QFD: From ‘Reqs’ to ‘Specs’
“House of Quality”, Hausing & Clauser, HBR, 1988
Quality Function Deployment

Customer Requirements

- Easy to close: 7
- Stays open on a hill: 5
- Easy to open: 3
- Doesn’t leak in rain: 3
- No road noise: 2

Importance weighting:

<table>
<thead>
<tr>
<th>Importance to Cust.</th>
<th>Energy needed to close door</th>
<th>Door seal resistance</th>
<th>Check force on level ground</th>
<th>Energy needed to open door</th>
<th>Accoust. Trans. Window</th>
<th>Water resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
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<td>X</td>
</tr>
</tbody>
</table>

Competitive evaluation:

- X = Us
- A = Comp. A
- B = Comp. B

(5 is best)

Relationships:

- Strong = 9
- Medium = 3
- Small = 1

Target values:

- Reduce energy level to 7.5 ft/lb
- Maintain current level
- Reduce force to 9 lb.
- Reduce energy to 7.5 ft/lb
- Maintain current level
- Maintain current level

Technical evaluation (5 is best)

- B
- A
- X
- B
- A
- X
- B
- X
- A
- B
- X
- B
- X
- A
- B
- X

Correlation:

- Strong positive
- Positive
- Negative
- Strong negative
Product
Deliver benefits at ‘right’ cost

Q
uality
Function
Deployment

“Voice of the Customer”

Dream

Reqs

Deliver benefits at ‘right’ cost

Starts with the Customer
Quality Function Deployment

"Voice of the Customer" Reqs

Dream

Hot trend: anthropological "empathic research"
“Personally, I would rather talk with three housewives for 2 hours each on their feelings about, say, washing machines than conduct a 1,000 person survey on the same topic. I get much better insight and perspective on what they are really looking for.”

Kenichi Ohmae, McKinsey

Source: HBR, Nov., 1988
In Depth Interviews

% Needs Identified

Number of Focus Groups or Interviews

Two hour focus groups

One hour, 1-on-1 interviews

Heavy Users
Lead Users
“Whiners”
Identifying & Clustering Attributes

Customer attributes and bundles of CAs for a car door

**Primary**

- Easy to open and close door
  - Good operation and use
    - Isolation
      - Arm rest
  - Interior trim

**Secondary**

- Clean
  - Fit

**Tertiary**

- Easy to close from outside
- Stays open on a hill
- Easy to open from outside
- Doesn’t kick back
- Easy to close from inside
- Easy to open from inside
- Doesn’t leak in rain
- No road noise
- Doesn’t leak in car wash
- No wind noise
- Doesn’t drip water or snow when open
- Doesn’t rattle
- Soft, comfortable
- In right position
- Material won’t fade
- Attractive (nonplastic look)
- Easy to clean
- No grease from door
- Uniform gaps between matching panels
## Determining Attribute Importance Weights

### Relative-importance weights of customer attributes

<table>
<thead>
<tr>
<th>Bundles</th>
<th>Customer Attributes</th>
<th>Relative Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy to open and close</td>
<td>Easy to close from outside</td>
<td>7</td>
</tr>
<tr>
<td>door</td>
<td>Stays open on a hill</td>
<td>5</td>
</tr>
<tr>
<td>Isolation</td>
<td>Doesn’t leak in rain</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>No road noise</td>
<td>2</td>
</tr>
</tbody>
</table>

A complete list totals 100.

More sophisticated method: **conjoint measurement**
Comparative Benchmarking

Customers’ evaluations of competitive products

<table>
<thead>
<tr>
<th>BUNDLES</th>
<th>CUSTOMER ATTRIBUTES</th>
<th>RELATIVE IMPORTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>EASY TO OPEN AND CLOSE DOOR</td>
<td>Easy to close from outside</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Stays open on a hill</td>
<td>5</td>
</tr>
<tr>
<td>ISOLATION</td>
<td>Doesn’t leak in rain</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>No road noise</td>
<td>2</td>
</tr>
</tbody>
</table>

Typical method: **semantic scaling**
Quality Function Deployment

“Voice of the Customer”

о “Dream”

о “Requirements”

о “Design”

о “Specifications”

From vague ideas (reqs) to objective criteria (specs)
### From Reqs to Specs – Step 1
Translating from ‘Customer-speak’ to “Engineer-speak”

Engineering characteristics tell how to change the product

<table>
<thead>
<tr>
<th>CUSTOMER ATTRIBUTES</th>
<th>Relative Importance</th>
<th>OPENCLOSE EFFORT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy to close from outside</td>
<td>7</td>
<td>+ Energy to close door</td>
</tr>
<tr>
<td>Stays open on a hill</td>
<td>5</td>
<td>+ Check force on level ground</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ Check force on 10° slope</td>
</tr>
<tr>
<td>Isolation</td>
<td></td>
<td>+ Door seal resistance</td>
</tr>
<tr>
<td>Doesn’t leak in rain</td>
<td>3</td>
<td>+ Road noise reduction</td>
</tr>
<tr>
<td>No road noise</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

#### CUSTOMER PERCEPTIONS

1. OUR CAR
2. A’S CAR
3. B’S CAR
From Reqs to Specs – Step 2
Identifying inter-relationships

Relationship matrix shows how engineering decisions affect customer perceptions

<table>
<thead>
<tr>
<th>Customer Attributes</th>
<th>Easy to close from outside</th>
<th>Stays open on a hill</th>
<th>Doesn’t leak in rain</th>
<th>No road noise</th>
</tr>
</thead>
<tbody>
<tr>
<td>EASY TO OPEN AND CLOSE DOOR</td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>ISOLATION</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Engineering Characteristics</th>
<th>Open-Close Effort</th>
<th>Sealing-Insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Energy to close door</td>
<td>+ Check force on level ground</td>
<td>+ Door seal resistance</td>
</tr>
<tr>
<td>+ Check force on 10 slope</td>
<td></td>
<td>+ Road noise reduction</td>
</tr>
</tbody>
</table>

Relationships
- Strong positive
- Medium positive
- Medium negative
- Strong negative

Customer perceptions
- 1
- 2
- 3
- 4
- 5
### From Reqs to Specs – Step 3
Calibrating the attribute values (objective measures)

#### Objective measures evaluate competitive products

<table>
<thead>
<tr>
<th>ENGINEERING CHARACTERISTICS</th>
<th>OPEN-CLOSE EFFORT</th>
<th>SEALING-INSULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+ Energy to close door</td>
<td>+ Check force on level ground</td>
</tr>
</tbody>
</table>

**Relationships**
- ✔ Strong positive
- ✔ Medium positive
- × Medium negative
- ✔ Strong negative

#### Customer attributes

<table>
<thead>
<tr>
<th>Easy to close from outside</th>
<th>Easy to open and close door</th>
<th>Doesn’t leak in rain</th>
<th>No road noise</th>
<th>Objective measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>To our car door</td>
</tr>
<tr>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>11 12 6 3 2</td>
</tr>
</tbody>
</table>

**Customer perceptions**

- ✔ Our car
- ✔ A’s car
- ✔ B’s car
Quality Function Deployment

“Voice of the Customer”

Dream > Design > Specs > Cost

Deliver

From physical attributes to $$$
Design for Manufacturing

- Cost-effective materials
- Repeatable tolerances
- Economies of scale & learning
- Standardized components
- Platforms & modules
- End-of-line customization (postponement)

Typically, over 75% of product costs are “design locked”
From dreams to practicality
Target Costing

• Determine price point for approximate feature/benefit combination

• Price - target profit = Target cost

• Iterate design trade-offs until target cost is hit
  ... Estimate cost function for attributes
  ... “Give up” low leverage design values

• Revalidate price point given revised design
QFD: *Putting it all together*
Quality Function Deployment

Closed loop – starting (and ending) with the customer
QFD: Rest of the process ...
The rest of the process …