ME 2110 - Creative Decisions & Design

- Quality Function Deployment
Phases of Design (Product Lifecycle)

1) **Customer Requirements**
   - Understand the Problem

2) **Specification Development**
   - Engineering Requirements

3) **Conceptual Design**

4) **Detail Design**

5) **Specification of Production**

6) **Manufacture**

7) **Recycle**
Quality Function Deployment (QFD)
(Planning Tool)

- Where can I sell it?
- How can I sell it?
- Why will people buy it?
- Why is it important?
QFD History

- The article that started it all
- Harvard Business Review
- Developed from a study in the Kobe shipyards

Digital Equipment, Hewlett-Packard, AT&T, and ITT are getting started with it. Ford and General Motors use it--at Ford alone there are more than 30 applications. The "house of quality," the basic design tool of the management approach known as quality function deployment (QFD), originated in 1972 at Mitsubishi's Kobe shipyard site. Toyota and its suppliers then developed it in numerous ways. The house of quality has been used successfully by Japanese manufacturers of consumer electronics, home appliances, clothing, integrated circuits, synthetic rubber, construction equipment, and agricultural engines. Japanese designers use it for services like swimming pools and retail outlets and even for planning apartment layouts.

A set of planning and communication routines, quality function deployment focuses and coordinates skills within an organization, first to design, then to manufacture and market goods that customers want to purchase and will continue to purchase. The foundation of the house of quality is the belief that products should be designed to reflect customer desires and tastes--so marketing people, design engineers, and manufacturing staff must work closely together from the time a product is first conceived.

The house of quality is a kind of conceptual map that provides the means for interfunctional planning and communication. People with different pro-

by JOHN R. HAUSER and DON CLAUSING

Design is a team effort, but how do marketing and engineering talk to each other?

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Needs of Shipyard Customers?

- Reliable Schedule
- Storage Space for Cargo
- Easy Access for Trucks
- Skilled, Reliable Labor
- Fast Crane
- ...

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Quality Function Deployment (QFD)

- **QFD is a planning tool**
  - translates customer needs into appropriate product development requirements
  - identifies the significant items on which to focus time, product improvement efforts, and other resources

- **QFD is not**
  - a quality control strategy
QFD

- QFD enables
  - identification of important issues and items
  - identification of trade-offs

- Can be an aid to achieving goals of
  - Quality
  - Cost
  - Timeliness

- QFD is customer-driven product development
Change Comparison

- Changes = $ (Time)
- Earlier Changes = Less $ Spent (Effective Time Usage)
Basic Business Transaction

- Customer
  - Wants
  - Needs
  - Desires

- Supplier (products or services)
  - Features
  - Advantages
  - Benefits
Mismatch -> Supplier must rely on marketing

- adjust price
- increase sales commissions
- carry inventory
- advertise
- public relations
House of Quality
(A Main Tool of QFD)
House of Quality

- **Customer Requirements**
- **Design Requirements**
- **Correlation Matrix**
- **Relationship Matrix**
- **How**
- **What**
- **How Much**
- **Engineering Competitive Assessment**

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House of Quality

- Example: car door
- Customer requirements - Whats
- Design requirements - Hows
House of Quality

- Relationship matrix
  - relates *Whats* to *Hows*
  - Blank row
    - no *How* for *What*
    - engineer doesn’t care
  - Blank column
    - no *What* for *How*
    - customer doesn’t care

- Importance of *What*
  - to customer
  - Example: Appearance
    - Not important for fuel pump
    - Important for car body

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Matrices

- Relationships
  - *Whats* to *Hows*
  - Strong - 9
  - Medium - 3
  - Weak - 1
  - Blank - No - 0

- Correlation matrix
  - *Hows* to *Hows*
  - Positive and negative

- Not always intuitive
Competitive Analyses

Example:

– Truck A was perceived as slower than Truck B.
– Technically, this was not true; why was it so perceived?
– Truck A
  ♦ was quieter
  ♦ was sturdier / stiffer
  ♦ lagged before it took off
Example House of Quality: A Cup of Coffee

- What
  - Hot
  - Taste
  - Smell
  - Stimulating
  - Color
  - Grounds
  - Not poisonous
  - Cost

- How
  - Serving temperature (Hot)
  - Taste jury (Taste)
  - Smell jury (Smell)
  - Measure caffeine level (Stimulating)
  - Color standard (Color)
  - Filter & weigh (Grounds)
  - Measure LD 50 (Limit poison)
  - Price ($)
Cup of Coffee - House of Quality

<table>
<thead>
<tr>
<th>WHATs</th>
<th>IMPORANCE</th>
<th>ENG. Characts.</th>
<th>CUSTOMER RATING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot</td>
<td></td>
<td></td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>Smell</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taste</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Color</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stimulating</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grounds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not Poisonous</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ORGANIZATIONAL DIFFIC</th>
<th>TARGETS</th>
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<tbody>
<tr>
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</table>

<table>
<thead>
<tr>
<th>ENGINEERING ASSESSMENT</th>
<th>ABSOLUTE IMPORTANCE</th>
<th>RELATIVE IMPORTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 4 3 2 1 0</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>ROOF</th>
<th>MATRIX</th>
<th>WEIGHTS</th>
<th>ARROWS</th>
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</thead>
<tbody>
<tr>
<td>Strong Pos</td>
<td>Strong</td>
<td>9</td>
<td>Maximize</td>
</tr>
<tr>
<td>Positive</td>
<td>Medium</td>
<td>3</td>
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</tr>
<tr>
<td>Negative</td>
<td>Weak</td>
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<td>Nominal</td>
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<tr>
<td>Strong Neg</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Cup of Coffee - House of Quality

The 181 from column 1 comes from:

\[ 8 \times 9 + 6 \times 3 + 9 \times 9 + 10 = 181 \]

The sum of the Absolute Importance row is:

\[ 181 + 132 + 54 + 99 + 18 + 108 + 90 = 682 \]

The 0.27 in column 1 of the Relative Importance row comes from:

\[ \frac{181}{682} = 0.27 \]

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Expectations are Important

- Standards are:
  - Set
  - Change (Starbucks)

- Examples:
  - Sun visor mirrors
  - Cargo net
  - Double cups for hot coffee; cardboard bands

- Benchmarking is important
  - Compare to your competition
  - What if you have no competition?
General House of Quality

- What (Market / Need)
- How (Manufacture)
- Relationships
- Conflicts
  - Customer
  - Producer
- Competition

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Analyzing and Diagnosing the Problem

Look for:

- Blank rows
- Blank columns
- Conflicts in the customer vs. technical (engineering) survey
- Communication opportunities
- Sales Points
- Resolve Negative Correlations
- Final Targets Correct
- What design requirements to be deployed to Phase II (Parts Deployment)?
4 Phases of QFD (Car Door Example)

- **Product planning**
  - Close door easily
  - Close fit

- **Part deployment**
  - Weather strip
  - Latch

- **Process planning** (Weather strip)
  - Extrude

- **Production planning**
  - Temperature
  - Pressure
  - Speed
Review: QFD Steps

- What (1)
- How (2)
- How Much (3)
- Relationship Matrix (4)
- Correlation Matrix (5)
- Competitive Analysis
- Analyze
- Deploy
Remember

- QFD
  - is a planning tool
  - is one of many planning tools

- Charts
  - are the means
  - are not the ends