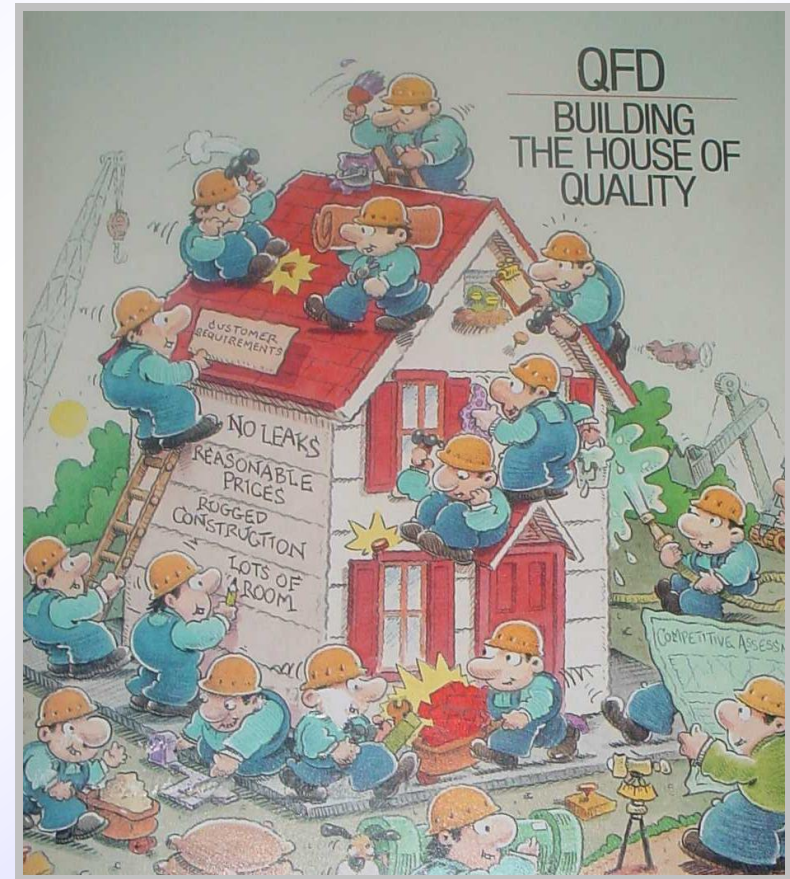


House of Quality and Solution Selection Matrices

Customer
Driven
Product
Development

Illustrated by
Examples



- Voice of Customer
- **House of Quality**

Identify
CCRs

Identify
Conceptual
Design

Build
Prototype

- Proof-of-Concept
- Bread Board Circuit
- Discrete Components
- Wire Wrap Board
- **End of Week 8**
- **Demo #1**

Analyze
Prototype
Perform.

- Collect data
- Statistically Analyze Data
- Design Meet CCRs?

Optimize
Design

- Surface Mount Chips
- Optimized Power
- PC Boards
- Manufacturability
- Robustness

Test &
Validate
Design

- Collect Data
- Statistically Analyze Data
- Run Charts

Package
Design

Document
Design

- Final Report
- Sponsor Docs.
- **Design Day**

- Survive Use Environment
- Heat Management
- Shock & Vibration
- **Week 15 – Demo #2**

DFSS Process Flow

Define
the
Project

- Charter

House of Quality & Solution Selection Matrix Discussion Objectives



- ◆ Understand purpose of each “Room” in the Matrix
- ◆ Illustrate 7-step approach to HOQ, via example
- ◆ Identify **C**ritical **C**ustomer **R**equirements (CCRs)
- ◆ Establish System Level Engineering Specifications
- ◆ Explain Solution Selection Matrix (Design Proposal)

House of Quality and Solution Selection Matrices Are . . .



- ◆ Tools to assist in data based decision making
- ◆ System to translate Customer Needs into System Level Engineering Specifications
- ◆ Tools to reduce design uncertainty
- ◆ Applied to Product, Service, Process, IT, or Software Designs

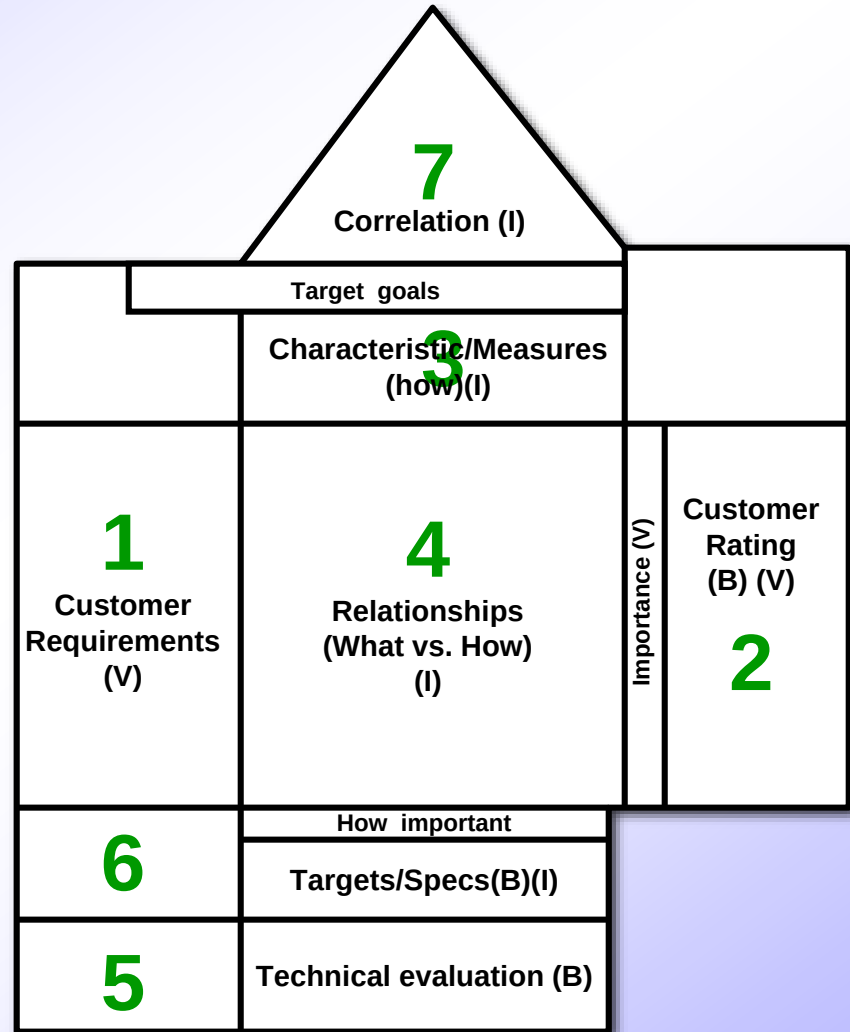
What is a House of Quality?

Graphical
representation of the
logic flow . . .

Customer Needs



Engineering Design
Specifications



(V) = Comes from VOC information

(B) = Comes from Benchmarking information

(I) = Comes from Internal Expertise

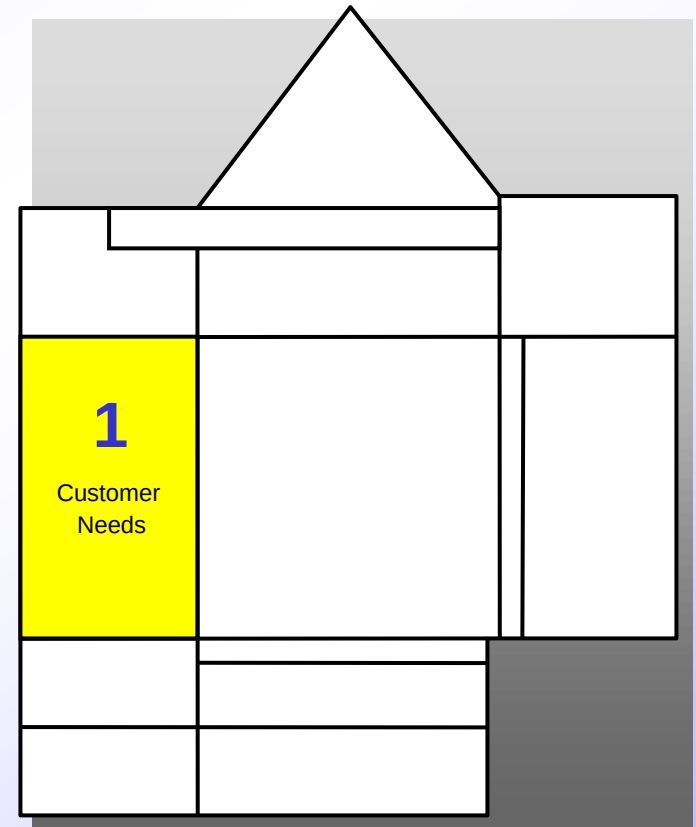
Customer Needs (Room 1)

Objective:

**Orderly summation of
Customer's Needs . . .**

from Voice of Customer . . .

**Collected early in DFSS
utilizing Voice of Customer
techniques**



Example: Bank Loan Customer Needs

Primary	Secondary
Friendly staff	Willing to answer questions
	Treat me nicely
Knowledgeable staff	Knows loan procedure
	Knows market
	Understands my situation
Speed	Money when I need it
	Application quickly filled out
Accurate	Don't make mistakes
	Give me the right rate

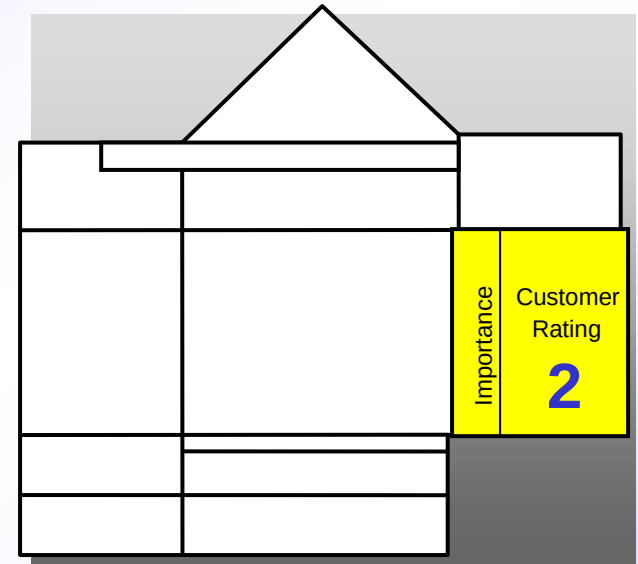


Tip: List of needs should be less than 20

Customer Rating (Room 2)

Objectives:

- **Document Importance of Customer Needs**
 - **1-5 Rating**
 - **Frequency of Response does not indicate Importance**
- **Plot Customer Perception (opinion) of our performance and that of Competition**
 - **Direct Competitors**
 - **“Best In Class” Competitors**



Information comes from Quantitative Voice of Customer

Example: Customer Rating

Primary Want	Secondary Want	Import	1	2	3	4	5
Friendly Staff	Willing to answer questions	5					
	Treat me nicely	3					
Knowledgeable Staff	Knows loan process	5					
	Knows market	4					
	Understands my situation	3					
Speed	Money when I need it	4					
	Application fast to fill out	2					
Accuracy	Don't make mistakes	4					
	Give me the right rate	3					

Key:

My Bank

The Bank

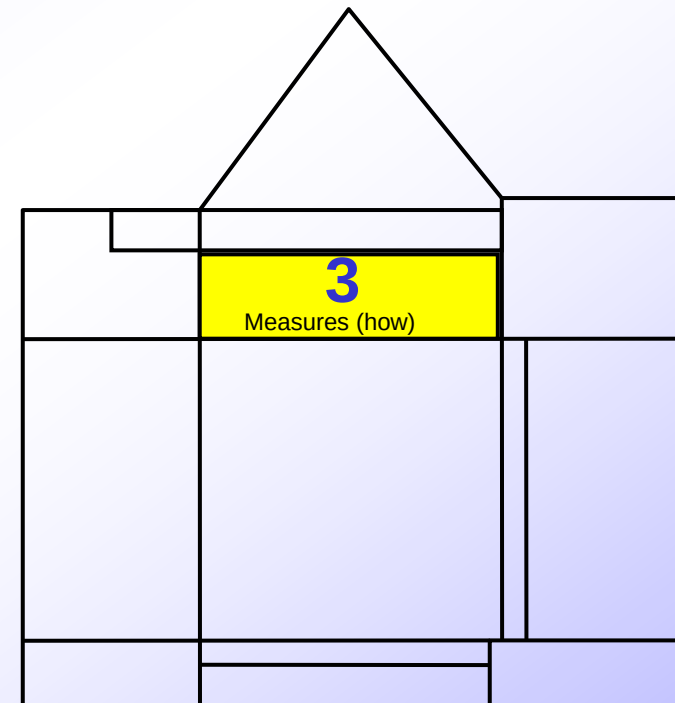
Bank One

Competition Comparison

Design Measures (Room 3)

Objectives:

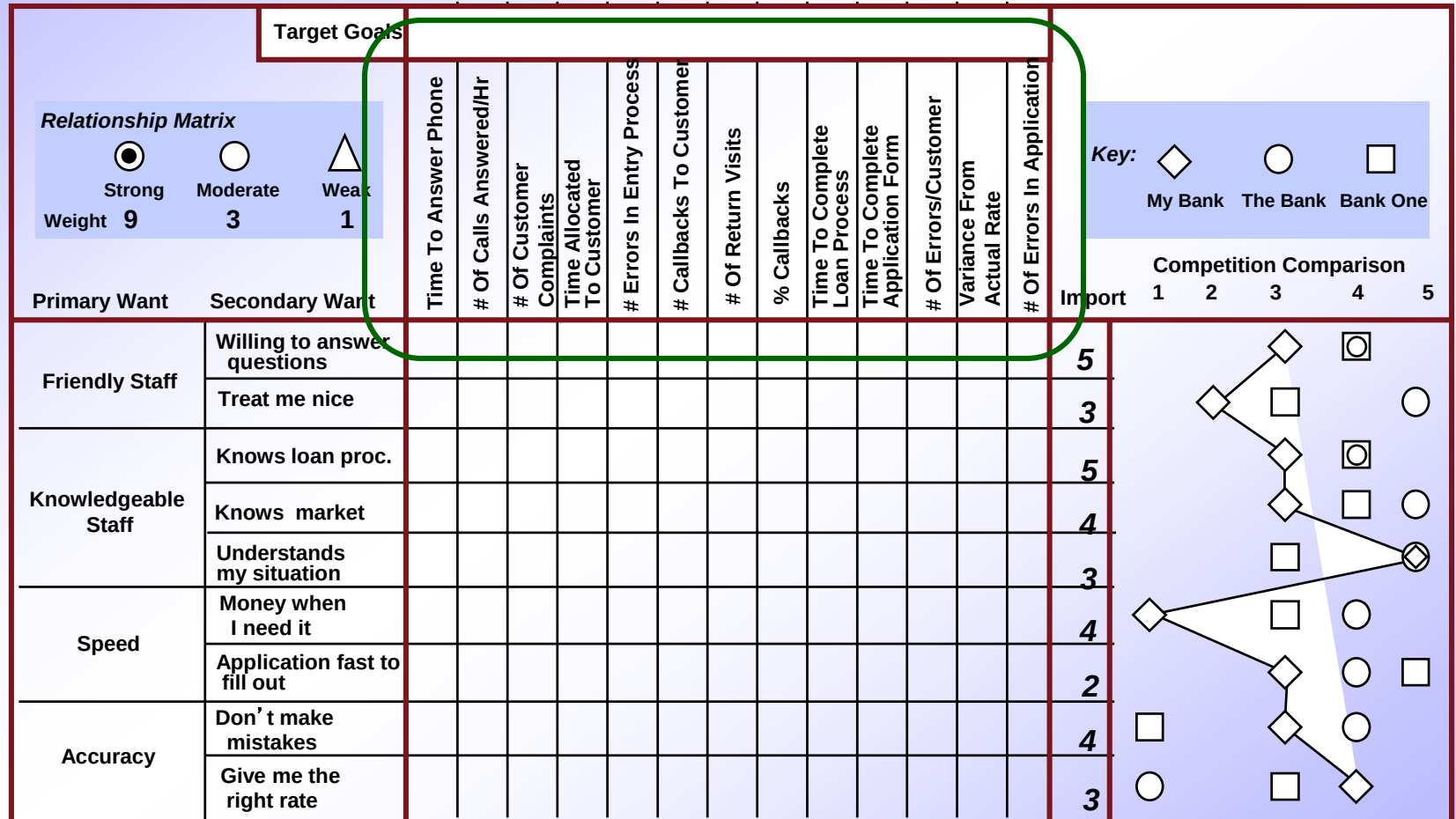
Translate from “Customer Speak”
to “Engineering Design Speak”



- Objective Measures that can be conducted during product development
- Ensure Customer Satisfaction



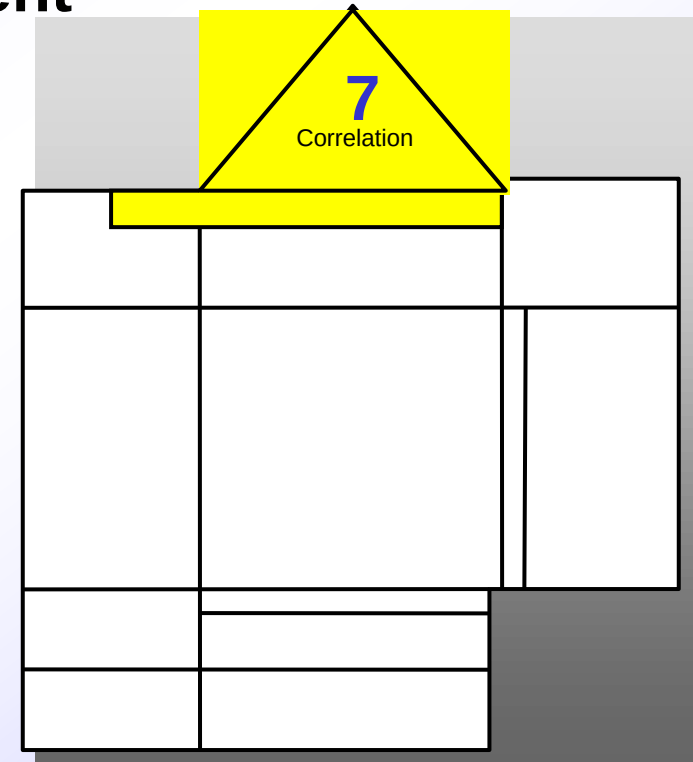
Example: Measures (Room 3)



Measures Correlation (Room 7)

Objectives:

- ◆ Establish direction of improvement for each Design Measure
 - Maximize ↑
 - Minimize ↓
 - Target a Specification ○
- ◆ Determine which Measures are related, and extent of Relationship
- ◆ Identify Design Conflicts that lead to compromise or Trade-off



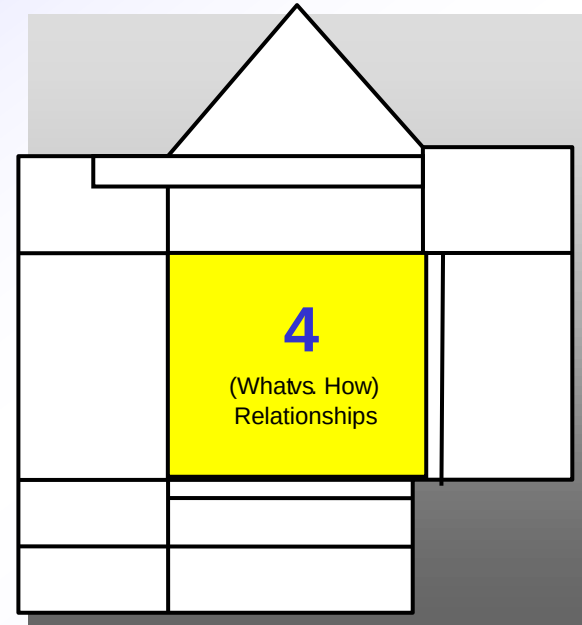
Relationships (Room 4)

Objective:

**Establish relationships between
Design Measures & Customer Needs**

Process:

- Use 9 (strong), 3 (moderate) and 1 (weak) . . . rate Relationship between each Measure and Customer Need
- Use Relationship Matrix symbols: ● ○ △
- Calculate score for each cell by multiplying Importance Rating (Room 2) by Relationship Rating
- Add up individual scores for each Measure to determine the “How Important” value



Example: Relationships (Room 4)

Facilitation Question: As I Maximize, Minimize, or Target
 (Measure) _____, what direct positive impact does it have on satisfying
 (Customer Need) _____?

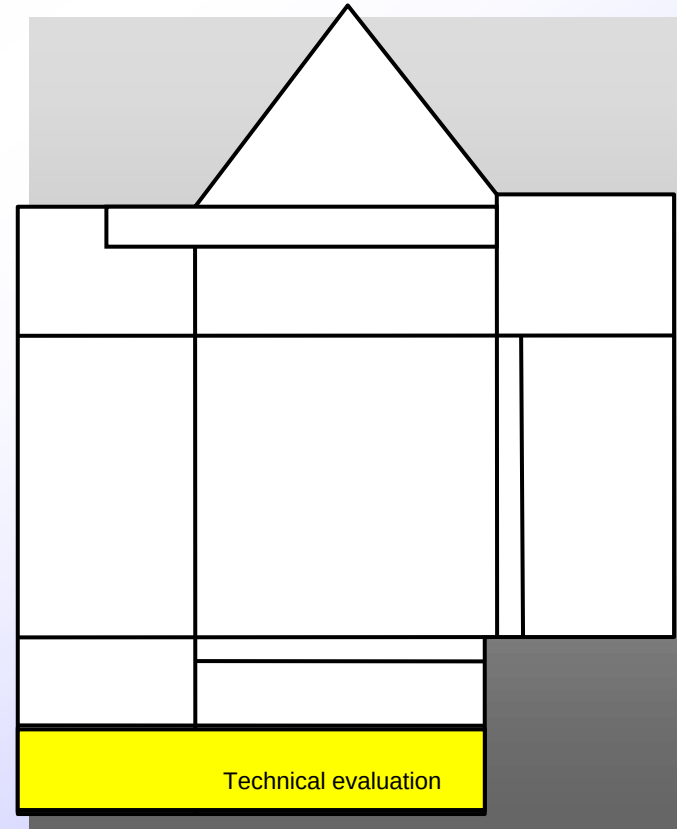
Relationship Matrix														Key:						Competition Comparison					

Technical Evaluation (Room 5)

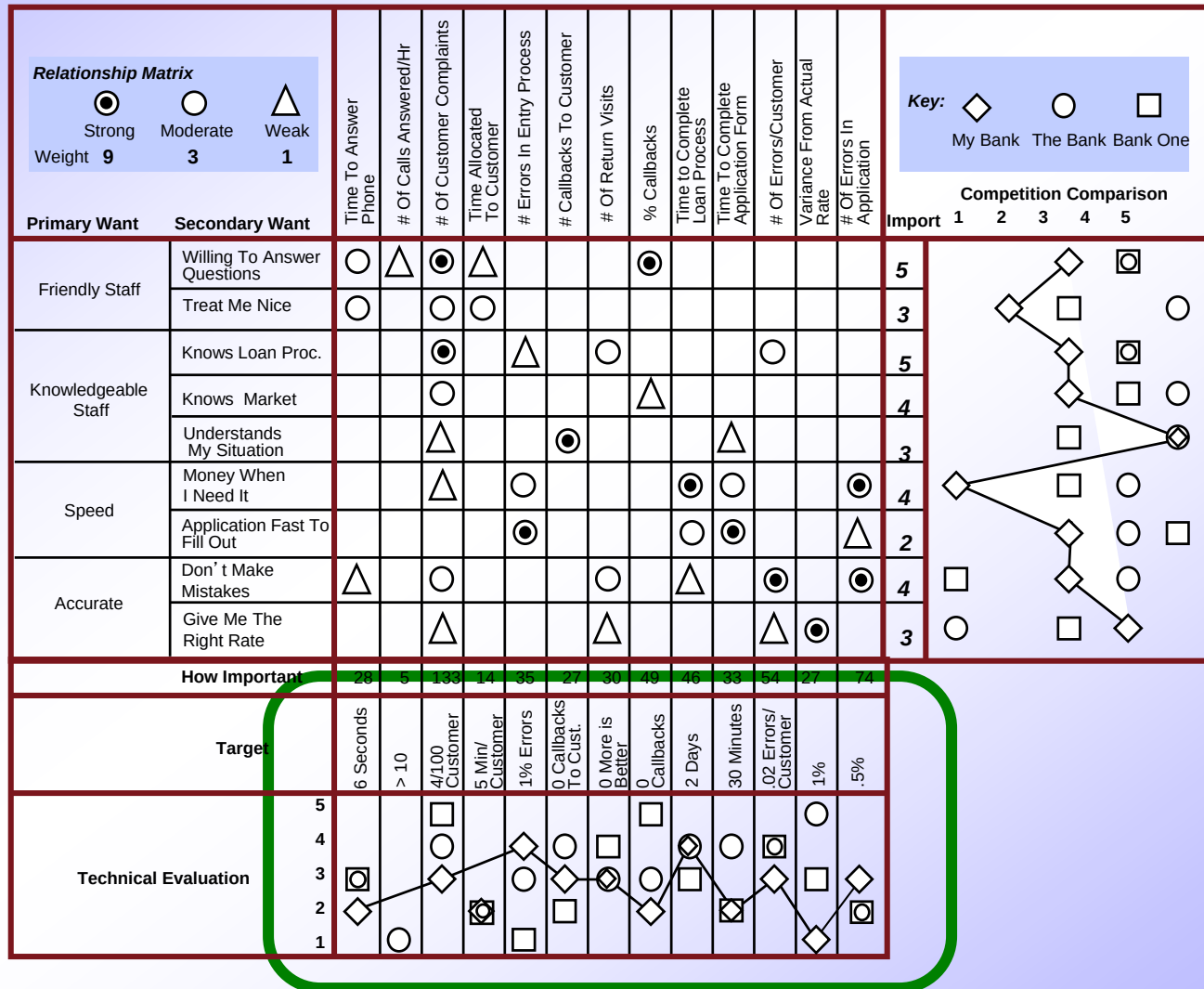
Objective:

Factual picture of how we technically compare to competition:

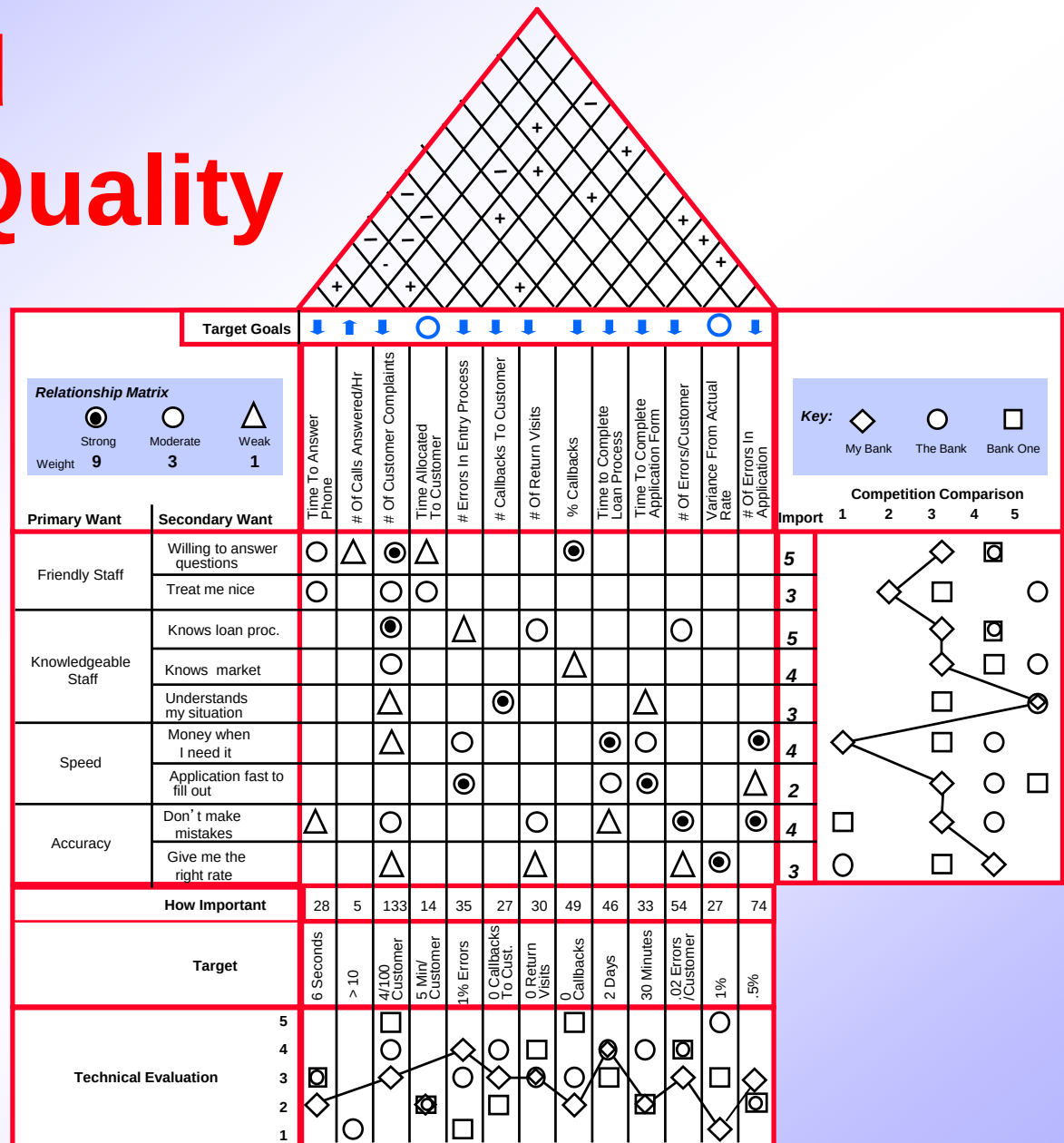
- **Best in class Technology**
- **Innovative technology**



Example: Technical Evaluation (Room 5)

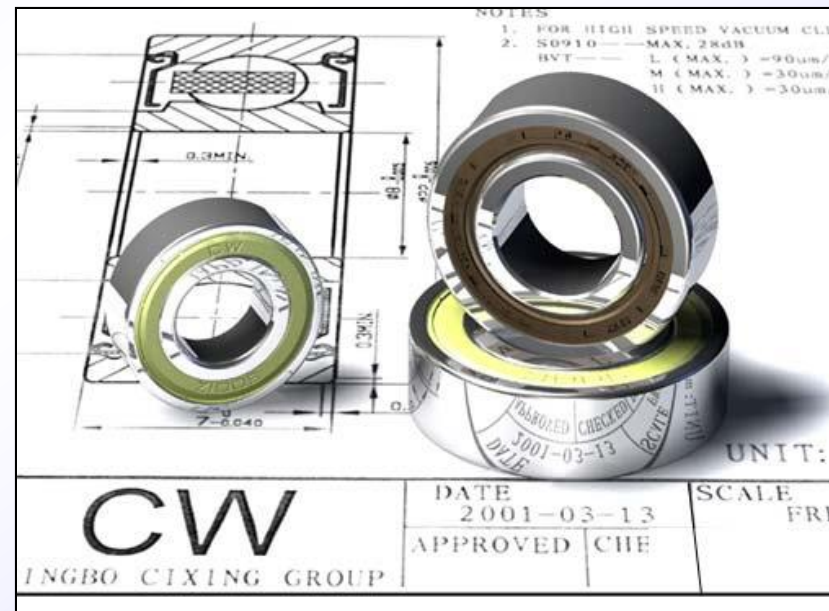


Completed House of Quality Example



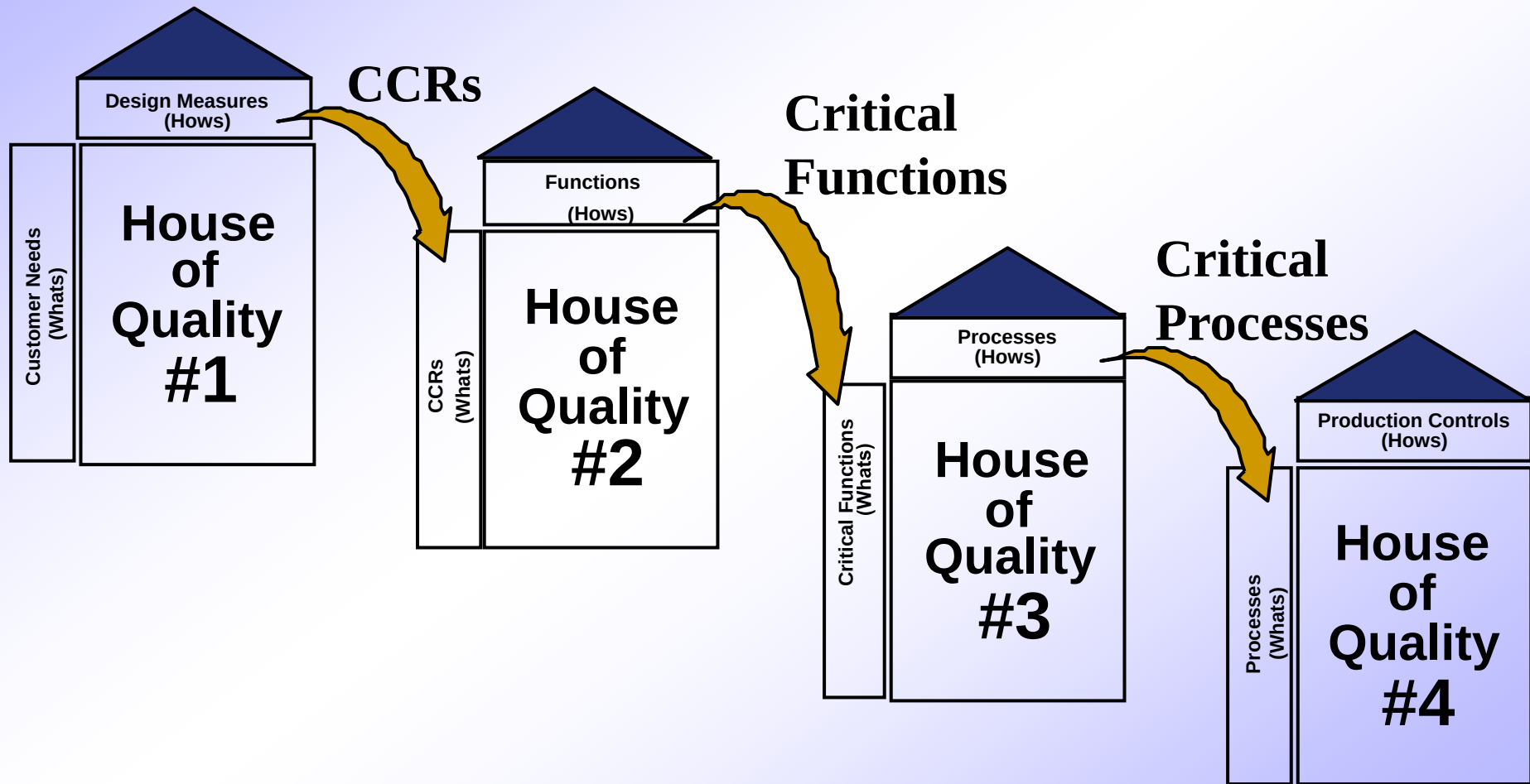
Establish Design Specifications

- ◆ Establish Targets, Upper Specification Limit (USL), and Lower Specification Limit (LSL) for each Measure in the HOQ
- ◆ Set Target Values to:
 - Ensure Customer Satisfaction
 - Gain Competitive advantage



Be sure to document System Level Specifications in bottom row of HOQ!

Developing Further Houses



Solution Selection Matrix Template

Engineering Criteria	Impt.	Possible Solutions					
		S ₁	S ₂	S ₃	S ₄		
Criteria ₁							
Criteria ₂							
Criteria ₃							
Criteria ₄							
Totals							

Restaurant Example: Solution Selection Matrix

Engineering Criteria	Imp t	Possible Solutions			
Ease of Remodeling	5				
Ease of Operation	3				
Staff Training	2				
Additional Capital	3				
Table Turnover Time	5				
Space Requirement	1				
Power Requirement	2				
Totals					

List 6 – 12 Engineering Criteria and Importance Rating

Criteria utilized to select solution
Examples:

- User friendly
- Maturity of technology
- Power requirements
- Space
- Weight
- Speed of response
- Hardware Platform – μ -processor, PC
- Software – C, Assembly Language

Importance Rating 1- 5

Restaurant Example: Solution Selection Matrix

Engineering Criteria	Imp t	Possible Solutions					
		Sport Bar	Western Theme	Evening Get Away	Burgers R Us	“Date Night”	Family Friendly
Ease of Remodeling	5						
Ease of Operation	3						
Staff Training	2						
Additional							
Table T Ti							
Space Re							
Power Re							
To							

List 8 – 10 Possible Solutions to your design challenge

- Features of finished design that cut across many full designs

Or . . .

- Specific full designs

Restaurant Example: Solution Selection Matrix

Engineering Criteria	Imp t	Possible Solutions					
		Sport Bar	Western Theme	Evening Get Away	Burgers R Us	“Date Night”	Family Friendly
Ease of Remodeling	5	9	3	1	3	1	1
Ease of Operation	3	9	9	3	9	1	1
Staff Training	2	9	3	1	9	3	3
Additional Capital	3	1	1	3	1	3	3
Table Turnover Time	5	9	3				
Space Requirement	1	9	3				
Power Requirement	2	1	1				
Totals		149	71	39	119	47	45



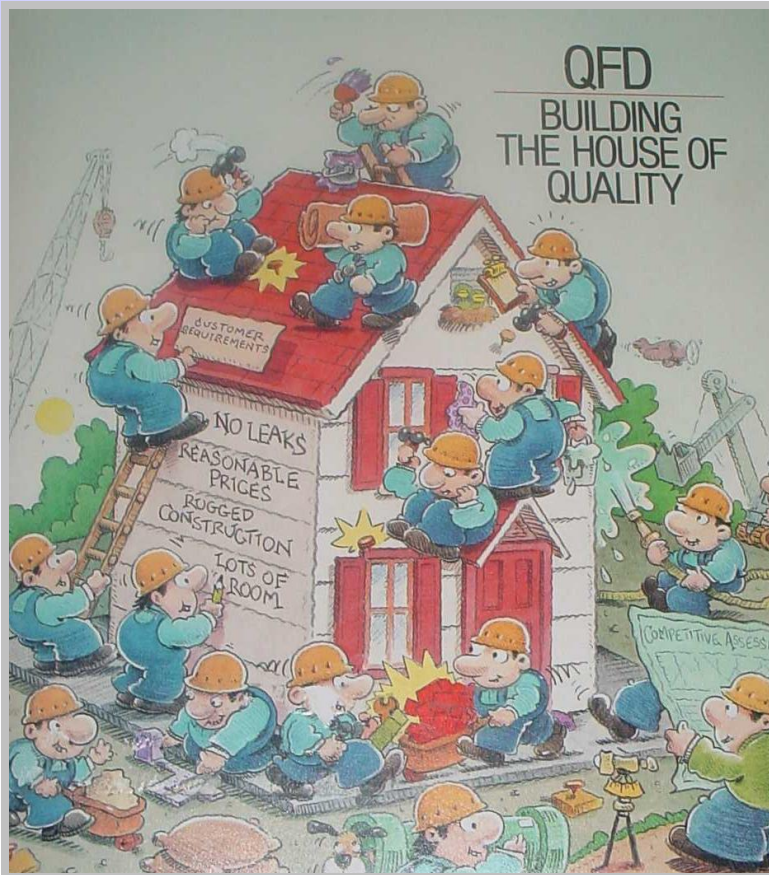
S_2 Total Calculation =
 $(S_2)(ImpC_1) + (S_2)(ImpC_2) + \dots$
 $+(S_2)(ImpC_N)$

House of Quality & Selection Matrix Discussion Summary

- ◆ Defined the purpose of each “Room” in the House of Quality (HOQ)
 - ◆ Illustrated, via an example
- ◆ Provided algorithm to determine Critical Customer Requirements (CCRs)
- ◆ Illustrated establishment of System Level Engineering Design Specifications
- ◆ Defined Solution Selection Matrix
- ◆ Provided Examples



Questions?



Solution Selection Matrix

Engineering Criteria	Impt.	
Criteria ₁		
Criteria ₂		
Criteria ₃		
Criteria ₄		
Totals		

List 6 – 12 Engineering Criteria and Importance Rating

Criteria utilized to select solution
Examples:

- User friendly
- Maturity of technology
- Power requirements
- Space
- Weight
- Speed of response
- Hardware Platform – μ -processor, PC
- Software – C, Assembly Language

Importance Rating 1- 5

Solution Selection Matrix

Engineering Criteria	Impt.	Possible Solutions					
		S ₁	S ₂	S ₃	S ₄		
Criteria ₁							
Criteria ₂							
Criteria ₃							
Criteria ₄							
Total							

List **8 - 10 possible solutions** to your design challenge

- Features of finished design that cut across many full designs

or . . .

- Specific full designs

Solution Selection Matrix

Engineering Criteria	Impt.	Possible Solutions					
		S ₁	S ₂	S ₃	S ₄		
Criteria ₁							
Criteria ₂							
Criteria ₃							



Specific Cell Rating . . .

Rate each cell on how well the Possible Solution meets the Design Criteria

Strong = 9 points, Moderate = 3 points, Weak = 1 point

Solution Selection Matrix

Engineering Criteria	Impt.	Possible Solutions					
		S ₁	S ₂	S ₃	S ₄		
Criteria ₁							
Criteria ₂							
Criteria ₃							
Criteria ₄							
Totals							

S₂ Total Calculation =

$$(S_2)(\text{Imp}C_1) + (S_2)(\text{Imp}C_2) + \dots (S_2)(\text{Imp}C_N)$$

