Product Planning & Development
(21-423)
Advanced Manufacturing Laboratory
Department of Industrial Engineering
Sharif University of Technology

Session #5

Course Description

- **Instructor**
  - Omid Fatahi Valilai, Ph.D. Industrial Engineering Department, Sharif University of Technology
  - Email: FValilai@sharif.edu, Tel: 6616-5706
  - Website: Sharif.edu/~fvalilai
- **Recommended prerequisite**
  - Manufacturing process I (21-418)
- **Class time**
  - Sunday-Tuesday 18:00-19:30
- **Course evaluation**
  - Mid-term (25%)
  - Final exam (40%)
  - Quiz (5%)
  - Exercise (Manufacturing Lab.) (30%)
Course Description (Continued...)

- Mid-term session:
  - Wednesday: 9th Ordibehesht 1394, 16:30 ~ 18:30
- Final Exam:
  - Monday: 1st Tir 1394, 09:00 ~ 11:30
- Reference:

Course Description (Continued..)

- Contents:
  - Product development in the changing Global world
  - Stages of Product Development
  - The Structure of the Product Design Process
  - Early design: Requirement definition and conceptual Design
  - Trade-off analyses: Optimization using cost and utility Metrics
  - Detailed design: Analysis and Modeling
  - Design Review: Designing to Ensure Quality
  - Production System: Strategies, planning, and methodologies
  - Production System Development
  - Planning and Preparation for Efficient Development
  - Supply chain: Logistics, packaging, supply chain, and the environment
The Structure of the Product Design Process

**Early Design:**

- Customer Needs Analysis

Defining the customer’s needs can be an extremely complex process resulting in many different and conflicting types of information.

There are several approaches for knowledge acquisition of customer needs.

The design team should use several of these methods to insure that the final requirements are representative of the customer.

**Methods for capturing and documenting customer needs:**

- Interviews of customers including techniques such as surveys
- Design partnerships or alliances
- Computer databases and data mining
- Consultants or experts
- Brainstorming sessions
- Personal and company experience
- Published information such as magazines, patents, etc.
- Technology capability forecasting
- Market and competitor benchmark analysis
- Prototyping and virtual reality
- House of quality or Quality Function Deployment
The Structure of the Product Design Process

- Early Design:
  - Customer Needs Analysis
  - Methods for capturing and documenting customer needs:
    - QFD
      - QFD constitutes "A system for translating customer requirements into appropriate company requirements at every stage, from research through production design and development, to manufacture, distribution, installation and marketing, sales and services"

- The QFD process begins when we endeavor to pinpoint customer requirements (or needs), which are usually expressed in terms of qualitative characteristics.

- During the process of product development, customer requirements are successively converted into internal company requisites, called design specifications
The Structure of the Product Design Process

* Early Design:
  - Customer Needs Analysis
  - Methods for capturing and documenting customer needs:
    - QFD

To effectively obtain the required quality characteristics, the identified manufacturing process specifications are translated into quality control specifications.

- Such specifications include like:
  - Inspection plans for acquired materials,
  - Information needed to determine which activities will need monitoring with statistical process control (SPC),
  - Planned preventive maintenance on machinery
  - Instructing and training operative personnel.
The Structure of the Product Design Process

- Early Design:
  - Customer Needs Analysis
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QFD PLANNING STRUCTURE

The first matrix to be used in QFD is known as the house of quality (HoQ).

This matrix serves to describe the basic process underlying QFD: the transition (based on a strategy of input-output) from a list of customer requirements, the “what,” through to a list of considerations as to “how” the requirements will be met (product characteristics).
The Structure of the Product Design Process

- Early Design:
  - Customer Needs Analysis
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![Diagram of QFD matrix](image)

**RELATIONSHIP MATRIX** ("WHATS" vs "HOWs")

- Temperature at which it is served
- Caffeine content
- Flavor components
- Flavor intensity
- Aroma components
- Aroma intensity
- Sales price
- Volume
- Coffee temperature after a given time lapse

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Advanced Manufacturing Laboratory, Department of Industrial Engineering, Sharif University of Technology
Product Planning & Development (21423), Session #5
The Structure of the Early Design:
- Customer Needs Analysis
- Methods for capturing customer needs:
  - QFD
The Structure of the Prod

- Early Design:
  - Customer Needs Analysis
  - Methods for capturing and documenting customer needs:
    - QFD

### QFD

<table>
<thead>
<tr>
<th>Customer Requirements</th>
<th>Mean time to failure = 50600 hours</th>
<th>Competitive Benchmarking</th>
</tr>
</thead>
<tbody>
<tr>
<td>High degree of compatibility</td>
<td>0</td>
<td>A B C O</td>
</tr>
<tr>
<td>Ease of operation</td>
<td>0</td>
<td>▲ ▲ ▲ ▲</td>
</tr>
<tr>
<td>Capable of close tolerance</td>
<td>0</td>
<td>▲ ▲ ▲ ▲</td>
</tr>
<tr>
<td>Minimum operating costs</td>
<td>0</td>
<td>▲ ▲ ▲ ▲</td>
</tr>
<tr>
<td>Highly reliable</td>
<td>0</td>
<td>▲ ▲ ▲ ▲</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Risk</th>
<th>Absolute</th>
<th>Relative</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Strong</td>
<td>12</td>
<td>108</td>
</tr>
<tr>
<td>3 Medium</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>1 Weak</td>
<td>0</td>
<td>14</td>
</tr>
</tbody>
</table>

| Key elements | X | X | X |

### Technical Benchmarking

| Our company: | 0 | 4 |
| Competitor: | A 3 | B 2 | C 1 |

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**Figure 1.10** The house of quality for the planning of a pencil. (From Waterman, G.S. [1993], *IIE Trans.*, 25(3), 59-65. With permission.)