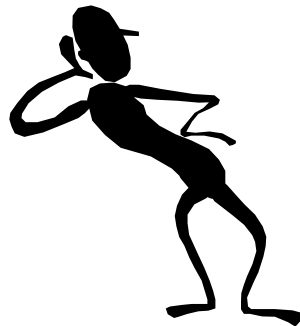




Surviving and Thriving with your Customer in a Downturn Economy:

Identifying and Understanding the Voice of the Customer (VOC)



**Test Week
June 1, 2009**

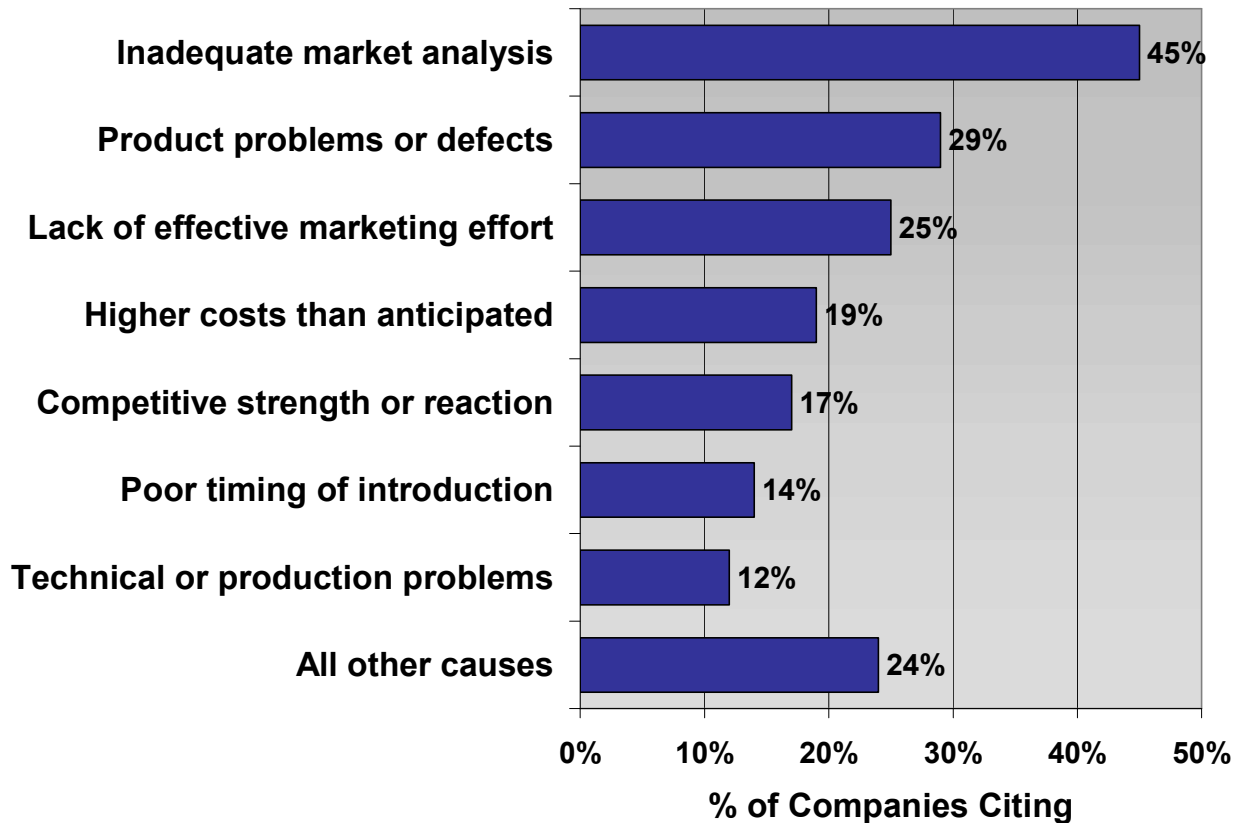
Introductions

- Name
- Organization
- Job Title/Duties
- Experience in Gaining Knowledge About Your Customer

Agenda

- Identifying and Segmenting Your Customer Base
- Prioritize Customer Segments
- Identifying and Obtaining Customer Requirements
 - Sources
 - Sampling
- Data Considerations
- Prioritizing Customer Requirements
- Translating Requirements into Measurable Entities
- Summary

Reasons for New Product Failure



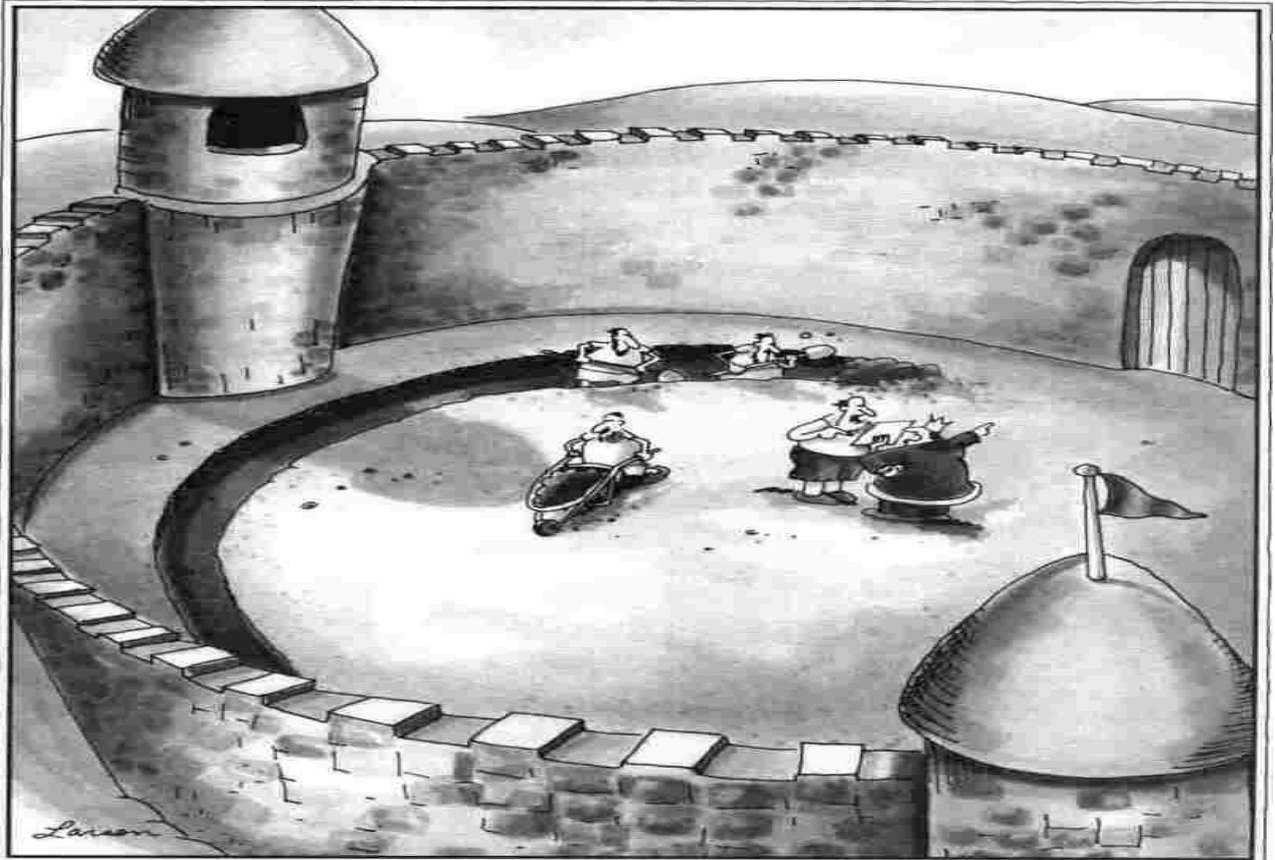
Source: *Winning at New Products (Accelerating the Process from Idea to Launch), Second Edition (1993)*
Robert G. Cooper

Basic Definitions

- Customer (*American Heritage Dictionary*):
 - A person who buys goods or services
 - A person with whom one must deal

- Expanded:
 - A person who buys goods or services or who is the recipient or user of the goods or services purchased
 - A person with whom one must deal or a person who is directly or indirectly impacted by one's actions

Understanding the Voice of the Customer



Identifying Customers and Segments



- Customers
 - Internal
 - External

- Segment customers in a way that makes sense for your product or service. Examples include:
 - Industry size
 - Geographic location
 - Climate
 - Product Application
 - Price point
 - Sales
 - Usage rate

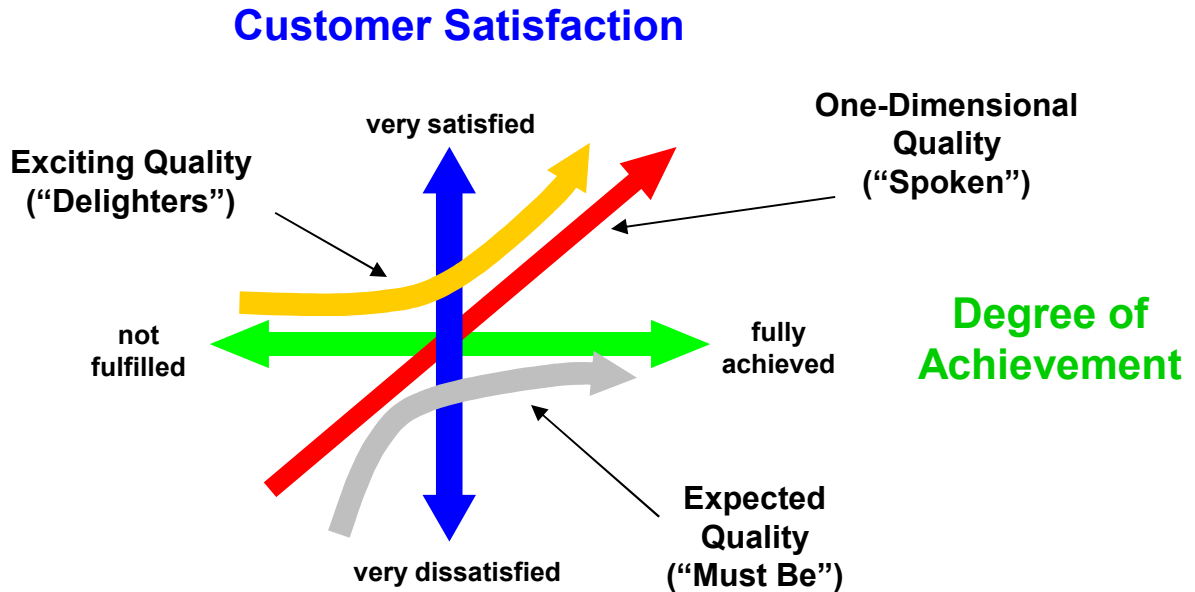
- Example:
 - Product: Laptop Computer
 - Customer Segments might include:
 - Business traveler
 - Home User
 - Small Business

Prioritizing Customer Segments

- Some customer segments may have higher priority based on business needs and benchmarking
- Segments should be rank ordered using a scale from high to low
 - 3 point scale: high, medium, low
 - 5 point scale: very high, high, medium, low, very low
- Example: Prioritizing customer Segments for a Laptop Computer Business

Customer Segment	Brief Description	Priority
Home users	Individual consumers; personal applications; not affiliated with businesses	Medium
Small Business	Small companies with 1-25 employees; business applications	High
Medium Business	Medium sized companies with 26-1,000 employees	Low
Large Corporations	Large corporations with over 1,000 employees	Low

Kano's Model (Customer Requirements)



NEEDS

Expected Quality (unspoken; basic)

- Not specifically requested; assumed to be present
- If present, customer is neither satisfied nor dissatisfied
- If absent, customer is very dissatisfied

WANTS

One-dimensional Quality (spoken; satisfiers)

- Specifically requested items; stated wants; directly proportional with customer satisfaction
- If present, customer is satisfied
- If absent, customer is dissatisfied

DELIGHTERS

Exciting Quality (unexpected)

- Unknown to the customer; Most difficult to define and develop
- If present, customer is very satisfied
- If absent, customer is neither satisfied or dissatisfied



Kano's Model

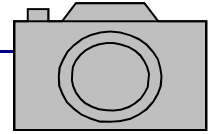
Other Types of Customer Requirements

- Indifferent
 - Customer is indifferent to whether this feature is present or not
 - Feature does not affect satisfaction level
- Reverse
 - Feature causes dissatisfaction
- Note: It is important to identify these features in order to avoid waste and high costs as well as lost customers

“If you’ve higher priorities than meeting your customers’ expectations, you’re in a whole lot more trouble than any book is going to bail you out of.”

***John Guaspari
Author, “I Know it When I See It” and “The Customer Connection”***

Example – Customer Requirements



- Needs (Expected Quality)
- Wants (One-Dimensional Quality)
- Delighters (Exciting Quality)
- Indifferent
- Reverse

Obtaining Customer Requirements

- Obtain requirements for each desired customer segment
- Realize that customers don't always know what they want, or may not verbalize what they want
- Consider interviewing customers in their own environment, when possible (“walk in their shoes”)

Several Sources for Customer Requirements

- Spec Documents
- Questionnaires (Surveys)
- Interviews
- Focus Groups
- User Tests / User Groups
- Existing Customer Data (feedback, comment cards, problem reports, etc.)
- Research (internet, professional association data)
- Team or Individual Assumptions

Questionnaires (Surveys)

- Usually easily and quickly done via
 - Internet
 - Telephone
 - Mail
 - In-person
- Can get large amount of data at fairly low cost
- Cautions:
 - Need a sufficiently large sample size
 - Sample size depends on:
 - Desired confidence level
 - Population variance
 - Desired precision
 - Perform random sampling
 - Determine confidence intervals
 - Wording of survey must be clear, concise, and unbiased

Questionnaires (Surveys)

- Basic types of questions

1. Forced Choice (binary)

Example: Did the reference manual contain all the information you needed?

___ yes ___ no

2. Multiple Choice

Example: The way I prefer to receive updates is:

- a. by mail
- b. by email
- c. by phone
- d. other: _____.

3. Rating (Likert Scale)

Example: The time it took to resolve my problem was satisfactory.

Strongly Disagree		No Opinion		Strongly Agree
1	2	3	4	5

4. Open Ended (*Example: What criteria do you use in selecting a Supplier?*)

For survey tips, see: <http://www.surveysystem.com/sdesign.htm> and <http://www.accesswave.ca/~infopoll/tips.htm>

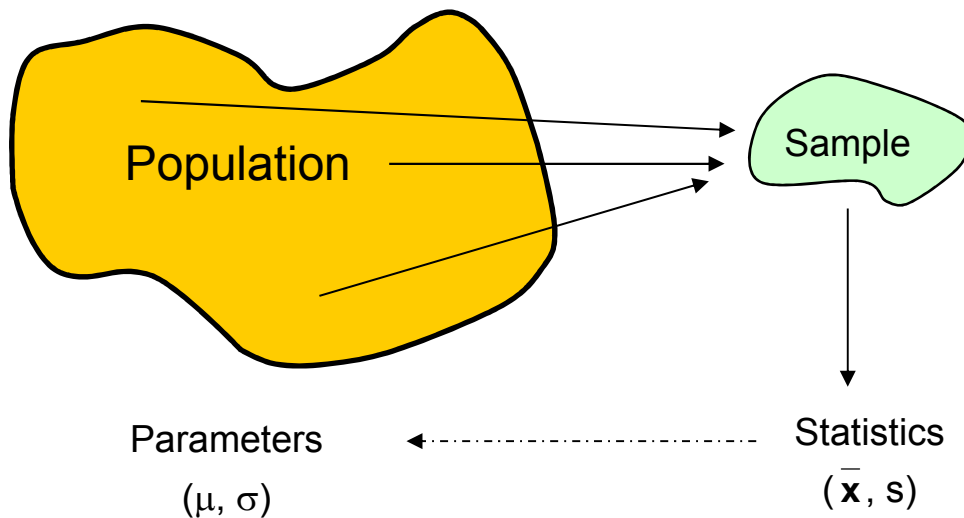
Interviews

- **Prepare for the interview**
 - Must be qualified to conduct the interview
 - Determine how many and length of time for each
 - For quantitative questions, ensure adequate sample size
 - Consider conducting interview in customer's environment
- **Conduct the interview**
 - Create a comfortable environment
 - Don't ask leading questions
 - Encourage comments and questions
 - Listen for critical pieces of information
 - Always thank the interviewee for their participation
- **Analyze the results**
 - Qualitative analysis of open-ended responses
 - Look for common themes
 - Summarize each interview and combine the results
 - Compute confidence intervals for quantitative responses

Some Comments on Sampling and Sample Size



Sampling ... “the act, process, or technique of selecting a suitable sample, or a representative part of a population for the purpose of determining parameters or characteristics of the whole population”



Review of Sampling Terminology

- **Population** – the set or collection of all possible objects or individuals of interest
 - Finite
 - fixed groups, such as items in a warehouse or current customer base
 - Infinite
 - changing, continuous flow of items through a business
 - Examples: items manufactured or shipped per day, website availability per quarter
- **Sample** - a subset of the population

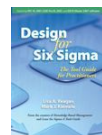
Sampling Terminology (cont.)

- Data gathered must be representative
- Poor approach
 - Convenience sample
 - Selecting convenient units from the population (just because it's easy; example: first 20 customers who arrive on a Monday morning)
- Preferred Choice
 - Random Sample
 - Sometimes called a probability sample
 - Types of random samples
 - Simple random sample
 - Every item has an equal chance of being selected (random number generator)
 - Systematic random sample
 - Selecting one unit on a random basis and then choosing additional items at evenly spaced intervals (example: every 5th record) (caution if there are cyclical trends in the data)
 - Stratified random sample
 - Simple random samples from population stratum (example: different income brackets, dollar values, geographic regions, customer segments, etc.)

Survey (Sample) Statistics

- Perform sampling (interviews, surveys, etc.) in each desired market segment
- Use confidence intervals when reporting results
 - Error bounds (margin of error) for an estimate
 - Provides an estimate of uncertainty based on sample data

**Confidence Interval =
Sample Point Estimate \pm Margin of Error**



Confidence
Intervals

Confidence Interval for a Population Mean

$$\begin{pmatrix} U \\ L \end{pmatrix} = \bar{x} \pm Z \left(\frac{s}{\sqrt{n}} \right)$$

Where

- U = upper confidence limit
- L = lower confidence limit
- \bar{x} = sample average
- Z = 2 (for 95% confidence) or
3 (for 99% confidence)
- s = sample standard deviation
- n = sample size

Confidence Interval Example (Estimating a Population Mean)

- Random sample of 100 bank customers were asked to rate their satisfaction with the bank on a scale from 0 to 10, where 10 represented perfectly satisfied
- Of the 100 respondents, the following summary information was obtained
 - Average rating = 6.4
 - Standard deviation = 2.1
- SPC XL / Analysis Tools / Confidence Interval / Mean (Normal)

Normal Confidence Interval (Mean)	
User defined parameters	
Sample Size (n)	100
Sample Avg	6.4
Sample Standard Dev	2.1
Confidence Level	90.00%
Confidence Interval	
Lower Limit	Upper Limit
6.051317857	6.748682143

90% confident that the true average rating is between 6.05 and 6.75 (or 6.4 +/- .35)

Confidence Interval for a Population Proportion

$$\begin{pmatrix} U \\ L \end{pmatrix} = p \pm Z \sqrt{\frac{pq}{n}}$$

Where

- U = upper confidence limit
- L = lower confidence limit
- p = proportion of “defectives”
(or category of interest) in the sample
- q = 1 – p (q is the proportion of “non-defectives”)
- Z = 2 (for 95% confidence) or
3 (for 99% confidence)
- n = sample size

Confidence Interval Example (Proportion)

- A random sample of 1000 bank customers were surveyed about their experiences
- One of the questions (yes/no) asked whether they were satisfied overall with the level of customer service provided
- 780 out of 1,000 customers responded “yes, they were satisfied”
 - Estimated proportion of satisfied customers = $780 / 1,000 = .78$ (or 78%)
- SPC XL / Analysis Tools / Confidence Interval / Proportion (Binomial)

Binomial Confidence Interval (Proportion)		
User defined parameters		
Sample Size (n)		1000
Number Defective(x)		780
Confidence Level		90.00%
Confidence Interval		
Lower Limit	< p <	Upper Limit
0.757353783	0.78	0.80141592

90% confident that the true percentage of satisfied customers is somewhere between 75.7% and 80.1% (roughly, 78% +/- 2%)

Exercise: Test of Proportions

- One can compare 2 proportions (fractions) to see if they are significantly (statistically) different.
- Statistical Considerations
 - Sample Size is important to be able to detect differences
 - P-value determines level of confidence.



Hypothesis Testing

Sample Size Considerations

- How much data is needed?
- Practical Considerations
 - What is your timeframe?
 - How expensive is data collection?
- Statistical Considerations
 - What is the population **variation**?
 - How much **precision** do you want in your estimate? (your desired margin of error, or width of the confidence interval)
 - What level of **confidence** do you desire?



Sample Size

Sample Size Formulas

- For estimating a mean value

$$\left(\begin{array}{c} U \\ L \end{array} \right) = \bar{x} \pm Z \left(\frac{s}{\sqrt{n}} \right) \Rightarrow n = \left[\left(\frac{Z\hat{\sigma}}{h} \right)^2 \right]$$

$\underbrace{\hspace{10em}}_{= h}$

SPC XL / Analysis Tools / Sample Size / Normal Conf Interval (mean)

- For estimating a proportion

$$\left(\begin{array}{c} U \\ L \end{array} \right) = p \pm Z \sqrt{\frac{pq}{n}} \Rightarrow n = \left[\frac{Z^2 pq}{h^2} \right]$$

$\underbrace{\hspace{10em}}_{= h}$

SPC XL / Analysis Tools / Sample Size / Binomial Conf Interval (proportion)

Example: Sample Size for Estimating a Mean

- A human resources specialist is preparing a survey to send out to a randomly selected sample of employees from her organization. The organization has over 10,000 employees from which she can select the sample
- The questions on the survey require responses on a 5 point Likert scale (i.e., 1 = strongly agree, 2 = moderately agree, etc.)
- The specialist would like to determine the sample size needed to estimate the true mean for each of the survey questions. She would like to estimate the true mean to within +/- .25 with 95% confidence (She expects the standard deviation to be around 1)

Sample Size for Estimating a Mean (cont.)

SPC XL / Analysis Tools / Sample Size / Normal Conf Interval (mean)

Sample Size to Estimate the Mean of a Normal Distribution	
User defined parameters	
Estimated Standard Dev	1
Half Interval Width	0.25
Confidence Level	95.00%
Results	
Estimated Sample Size (n)	62

n = 62

note: if past data indicate only a 75% return rate on surveys, it will be necessary for the manager to send out 83 surveys.

- Methods for estimating the standard deviation
 - Use historical data, if available
 - Use data from a similar process
 - Take a small pre-sample of data
 - Make an estimate based on the expected range
 - Use Range/ 6 (or range/ 4 to be more conservative)
 - Example: estimated std deviation = $(5-1)/4 = 4/4 = 1$

Example: Sample Size for Estimating a Prop.

- Suppose we're interested in estimating the true proportion of users who are dissatisfied with our customer support
- We believe that the proportion is around .10 (10%) or less, and we'd like to estimate the true proportion to within +/- .03 (3%) with 95% confidence

SPC XL / Analysis Tools / Sample Size / Binomial Conf. Interval (proportion)

Binomial Sample Size	
User defined parameters	
Proportion defectives (p)	0.1
Half Interval Width	0.03
Confidence Level	95.00%
Results	
Estimated Sample Size (n)	385

From historical data, or a small pre-sample, or an estimate (if unknown, $p=.5$ can be used to produce a conservative (worst case) estimate of sample size)

n = 385

Sample Size Exercise

You wish to collect data from a survey that has two types of questions. For each of the question types below, you wish to achieve the given error with 95% confidence. What sample size is required?

- a. Several questions will be scaled from 1 to 10. You expect a standard deviation of about 1.5 on this scale and you want an error of no more than ± 0.5 .

- b. The remaining questions will be true/false. You wish to estimate the true proportion responding “true” with an error of no more than 5%.

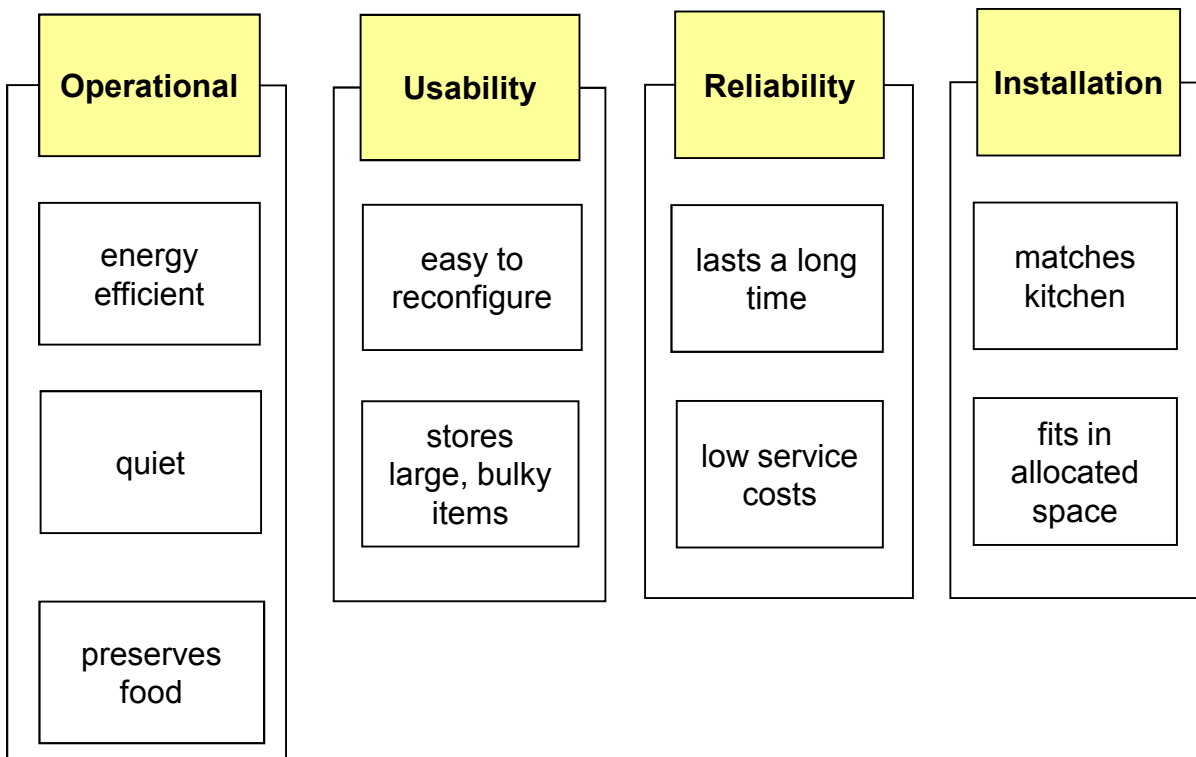
Example: Refrigerator

- Suppose we are designing (or re-designing) a refrigerator
- A partial listing of customer requirements, gathered from interviews and surveys are as follows:
 - “Should last a long time”
 - “Needs to preserve food”
 - “Want it to be quiet”
 - “Would like it to match my kitchen”
 - “Needs to fit”
 - “Want to be able to easily reconfigure the shelves”
 - “Want to fit large, bulky items”
 - “Want it to be energy efficient”
 - “Want it to be inexpensive to service”



Affinity Diagram

- With long lists of requirements, using an affinity diagram can be very helpful
- Group requirements into logical groups



Steps for Creating an Affinity Diagram



- Gather and write all qualitative customer requirements on sticky notes.
 - Don't use long descriptions like "When I go to the grocery store and buy large gallons of apple cider or stacked pizza crusts, I'd like to be able to find a place to store them in the refrigerator." Instead: "Stores large, bulky items"
- Put all the notes on a wall or desk.
- Sort the notes into logical, related groups
- As a group, agree on a short title for the group.
- Create the affinity diagram.

Creating the First House of Quality

- **Step 1:** Place the Customer Requirements in the first column of the matrix

Customer Requirements
↓

A: energy efficient										
B: quiet										
C: preserves food										
D: easy to reconfigure										
E: handles large, bulky items										
F: lasts a long time										
G: matches kitchen										

Creating the First House of Quality (cont.)

- Step 2:** Assign a rating for each requirement (typically on a scale from 1-5), where 5 (higher numbers) reflects requirements that are more critical (important) to the customer

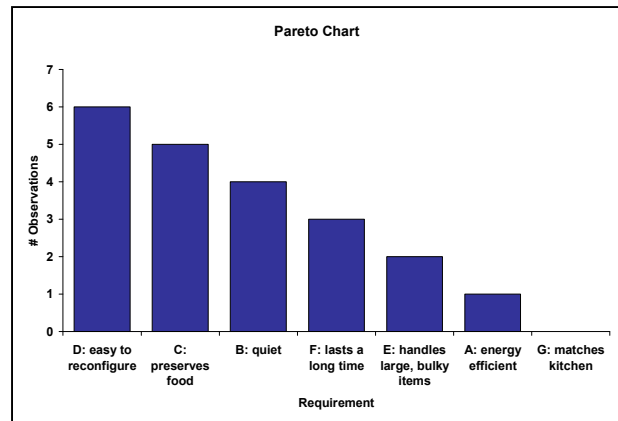
		Rating									
		1	2	3	4	5	6	7	8	9	10
A: energy efficient	2										
B: quiet	4										
C: preserves food	5										
D: easy to reconfigure	5										
E: handles large, bulky items	3										
F: lasts a long time	4										
G: matches kitchen	1										

Methods for Rating Customer Requirements

- Method 1 – Pairwise Comparison

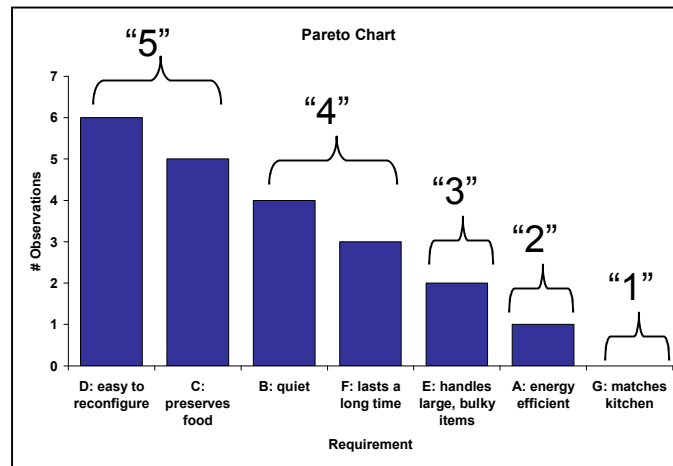
- Compare each requirement against all other requirements
- For each pairwise comparison, customers determine the “winner” (i.e., which requirement takes priority), indicated by the letter placed in the cell
- The total number of occurrences of each requirement in the matrix is tallied and the results are displayed in a Pareto (bar) chart

Customer Requirements		<div style="display: flex; justify-content: space-around; text-align: center;"> <div style="transform: rotate(-45deg);">A: energy efficient</div> <div style="transform: rotate(-45deg);">B: quiet</div> <div style="transform: rotate(-45deg);">C: preserves food</div> <div style="transform: rotate(-45deg);">D: easy to reconfigure</div> <div style="transform: rotate(-45deg);">E: handles large, bulky items</div> <div style="transform: rotate(-45deg);">F: lasts a long time</div> <div style="transform: rotate(-45deg);">G: matches kitchen</div> </div>						
		A	B	C	D	E	F	G
A	A: energy efficient	X	X	X	X	X	X	X
B	B: quiet	B	X	X	X	X	X	X
C	C: preserves food	C	C	X	X	X	X	X
D	D: easy to reconfigure	D	D	D	X	X	X	X
E	E: handles large, bulky items	E	B	C	D	X	X	X
F	F: lasts a long time	F	B	C	D	F	X	X
G	G: matches kitchen	A	B	C	D	E	F	X



Methods for Rating Requirements (cont.)

- Method 1: Pairwise Comparison (cont.)



- Requirements are assigned a rating of 1 to 5, based on the Pareto results and conversations with the customer:
 - 5: Must haves (most critical)
 - 4: Highly desirable
 - 3: Desirable; Important
 - 2: Useable; somewhat important
 - 1: Nice-to-have, but not critical



Pairwise
Comparison

Methods for Rating Requirements (cont.)

- Method 2: Multi-Voting

	Jason	Larry	Kurt	Linda	Sam	Joan	Chris		
Customer Requirements								Total	Ranking
A: energy efficient				X				1	6
B: quiet			X		X	X	X	4	3
C: preserves food	X	X	X	X		X		5	2
D: easy to reconfigure	X	X	X	X	X		X	6	1
E: handles large, bulky items	X						X	2	5
F: lasts a long time		X			X	X		3	4
G: matches kitchen								0	7

- Each person votes for the top ____ requirements (3, in this example)
- Votes are summed for each requirement and ranked by their total
- Requirements receiving the most votes are deemed most critical
- The total number of votes for each requirement in the matrix may be displayed in a Pareto (bar) chart



Multi
Voting

Methods for Rating Requirements (cont.)

- Method 3: Nominal Group Technique

	Jason	Larry	Kurt	Linda	Sam	Joan	Chris		
Customer Requirements								Total	Ranking
A: energy efficient	4	5	4	3	6	7	6	35	6
B: quiet	5	4	1	7	2	2	2	23	3
C: preserves food	2	2	3	2	4	1	5	19	2
D: easy to reconfigure	1	3	2	1	1	5	1	14	1
E: handles large, bulky items	3	6	5	4	5	4	3	30	5
F: lasts a long time	6	1	6	5	3	3	4	28	4
G: matches kitchen	7	7	7	6	7	6	7	47	7

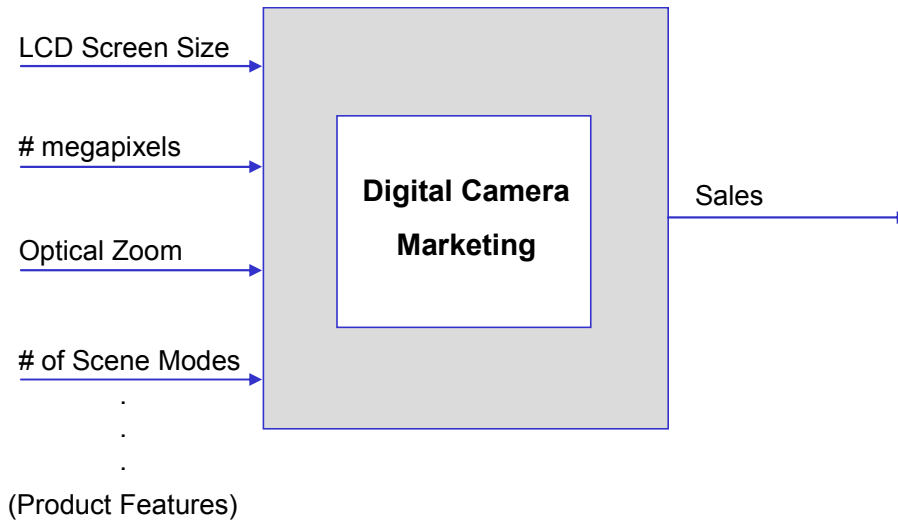
- Each person in the group rank orders the set of requirements
- Rank orderings are summed for each requirement and ranked by their total
- Note: If a “1” represents the first choice, then the lowest overall total is the most important requirement



Nominal
Group Tech.

Methods for Rating Requirements (cont.)

- Method 4 – DOE with User Groups



Factors and Settings for DOE

Product Feature	Low	High
LCD Screen Size	2.5 in.	3.1 in.
# megapixels	6	10
Optical Zoom	2X	3X
# of Scene Modes	11	22
Video Capture	No	Yes
Weight	4 oz.	5.5 oz.
red eye reduction	No	Yes
Storage format	SD	xD
Body Color	Silver	Choice of 5
Camera Case	No	Yes
Editing Software	No	Yes



DOE

Taguchi L12 Screening Design Matrix

- Digital Camera features (requirements) used as “factors” in a screening design
- Customers (users) represent “replicates”
- Response (Y) is the rank order, where each person rank orders the 12 camera choices from 1 to 12. “1” represents their most preferred choice, while “12” represents their least preferred choice

Factor	A	B	C	D	E	F	G	H	I	J	K
Row #	LCD Screen Size	Megapixels	Optical Zoom	Num Scene Modes	Video Capture	Weight	Red Eye Reduction	Storage Format	Body Color	Camera Case	Editing Software
1	2.5	6	2	11	1	4	1	1	1	1	1
2	2.5	6	2	11	1	5.5	2	2	2	2	2
3	2.5	6	3	22	2	4	1	1	2	2	2
4	2.5	10	2	22	2	4	2	2	1	1	2
5	2.5	10	3	11	2	5.5	1	2	1	2	1
6	2.5	10	3	22	1	5.5	2	1	2	1	1
7	3.1	6	3	22	1	4	2	2	1	2	1
8	3.1	6	3	11	2	5.5	2	1	1	1	2
9	3.1	6	2	22	2	5.5	1	2	2	1	1
10	3.1	10	3	11	1	4	1	2	2	1	2
11	3.1	10	2	22	1	5.5	1	1	1	2	2
12	3.1	10	2	11	2	4	2	1	2	2	1

Taguchi L12 Digital Camera “Combinations”

Camera/Run 1		Camera/Run 2		Camera/Run 3		Camera/Run 4	
LCD Size	2.5 in.	LCD Size	2.5 in.	LCD Size	2.5 in.	LCD Size	2.5 in.
# Megapixels	6	# Megapixels	6	# Megapixels	6	# Megapixels	10
Optical Zoom	2X	Optical Zoom	2X	Optical Zoom	3X	Optical Zoom	2X
# Scene Modes	11	# Scene Modes	11	# Scene Modes	22	# Scene Modes	22
Video Capture	no	Video Capture	no	Video Capture	yes	Video Capture	yes
Weight	4 oz.	Weight	5.5 oz.	Weight	4 oz.	Weight	4 oz.
Red eye reduction	no	Red eye reduction	yes	Red eye reduction	no	Red eye reduction	yes
Storage Format	SD	Storage Format	xD	Storage Format	SD	Storage Format	xD
Body Color	silver	Body Color	choice/5	Body Color	choice/5	Body Color	silver
Camera Case	no	Camera Case	yes	Camera Case	yes	Camera Case	no
Editing Software	no	Editing Software	yes	Editing Software	yes	Editing Software	yes

Camera/Run 5		Camera/Run 6		Camera/Run 7		Camera/Run 8	
LCD Size	2.5 in.	LCD Size	2.5 in.	LCD Size	3.1 in.	LCD Size	3.1 in.
# Megapixels	10	# Megapixels	10	# Megapixels	6	# Megapixels	6
Optical Zoom	3X	Optical Zoom	3X	Optical Zoom	3X	Optical Zoom	3X
# Scene Modes	11	# Scene Modes	22	# Scene Modes	22	# Scene Modes	11
Video Capture	yes	Video Capture	no	Video Capture	no	Video Capture	yes
Weight	5.5 oz.	Weight	5.5 oz.	Weight	4 oz.	Weight	5.5 oz.
Red eye reduction	no	Red eye reduction	yes	Red eye reduction	yes	Red eye reduction	yes
Storage Format	xD	Storage Format	SD	Storage Format	xD	Storage Format	SD
Body Color	silver	Body Color	choice/5	Body Color	silver	Body Color	silver
Camera Case	yes	Camera Case	no	Camera Case	yes	Camera Case	no
Editing Software	no	Editing Software	no	Editing Software	no	Editing Software	yes

Camera/Run 9		Camera/Run 10		Camera/Run 11		Camera/Run 12	
LCD Size	3.1 in.	LCD Size	3.1 in.	LCD Size	3.1 in.	LCD Size	3.1 in.
# Megapixels	6	# Megapixels	10	# Megapixels	10	# Megapixels	10
Optical Zoom	2X	Optical Zoom	3X	Optical Zoom	2X	Optical Zoom	2X
# Scene Modes	22	# Scene Modes	11	# Scene Modes	22	# Scene Modes	11
Video Capture	yes	Video Capture	no	Video Capture	no	Video Capture	yes
Weight	5.5 oz.	Weight	4 oz.	Weight	5.5 oz.	Weight	4 oz.
Red eye reduction	no	Red eye reduction	no	Red eye reduction	no	Red eye reduction	yes
Storage Format	xD	Storage Format	xD	Storage Format	SD	Storage Format	SD
Body Color	choice/5	Body Color	choice/5	Body Color	silver	Body Color	choice/5
Camera Case	no	Camera Case	no	Camera Case	yes	Camera Case	yes
Editing Software	no	Editing Software	yes	Editing Software	yes	Editing Software	no

Exercise



- Use DOE Pro software and the data set provided, with rank orders from a previous class, to determine the importance of the requirements (features)
- Which requirements (features) are statistically significant? (multiple regression)
- Review the marginal means plots and Pareto of regression coefficients. How would you assign importance ratings?

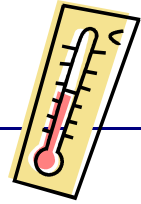
Creating the First House of Quality (cont.)

- **Step 3:** Identify one (or more) CTCs for each customer requirement and place along the top row

CTCs →

A: energy efficient	2										
B: quiet	4										
C: preserves food	5										
D: easy to reconfigure	5										
E: handles large, bulky items	3										
F: lasts a long time	4										
G: matches kitchen	1										

Identifying CTCs



- CTCs (Critical-to-Customer) are measurable characteristics that directly relate to the customer requirements ... they tell us how we're doing in meeting a customer requirement
- If it is not measurable, it is not a CTC
- CTCs should have units and an operational definition
- This step takes time, and we may have to invent new methods or ways to measure a requirement. This is done via brainstorming, clarifying requirements with the customer, etc.

Identifying CTCs for the Refrigerator Example

CTCs →

		energy efficiency rating	noise level (db)	temperature range	cooling speed	% adjustable shelves	disassy / reassy time (sec)	shelf depth and width (in.)	door tray depth (in.)	mean time to failure	# available colors
A: energy efficient	2										
B: quiet	4										
C: preserves food	5										
D: easy to reconfigure	5										
E: handles large, bulky items	3										
F: lasts a long time	4										
G: matches kitchen	1										

Creating the First House of Quality

- **Step 4:** Rate the strength of the relationship between each customer requirement and the CTCs

9 = strong relationship
3 = medium relationship
1 = weak relationship
Blank = no relationship


		energy efficiency rating	noise level (db)	temperature range	cooling speed	% adjustable shelves	disassy / reassy time (sec)	shelf depth and width (in.)	door tray depth (in.)	mean time to failure	# available colors
A: energy efficient	2	9	1	3	9			1	1	1	
B: quiet	4	3	9	1	3						
C: preserves food	5	3		9	9			1	1	1	
D: easy to reconfigure	5					3	9				
E: handles large, bulky items	3					9	1	9	9		
F: lasts a long time	4	1			1					9	
G: matches kitchen	1										9

Completing the First House of Quality

- **Step 5:** Calculate a weighted sum for each column (CTC)

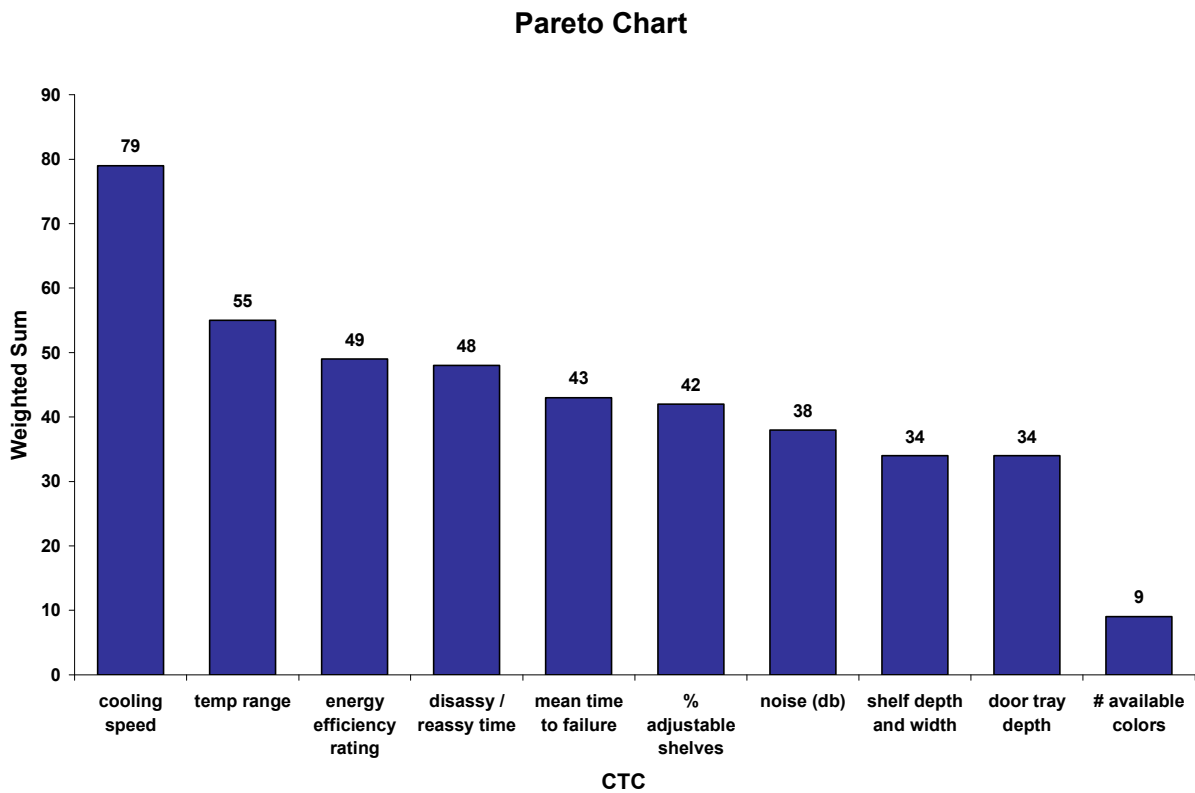
Cross-multiply the requirement rating by the relationship rating

Example: Energy Efficiency
 weighted sum = (2x9) + (4x3) + (5x3) + (4x1) = 49

		energy efficiency rating	noise level (db)	temperature range	cooling speed	% adjustable shelves	disassy / reassy time (sec)	shelf depth and width (in.)	door tray depth (in.)	mean time to failure	# available colors
A: energy efficient	2	9	1	3	9			1	1	1	
B: quiet	4	3	9	1	3						
C: preserves food	5	3		9	9			1	1	1	
D: easy to reconfigure	5					3	9				
E: handles large, bulky items	3					9	1	9	9		
F: lasts a long time	4	1			1					9	
G: matches kitchen	1										9
		49	38	55	79	42	48	34	34	43	9

Pareto Chart of the CTCs (Weighted Sums)

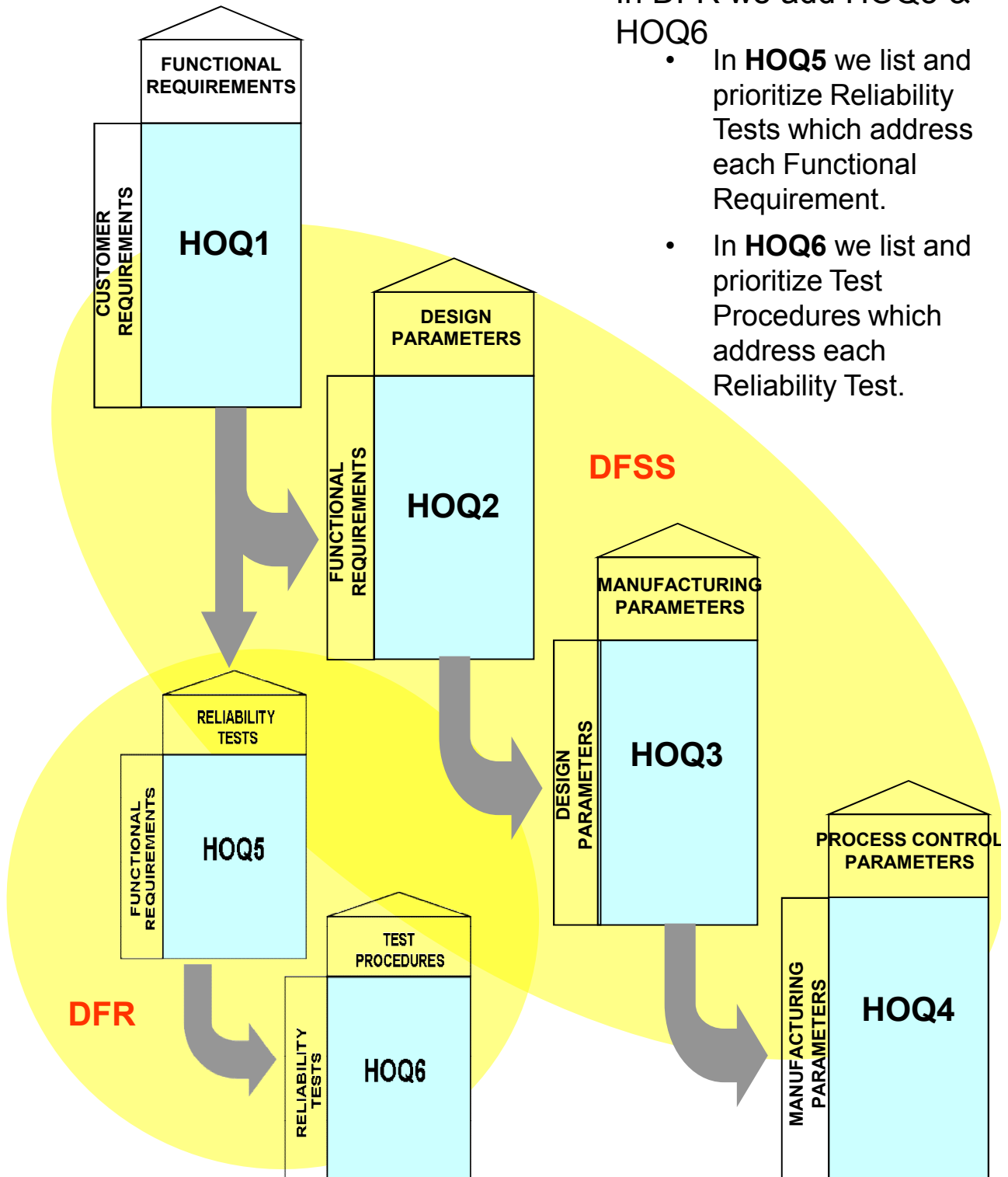
SPC XL / Analysis Diagrams / Pareto Chart



Where do these CTCs go?

Systems Engineering and the Houses of Quality

- In DFSS we use HOQ1-4
- In DFR we add HOQ5 & HOQ6
 - In **HOQ5** we list and prioritize Reliability Tests which address each Functional Requirement.
 - In **HOQ6** we list and prioritize Test Procedures which address each Reliability Test.



Exercise on First House of Quality

- In small groups
- Select a work or project-related product or service
- Identify one member of the team to play the role of “customer” and have them identify 5 customer requirements:
 1. _____
 2. _____
 3. _____
 4. _____
 5. _____
- Use the pairwise comparison matrix on the next page and have the “customer” complete each comparison to prioritize the requirements (optionally, all team members may play the role of “customer” and complete the pairwise comparison matrix as a group, or use the multi-voting or nominal group technique)
- Complete the first House and quality and determine prioritized CTCs

Pairwise Comparison of Requirements

	A:	B:	C:	D:	E:
A:	X	X	X	X	X
B:		X	X	X	X
C:			X	X	X
D:				X	X
E:					X

Pareto of Requirements:



Completed First House of Quality

		<p>CTCs →</p>									
		<p>Rating ↓</p>									
A:											
B:											
C:											
D:											
E:											
Weighted Sums →											

Pareto of CTCs



Key Takeaways

- What does Kano's Model tell us?
- Why do we segment customers?
- What are some methods for obtaining customer requirements?
- What are some prioritization techniques?
- What are some considerations for determining sample size?
- Why do we use confidence intervals?
- What is the outcome of HOQ#1?
- Other notes:

Contact Information

For more information, please contact

Air Academy Associates

1650 Telstar Drive, Suite 110
Colorado Springs, CO 80920

Office: 719-531-0777

Fax: 719-531-0778

aaa@airacad.com

www.airacad.com

