Week 10 – Thursday

Cost and Price of Products and Engineering Economics

Ref: Ulrich & Eppinger text:
Chapter 13 (Design for Manufacturing),
Chapter 17 (Product Development Economics)
Notes

• Report Assignment 3 Due Today at 11:59 pm
• Site Visits 2 Next Tues and Thurs
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?
Many Attributes Contribute to Cost…

- Parts cost
- Volume discounts
- Advertising
- Marketing costs
- G&A overhead
- Variable costs
- Tooling
- Labor cost
- Transportation
- Packaging
- Profit
- Fixed costs
- QC on incoming parts
- Warranty
- Inventory
- Liability
- Development costs
- Clinical trials
A novel, aftermarket product for cars

• Given:
  – 5 year life
  – 10% fuel economy improvement
  – No/low cost to install

• Assumptions:
  – 15,000 miles driven/year
  – 20 mpg average currently
  – $3.50/gallon fuel price

What should the selling price of the product be?
Attributes related to the price of a product

- Value provided or perceived
- Life cycle cost
- Popularity/image/“sizzle”
- Options available
- Profit to seller

The price of a product should ideally be set at a level roughly equal to the purchaser’s perception of the product’s value (e.g., “I need a 2 year payback in order to buy it” or the product’s image “It’s cool, I want it”) The latter is a highly variable individual perception and difficult to accurately define.

The availability of competitive products and the passing of time tend to lower the perceived value of a product.
Fixing a Price

• Estimate **value** to end users
  – Desired payback generally needs to be met
  – Subtract switching costs

• Compare with pricing of equivalent products
  – If you don’t have a differentiated product, getting a premium price is difficult
Estimating Value to Customer…

Breakeven cost calculation:

Fuel costs today:
15,000 miles/year ÷ 20 miles/gallon = 750 gallons/year
750 gallons/year x $3.50/gallon = $2625/year

Potential fuel costs with aftermarket product:
15,000 miles/year ÷ 22 miles/gallon = 682 gallons/year
682 gallons/year x $2.75/gallon = $2387/year

Potential annual fuel savings:
$2625 - $2387 = $238/year

Potential fuel savings over the life of the product:
$238/year x 5 years = $1190
(neglecting time value of money)

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.
“Supply Chain” for Auto Accessory

(organizations that touch it)

- Raw materials provider $0.20
- Manufacturing costs $0.32
- Channel (distribution) $0.18
- Profit $0.30
- Customer $1.00

Cost ≠ Price
Manufacturing System Model

[Diagram showing the flow of inputs (raw materials, purchased components, labor, energy, supplies, services) to outputs (equipment information, tooling, finished goods, waste).]
Manufacturing Cost

• Cost estimation is an art
• Several layers of detail, use what’s appropriate
• Manufacturing process matters….a lot!
• Volume matters…a lot!
• Everything starts with a good bill of materials (BOM)
• Cost of the prototype ≠ cost of the product!

• See Ulrich and Eppinger Chapter 11 for details
Manufacturing Costs

- Categories of Manufacturing costs
  - Direct materials cost
  - Direct labor cost
  - Manufacturing (or Factory) overhead cost

- Further sub-division
  - Variable costs: directly related to the volume of products manufactured
  - Fixed costs: cost incurred regardless of quantity
Elements of Manufacturing Cost
Design detail #1

Which is the preferred design from the manufacturability perspective? Why?
Design detail #2

Which is the preferred design from the manufacturability perspective? Why?
Which is the preferred design from the manufacturability perspective? Why?
Product Costs

• Product cost is more than materials cost plus labor cost
• It must account for all costs required for the production of the product
• Product cost models differ from company to company
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
  – Administrative costs
    • Executive, organizational and clerical costs
    • Product Engineering falls in this category
Where Do These Costs Fit?

Direct

- Administration
- Components
- Design
- Purchasing
- Marketing
- Labor
- Liability

Indirect

- Warranty
- Tooling
- Material
- Sales
- Accounting
Development Costs

• Includes many things:
  – Information gathering
  – Market research, patents, ...
  – Engineering design and development, testing, CAD/simulation/...
  – Prototype construction and test
  – Product validation
  – and more…
What have we learned?

• Mfg. Cost + Non-mfg. Cost = Cost
• Cost ≠ Price
• Mfg. Cost + Profit ≠ Price
Prototype Costs

- Need for Bill of Materials
- Low quantity pricing (1-?)
- Split out subassemblies
- Catalog parts vs. fabricated parts

Prototype cost ≠ Product cost!
Prototype BOM

• You will need to create a BOM table for the prototype you will have at the Design Show.
• It must show quantity, part number, source, part cost, extended cost, total cost, etc.
• Include fabricated and purchased parts.
• Make “guesstimates” where appropriate.
• Create in Excel and upload to the team’s Google site.
## Financial Proforma Example

$ values in thousands

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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.
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.