

- Development costs are one of the non-manufacturing costs and includes things such as:
 - Information gathering
 - Market research, patents, ...
 - Engineering design and development, testing, CAD/simulation/...
 - Prototype construction and test
 - Product validation
 - and more...

This should look familiar!

Prototype BOM

- You will need to create a Bill of Material for your prototype/design.
- It must show quantity, part number, source, part cost, extended cost, total cost, etc.
- Split into sub-assemblies as appropriate.
- Include fabricated and purchased parts.
- Make “guesstimates” where appropriate.
- Your advisor may be able to provide cost information.

Prototype cost \neq Product cost

Prototype BOM Example

Part #	Description	Source	Part Number	Qty	Cost	Total
B-1	Aluminum Elbow	NA	NA	4	REF	\$ 330.00
B-2	Aluminum Clip	NA	NA	4	REF	\$ 210.00
B-3	1/4 x 1 x 20" Aluminum Bar	Discount Steel	NA	2	\$ 6.79	\$ 13.58
B-4	1' x 3/4 in. OD Aluminum Tubing	Discount Steel	NA	4	\$ 5.88	\$ 23.52
B-5	CM 1/4-20 x 3/4 Bolt	Ace Hardware	NA	4	\$ 1.10	\$ 4.40
B-6	CM 1/4-20 x 2 Bolt	Ace Hardware	NA	4	\$ 1.60	\$ 6.40
B-7	CM 1/4-20 Nut	Ace Hardware	NA	4	\$ 0.65	\$ 2.60
B-8	CM 1/4-20 x 1 Thumb Screw	McMaster-Carr	91510A157	1	\$ 1.35	\$ 1.35
					Total	\$ 590.50

(REF) Rough Machining Costs			
Part #	Set-Up Time (hrs.)	Mfg. Time (hrs.)	Cost / Part
B-1	2.5	0.75	150 + 45/part
B-2	1.5	0.5	90 + 30/part

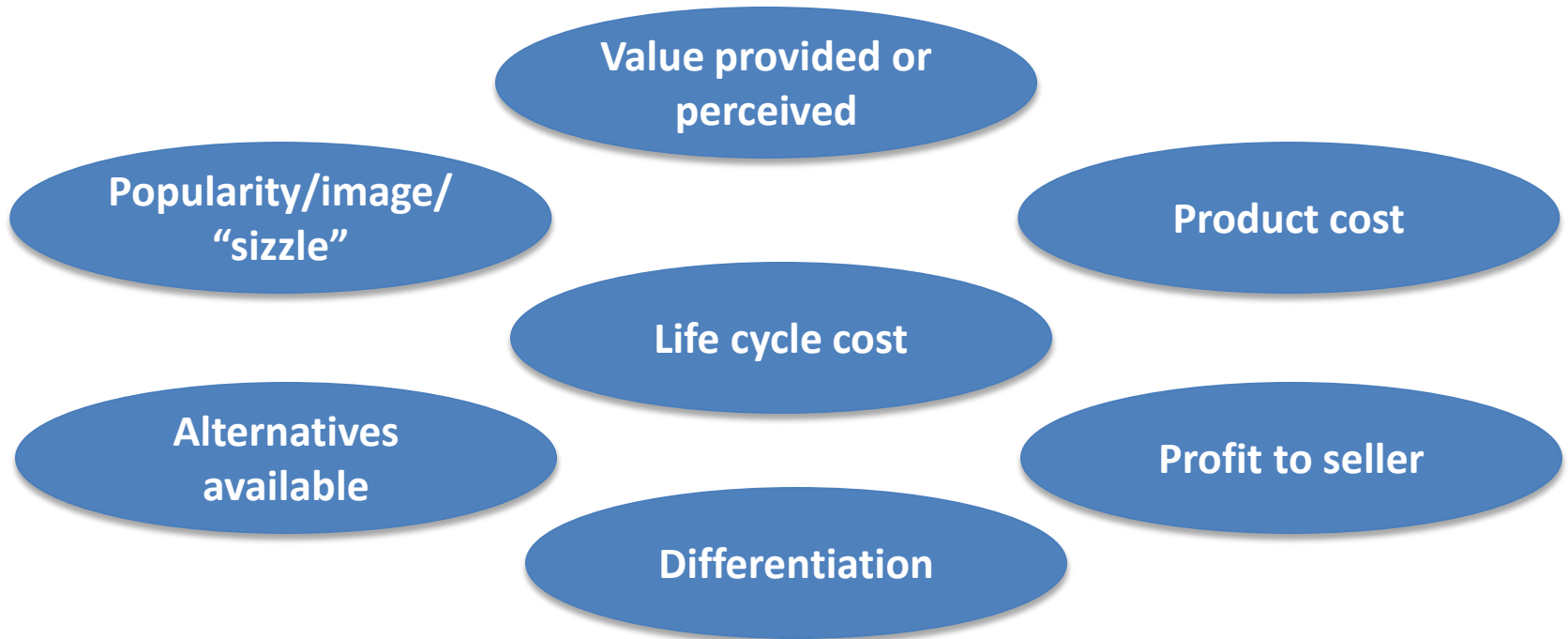
The machining costs given assume a shop time cost of \$60/hr.

Cost Estimation



- Cost estimation is an art
- Several layers of detail, use what's appropriate
- Manufacturing process matters....a lot!
- Volume matters...a lot!
- Using mass produced, commercial off the shelf (COTS) parts whenever possible can be a cost-effective approach
- Everything starts with a good bill of materials (BOM)

Attributes related to the **price** of a product*



- The price of a product should reflect the purchaser's perception of the product's value. For example, a commercial customer might say "I need a 2 year payback in order to buy it". The decision to buy a specific consumer product often is about the product's image (e.g., Prius). The latter is a highly variable individual perception and difficult to predict.
- A product with differentiation from alternatives can demand a price premium.
- The availability of competitive products and the passing of time tend to lower the perceived value of a product.
- Product cost and required profit set minimum limits, but price should reflect value to end user.

A novel, aftermarket product for automobiles

- **Given:**
 - 5 year life
 - 10% fuel economy improvement
 - No/low cost to install
- **Assumptions:**
 - 15,000 miles driven/year
 - 20 mpg average currently
 - \$2.75/gallon fuel price

What should the selling price of the product be?

A novel, aftermarket product for automobiles

Break-even cost calculation:

Fuel costs today:

$15,000 \text{ miles/year} \div 20 \text{ miles/gallon} = 750 \text{ gallons/year}$

$750 \text{ gallons/year} \times \$2.75/\text{gallon} = \$2062/\text{year}$

Potential fuel costs with aftermarket product:

$15,000 \text{ miles/year} \div 22 \text{ miles/gallon} = 682 \text{ gallons/year}$

$682 \text{ gallons/year} \times \$2.75/\text{gallon} = \$1876/\text{year}$

Potential annual fuel savings:

$\$2062 - \$1876 = \$186/\text{year}$

Potential fuel savings over the life of the product:

$\$186/\text{year} \times 5 \text{ years} = \930

The price that an educated consumer would pay for this product is less than the savings it will generate. How much the purchaser will be willing to spend depends on a number of factors such as magnitude of initial cost and risk.

What have we learned?

Manufacturing Cost + Non-manufacturing Cost = Cost

Prototype Cost \neq Product Cost

Cost \neq Price

Manufacturing Cost + Profit \neq Price

Price should reflect value

Midterm Exams

- The capstone design course is an important element of the ABET accreditation review.
- We are required to keep the exams and provide them to the accreditation auditors.
- You must return your exam to us before you leave the classroom today.
- If you wish to make a request for regrading a problem, you can submit a short explanation of what you're requesting to the course staff by email.

Financial Proforma Example

\$ values in thousands

	Year									
	1	2	3	4	5	6	7	8	9	10
Development cost	(\$1,500)	(\$1,500)	(\$500)							
Ramp-up cost		(\$800)	(\$600)							
Marketing & support cost		(\$100)	(\$250)	(\$250)	(\$250)	(\$250)	(\$250)	(\$250)	(\$250)	(\$250)
Production cost			(\$2,500)	(\$3,375)	(\$4,000)	(\$3,900)	(\$3,900)	(\$3,900)	(\$3,800)	(\$3,800)
Production volume			5,000	7,500	10,000	10,000	10,000	10,000	10,000	10,000
Production unit cost			\$ (0.500)	\$ (0.450)	\$ (0.400)	\$ (0.390)	\$ (0.390)	\$ (0.390)	\$ (0.380)	\$ (0.380)
Sales revenue			\$4,000	\$6,000	\$8,000	\$7,800	\$7,600	\$7,500	\$7,350	\$7,200
Sales volume			5,000	7,500	10,000	10,000	10,000	10,000	10,000	10,000
Unit price			\$ 0.800	\$ 0.800	\$ 0.800	\$ 0.780	\$ 0.760	\$ 0.750	\$ 0.735	\$ 0.720
Period cash flow	(\$1,500)	(\$2,400)	\$150	\$2,375	\$3,750	\$3,650	\$3,450	\$3,350	\$3,300	\$3,150
Period discounted cash flow	(\$1,500)	(\$2,160)	\$122	\$1,731	\$2,460	\$2,155	\$1,833	\$1,602	\$1,421	\$1,220
Cumulative discounted cash flow	(\$1,500)	(\$3,660)	(\$3,539)	(\$1,807)	\$653	\$2,809	\$4,642	\$6,244	\$7,665	\$8,885

Project Net Present Value (NPV) \$5,681

Assumptions:

10.0% = Discount factor / weighted average cost of capital

NOTE: Items in blue cells are required inputs. The balance of the cells are calculated.

Financial Proforma Example

\$ values in thousands

	Year									
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Production cost			(\$2,500)	(\$3,375)	(\$4,000)	(\$3,900)	(\$3,900)	(\$3,900)	(\$3,800)	(\$3,800)
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Period cash flow	(\$1,500)	(\$2,400)	\$150	\$2,375	\$3,750	\$3,650	\$3,450	\$3,350	\$3,300	\$3,150
Period discounted cash flow	(\$1,500)	(\$2,040)	\$108	\$1,459	\$1,958	\$1,620	\$1,301	\$1,074	\$899	\$730
Cumulative discounted cash flow	(\$1,500)	(\$3,540)	(\$3,432)	(\$1,973)	(\$16)	\$1,604	\$2,905	\$3,979	\$4,878	\$5,608

Project Net Present Value (NPV) **(\$1,514)**

Assumptions:

15.0% = Discount factor / weighted average cost of capital

NOTE: Items in blue cells are required inputs. The balance of the cells are calculated.

Applying a Monte Carlo simulation or sensitivity analysis to a proforma creates a “big picture” view of the opportunity. Crystal Ball is one software that does Monte Carlo analyses from an Excel proforma.