Chapter 4
Product Design

October 1, 2008

OBJECTIVES

- Product Development Process
- Economic Analysis of Development Projects
- Designing for the Customer
- Design for Manufacturability
- Measuring Product Development Performance

- cf. Flow Charts at Hewlett-Packard (QC9.avi)
- cf. Product Design at TriState Industries (TPD1.avi)

The Product Design Process

- Contract manufacturers: Companies that specialize in manufacturing products for other companies.
  - Ex: Electronic products, clothing, drug, plastics, and custom manufacturing.
- Core competency: A company's core competency is the one thing that it can do better than its competitors.
- The characteristics of a core competency:
  - It provides potential access to a wide variety of markets
  - It increases perceived customer benefits
  - It is hard for competitors to imitate

Typical Phases of Product Development

- Planning
- Concept Development
- System-Level Design
- Design Detail
- Testing and Refinement
- Production Ramp-up
Economic Analysis of Project Development Costs

- Using measurable factors to help determine:
  - Operational design and development decisions
  - Go/no-go milestones
- Building a Base-Case Financial Model
  - A financial model consisting of major cash flows
  - Sensitivity Analysis for “what if” questions
- cf. p. 118-119

Designing for the Customer: Quality Function Deployment (QFD)

- Interfunctional teams from marketing, design engineering, and manufacturing
- Voice of the customer
- House of Quality

House of Quality

Designing for the Customer: The House of Quality

Customer requirements information forms the basis for this matrix, used to translate them into operating or engineering goals.
Designing for the Customer: Value Analysis/Value Engineering

- Achieve equivalent or better performance at a lower cost while maintaining all functional requirements defined by the customer
- Does the item have any design features that are not necessary?
- Can two or more parts be combined into one?
- How can we cut down the weight?
- Are there nonstandard parts that can be eliminated?

Design for Manufacturability

- Traditional Approach
  - “We design it, you build it” or “Over the wall”
- Concurrent Engineering
  - “Let’s work together simultaneously”

Design for Manufacturing and Assembly (DFMA)

- Greatest improvements related to DFMA arise from simplification of the product by reducing the number of separate parts:
  1. During the operation of the product, does the part move relative to all other parts already assembled?
  2. Must the part be of a different material or be isolated from other parts already assembled?
  3. Must the part be separate from all other parts to allow the disassembly of the product for adjustment or maintenance?

Measuring Product Development Performance

<table>
<thead>
<tr>
<th>Performance Dimension</th>
<th>Measures</th>
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| Time-to-market        | • Freq. of new products introduced
                       | • Time to market introduction
                       | • Number stated and number completed
                       | • Actual versus plan
                       | • Percentage of sales from new products |
| Productivity          | • Engineering hours per project
                       | • Cost of materials and tooling per project
                       | • Actual versus plan |
| Quality               | • Conformance-reliability in use
                       | • Design-performance and customer satisfaction
                       | • Yield-factory and field |
Which of the following is the first phase of the typical phases of product development?

a. Product/process engineering  
b. Product planning  
c. Concept development  
d. Planning  
e. Ramp-up  

Answer: d. Planning

Which of the following is primarily focused on getting the voice of the customer into design specifications in product development?

a. Concurrent engineering  
b. Value engineering  
c. DFMA  
d. Quality function deployment  
e. None of the above  

Answer: d. Quality function deployment

Which of the following is the first step in building a House of Quality in product development?

a. Develop a list of customer requirements for the product  
b. Concept development  
c. Pilot production/Ramp-up  
d. Concurrent engineering  
e. None of the above  

Answer: a. Develop a list of customer requirements for the product

Of the following abbreviated concepts which derive the greatest product improvements as a result of simplification of the product by reducing the number of separate parts?

a. DFMA  
b. QFD  
c. VA/VE  
d. CAD  

Answer: a. DFMA (Design for Manufacturing and Assembly)