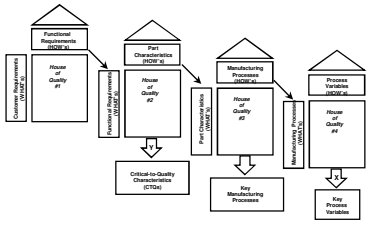
QFD FUNDAMENTALS



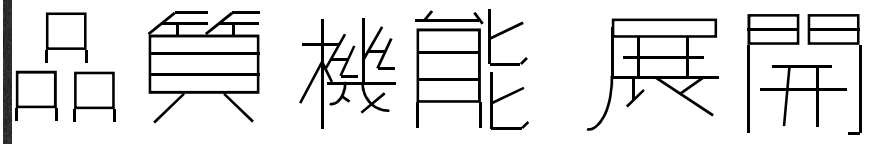
BRIEF HISTORY OF QFD

Origin - Mitsubishi Kobe Shipyard 1972

- The technique was invented by Akashi Fukuhara of Japan and first applied with very good results at Toyota and Its Suppliers.
- Expanded To Other Japanese Manufacturers
  - Consumer Electronics, Home Appliances, Clothing, Integrated Circuits, Apartment Layout Planning
- Adopted By Ford and GM in 1980s
- Digital Equipment, Hewlett-Packard, AT&T, ITT

Foundation - Belief That Products Should Be Designed To Reflect Customer Desires and Tastes

Derivation of Quality Function Deployment



Hin Shitsu — Ki No — Ten Kai

Quality
Features
Attributes
Qualities

Function
Mechanization

Deployment
Diffusion
Development
Evolution

WHAT'S IN A NAME

WHAT IS QFD ?

QFD - Quality Function Deployment

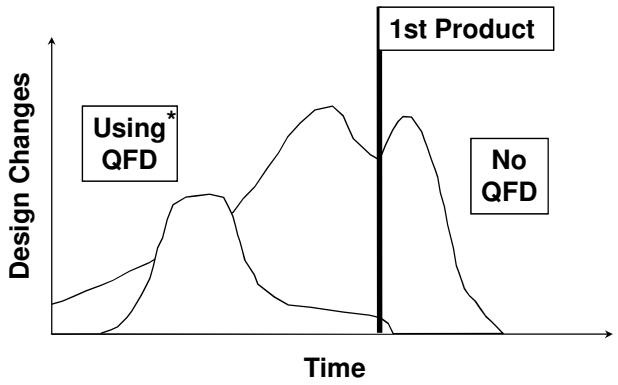
Method for Translating Customer Requirements Into An Appropriate Company Program and Technical Requirements at Each Phase of the Product Realization Cycle.

- **An Orderly Process for Determining Critical Quality Characteristics**
- **It is a complete planning process as opposed to problem solving and analysis.**
- **Common Sense Approach**
- **BASIS - Ask Your Customer**
  - **Listen --- REALLY LISTEN**

CREATIVE DEFINITIONS OF QFD

- A systematic way of documenting and breaking down customer needs into manageable and actionable detail.
- A planning methodology that organizes relevant information to facilitate better decision making.
- A way of reducing the uncertainty involved in product and process design.
- A technique that promotes cross-functional teamwork.
- A methodology that gets the right people together, early, to work efficiently and effectively to meet customers' needs.
- QFD is a structured methodology to identify and translate customer needs and wants into technical requirements and measurable features and characteristics:
  - From marketing and sales
  - To research and product development
  - To engineering and manufacturing
  - To distribution and services

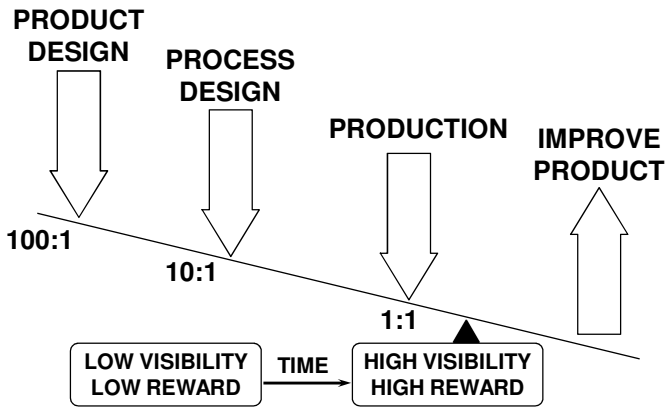
WHY USE QFD?



QFD Can Reduce Startup Time and Costs

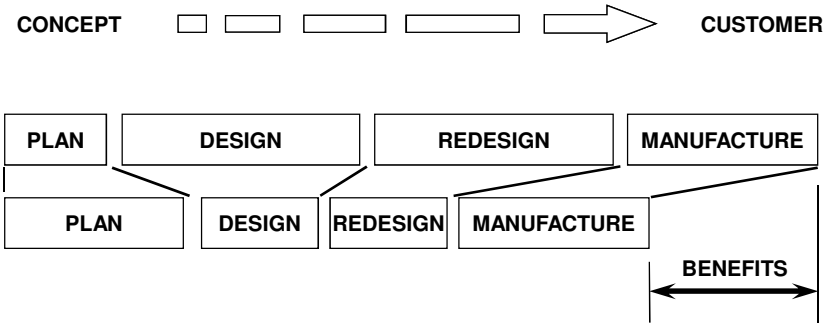
* Typical Automotive Data

WHY DOES QFD WORK?



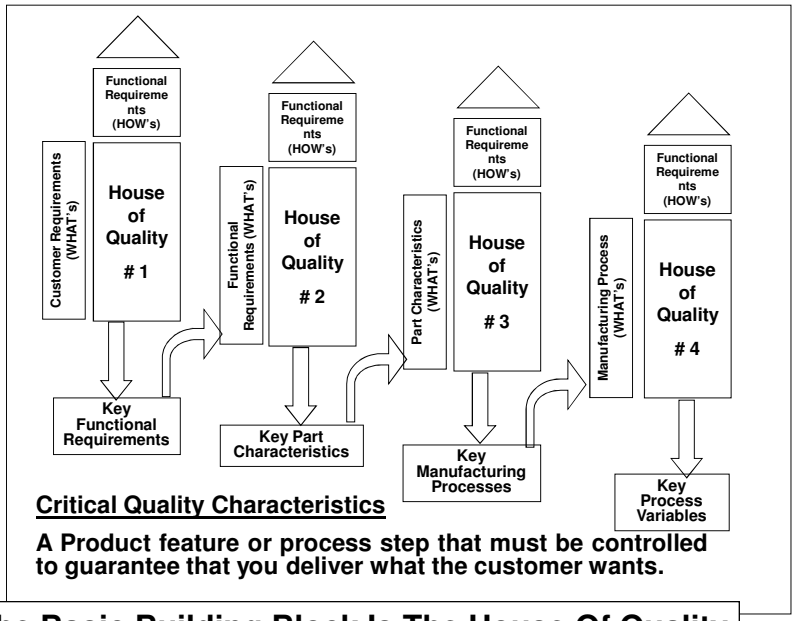
The Quality Lever

WHAT DOES QFD DO?



QFD IS A PRODUCTIVITY ENHANCER

HOW DOES QFD WORK?



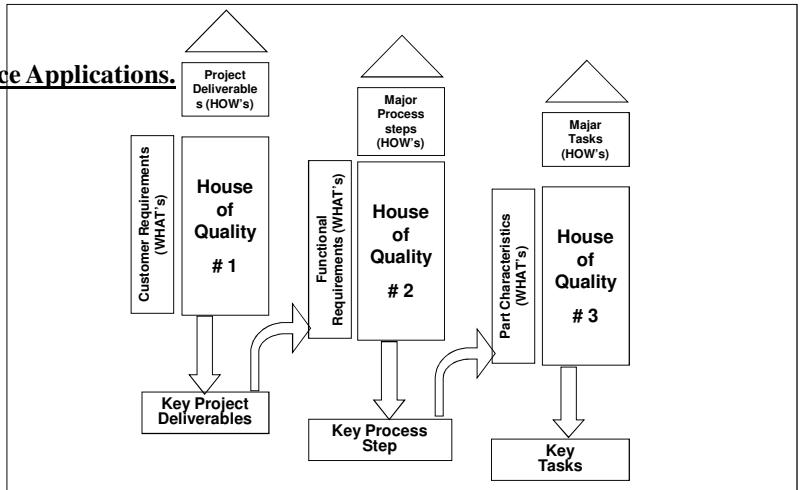
Critical Quality Characteristics

A Product feature or process step that must be controlled to guarantee that you deliver what the customer wants.

The Basic Building Block Is The House Of Quality

HOW DOES QFD WORK?

Service Applications.

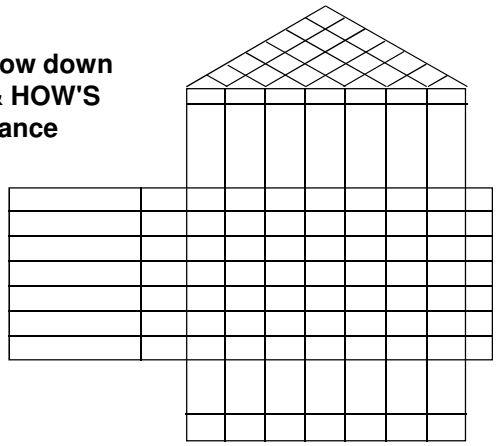


Critical Quality Characteristics

A Product feature or process step that must be controlled to guarantee that you deliver what the customer wants.

THE BASIC HOUSE OF QUALITY

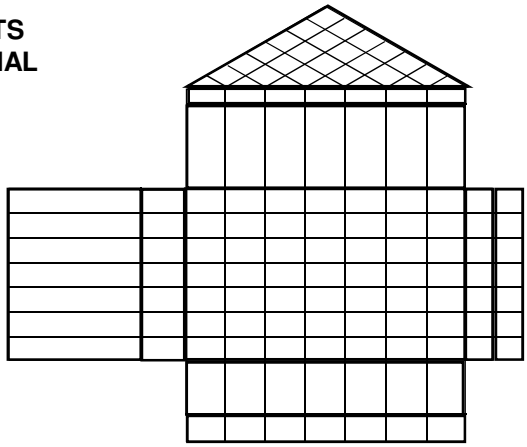
- Establishes the Flow down
- Relates WHAT'S & HOW'S
- Ranks The Importance



The Basis of QFD is the House

THE BASIC HOUSE OF QUALITY

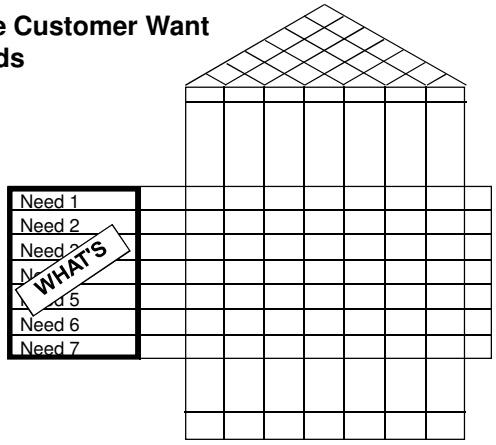
- ▭ KEY ELEMENTS
- ▭ INFORMATIONAL ELEMENTS



Two Element Types In Each House

KEY ELEMENTS - "WHAT'S"

- What Does The Customer Want
- Customer Needs
- CTQs
- Ys



Voice of the Customer

List customer requirements and rank

Customer Requirements	Importance on 10 point scale
Very Important	
Moderately Important	
Slightly important	

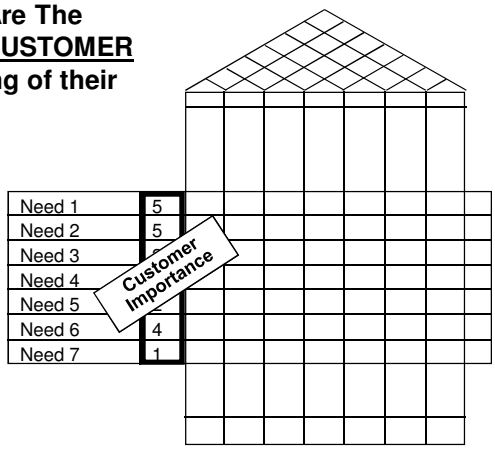
QFD… BEGIN WITH THE CUSTOMER

What Does the Customer Want?

What
Responsiveness to the Customer
Price & Product Competitiveness
Hardware Quality
Hardware On Time Delivery
Software Quality
Software On Time Delivery
Contract Understanding
Product Performance

KEY ELEMENTS - CUSTOMER IMPORTANCE

- **How Important Are The What's <u>TO THE CUSTOMER</u>**
- **Customer Ranking of their Needs**



Voice of the Customer

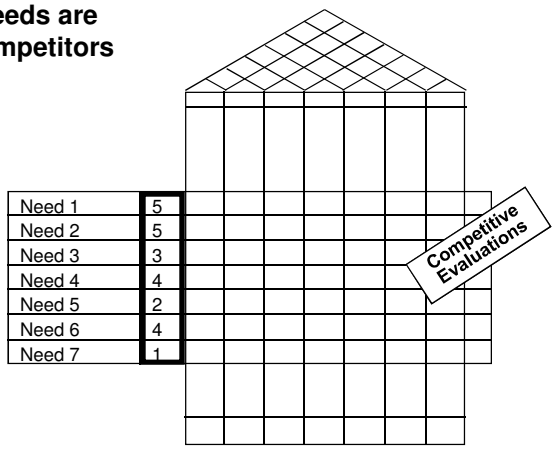
CUSTOMER IMPORTANCE

Identify the Functions or Processes that Impact Customer Wants

Responsiveness to the Customer	5
Price & Product Competitiveness	3
Hardware Quality	5
Hardware On Time Delivery	4
Software Quality	3
Software On Time Delivery	4
Contract Understanding	3
Product Performance	4

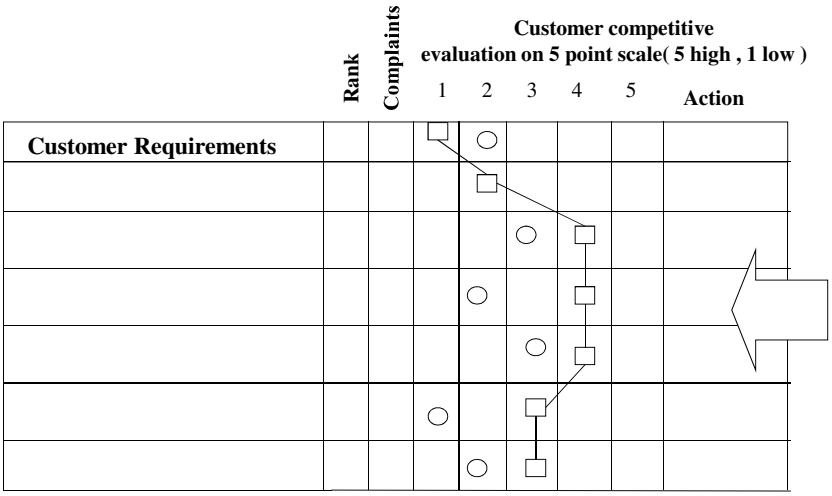
KEY ELEMENTS – Competitive Evaluation

- **How customer needs are addressed by competitors**
- **Any advantage!!**



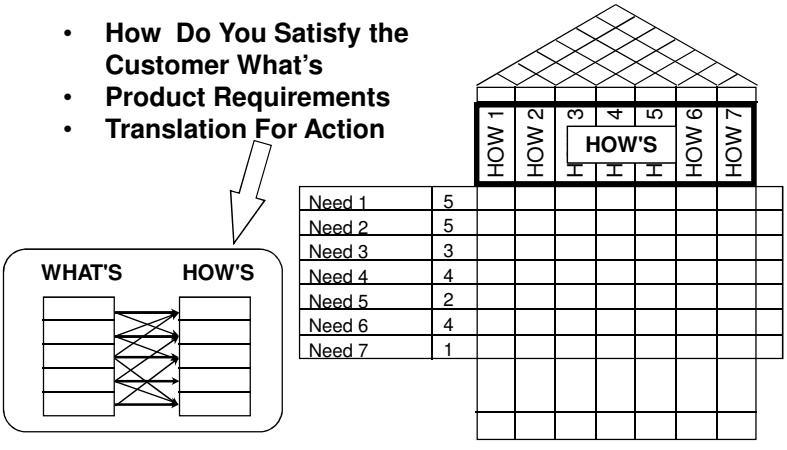
Market Scenario

Comparing product with the nearest competitor



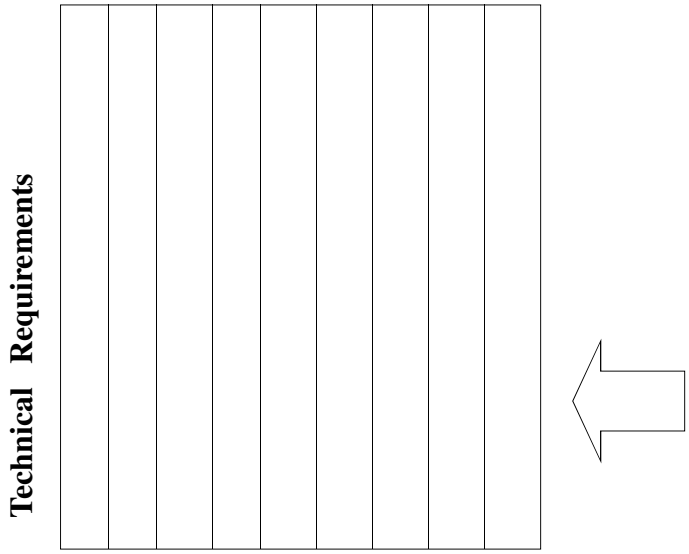
KEY ELEMENTS - "HOW'S"

- How Do You Satisfy the Customer What's
- Product Requirements
- Translation For Action



Satisfy the Customer Needs

List technical requirements to meet customer requirements

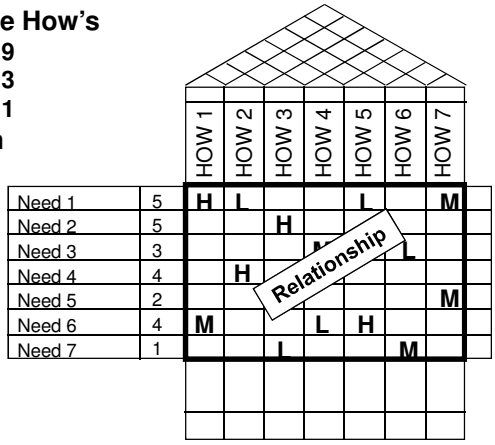


TRANSLATING WHATS TO HOWS

Identify the Functions or Processes that Impact Customer Wants		Sales	Project Management	Engineering	Manufacturing	Sourcing	Partners	Field Engineer
Responsiveness to the Customer	5							
Price & Product Competitiveness	3							
Hardware Quality	5							
Hardware On Time Delivery	4							
Software Quality	3							
Software On Time Delivery	4							
Contract Understanding	3							
Product Performance	4							

KEY ELEMENTS - RELATIONSHIP

- **Strength of the Interrelation Between the What's and the How's**
  - **H Strong 9**
  - **M Medium 3**
  - **L Weak 1**
- **Transfer Function**
- **Y = f(X)**



Untangling The Web

THE RELATIONSHIP BETWEEN WHAT & HOW

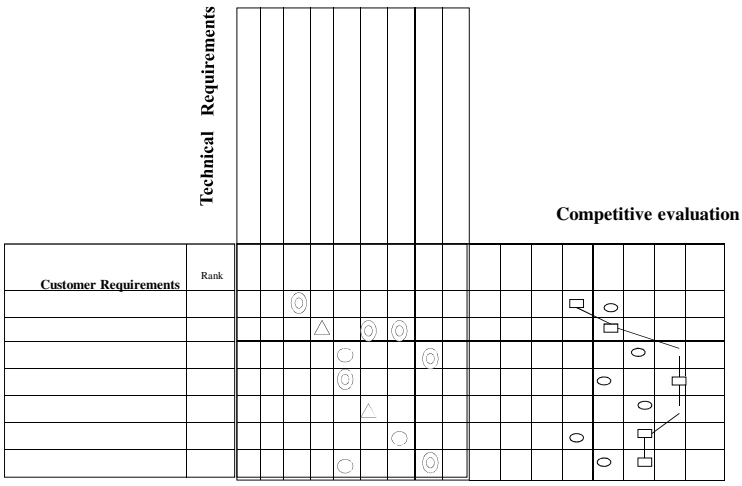
Evaluate the Impact of Each Function/Process on the Customer Wants

Hows / Whats

Whats		Sales	Project Management	Engineering	Manufacturing	Sourcing	Partners	Field Engineer
Responsiveness to the Customer	5	9	9	9	3	1	3	9
Price & Product Competitiveness	3	9		9	9			
Hardware Quality	5			3	9	9	3	9
Hardware On Time Delivery	4	1	3	3	9	9	3	
Software Quality	3			9	3	3		3
Software On Time Delivery	4		3	9		3	3	1
Contract Understanding	3	9	9	9			3	1
Product Performance	4	3		9	3		3	9
Expect to find no single solution								

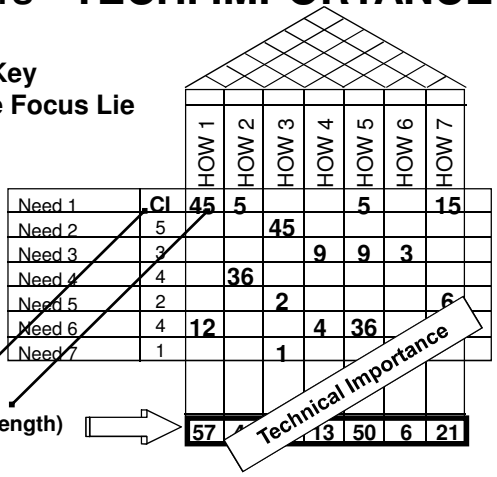
Relationship
Direct & Strong = 9
Direct = 3
Indirect = 1

QFD matrix overview after earlier steps



KEY ELEMENTS - TECH. IMPORTANCE

- Which How's are Key
- Where Should The Focus Lie



- $TI = \sum_{column} (CI * Strength)$

Ranking The HOW'S

Technical Importance

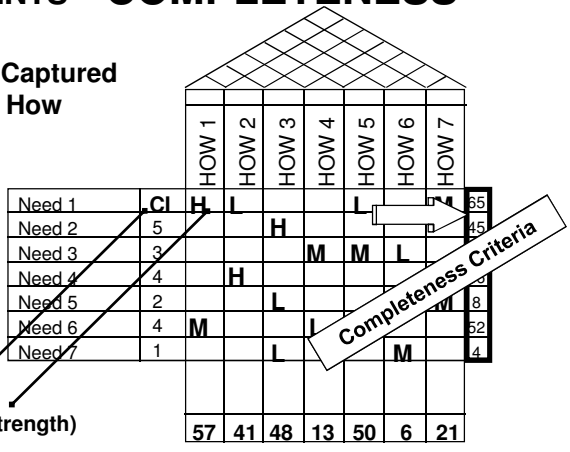
		Sales	Project Management	Engineering	Manufacturing	Sourcing	Partners	Field Engineer
Responsiveness to the Customer	5	9	9	9	3	1	3	9
Price & Product Competitiveness	3	9		9	9			
Hardware Quality	5			3	9	9	3	9
Hardware On Time Delivery	4	1	3	3	9	9	3	
Software Quality	3			9	3	3		3
Software On Time Delivery	4		3	9		3	3	1
Contract Understanding	3	9	9	9			3	1
Product Performance	4	3		9	3		3	9
		115	96	225	144	107	75	142

Calculate the overall magnitude of the impact each function/process has on the customer wants

Where would you focus a project?

KEY ELEMENTS - COMPLETENESS

- **Are All The How's Captured**
- **Is A What Really A How**



- $CC = \sum_{row}(CI * Strength)$

Have We Captured the HOW'S

INFORMATION - TARGET DIRECTION

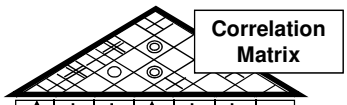
- Information On The HOW'S
  - ↑ More Is Better
  - ↓ Less Is Better
  - ⬭ Specific Amount

		HOW 1 ↑	HOW 2 ↓	HOW 3 ↓	HOW 4 ↑	HOW 5 ↓	HOW 6 ↓	HOW 7 ⬭	
Need 1	5	H	L			L		M	65
Need 2	5			H					45
Need 3	3				M	M	L		21
Need 4	4		H						36
Need 5	2			L				M	8
Need 6	4	M			L	H			52
Need 7	1			L			M		4
		57	41	48	13	50	6	21	

The Best Direction

INFORMATION - CORRELATION MATRIX

- Impact Of The How's On Each Other
  - ◎ Strong Positive
  - ○ Positive
  - ╳ Negative
  - ✳ Strong Negative

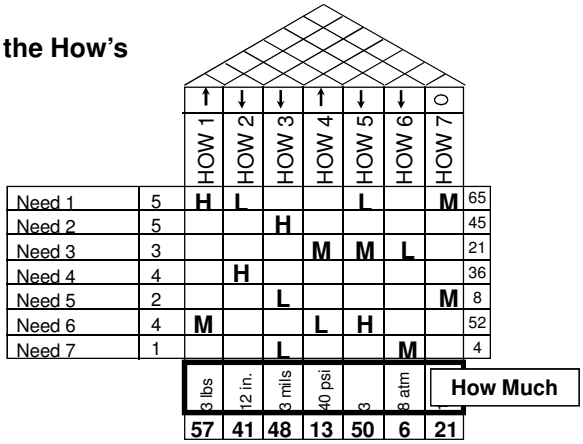


		HOW 1 ↑	HOW 2 ↓	HOW 3 ↓	HOW 4 ↑	HOW 5 ↓	HOW 6 ↓	HOW 7 ○	
Need 1	5	H	L			L		M	65
Need 2	5			H					45
Need 3	3				M	M	L		21
Need 4	4		H						36
Need 5	2			L				M	8
Need 6	4	M			L	H			52
Need 7	1			L			M		4
		3 lbs	12 in.	3 mils	40 psi	3	8 atm	1 mm	
		57	41	48	13	50	6	21	

Conflict Resolution

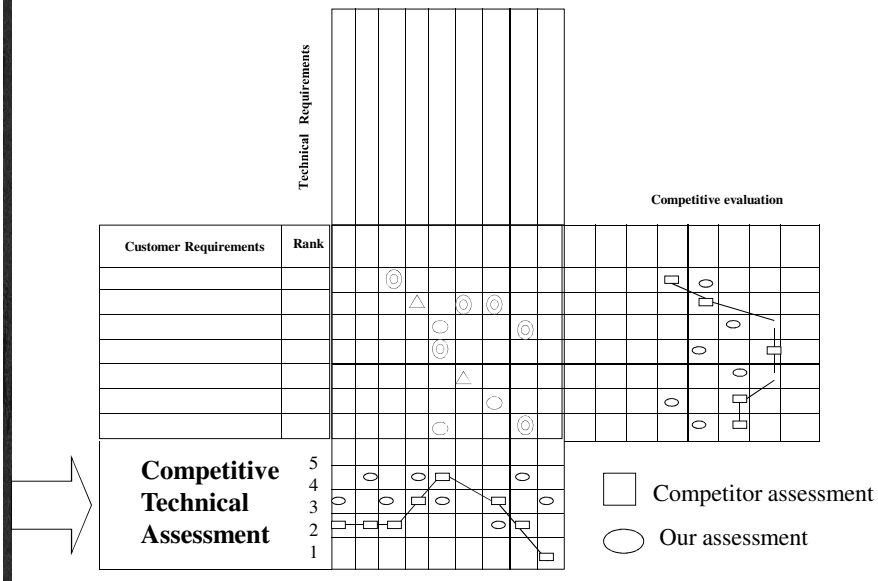
INFORMATION - HOW MUCH

- Target Values for the How's
- Note the Units

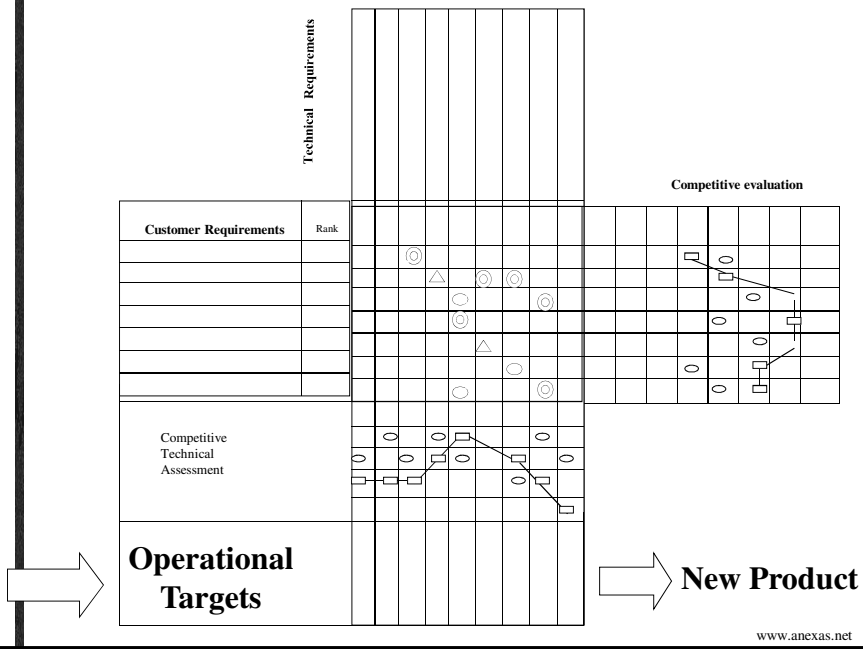


Consistent Comparison

Do competitive technical Assessment



Mention operational targets or action points



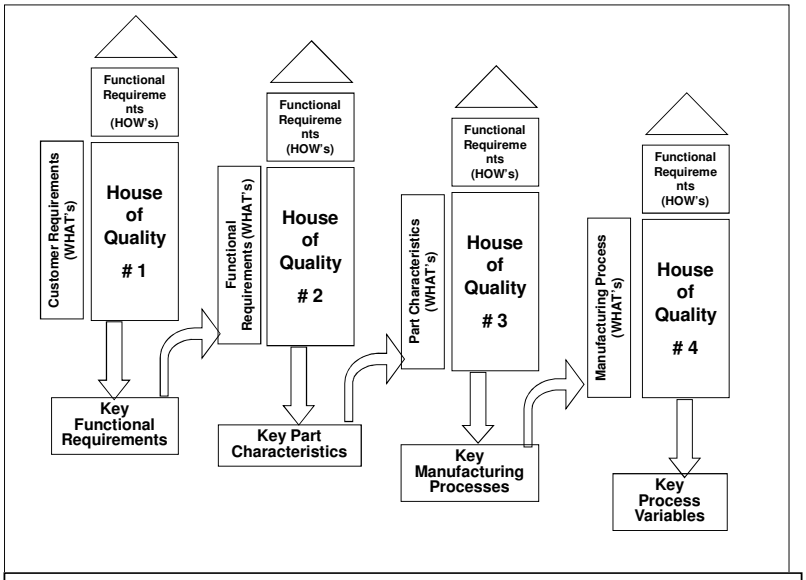
QFD FLOWDOWN

Levels Of Granularity

Manufacturing Environment	Software Environment	Service Environment
Customer Wants	Customer Wants	Customer Wants
Technical Requirements	Product Functionality	Service Requirements
Part Characteristics	System Characteristics	Service Processes
Manufacturing Process	Design Alternatives	Process Controls
Production Requirements		

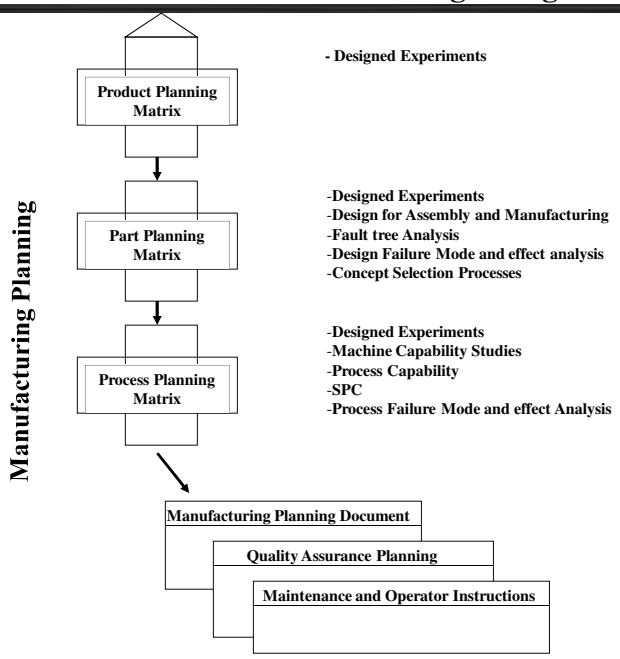
Flow down Relates The Houses To Each Other

QUALITY FUNCTION DEPLOYMENT



NOTE: The How's at One Level Become the What's at the Next Level

Putting all together



- Designed Experiments

-Designed Experiments
-Design for Assembly and Manufacturing
-Fault tree Analysis
-Design Failure Mode and effect analysis
-Concept Selection Processes

-Designed Experiments
-Machine Capability Studies
-Process Capability
-SPC
-Process Failure Mode and effect Analysis

ANALYZING & DIAGNOSING THE QFD

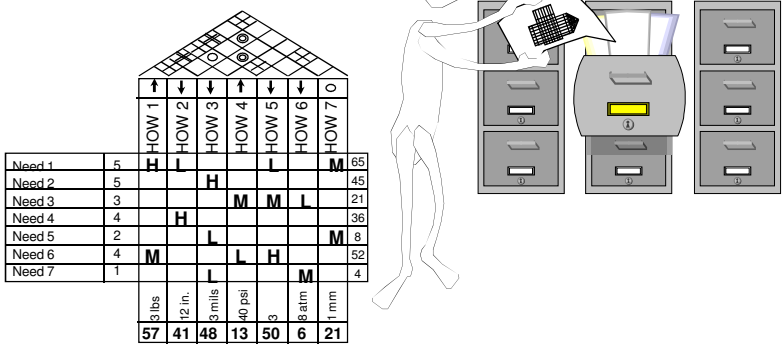
1. Blank rows
2. Blank columns
3. No design constraints in hows
4. Resolve negative correlations
5. Finalize target values
6. What technical requirements should be developed to phase II (Design development) ?

COMMON QFD PITFALLS

- **QFD On Everything**
  - Set the "Right" Granularity
  - Don't Apply To Every Last Project
- **Inadequate Priorities**
- **Lack of Teamwork**
  - Wrong Participants
  - Lack of Team Skills
  - Lack of Support or Commitment
- **Too Much "Chart Focus"**
- **"Hurry up and Get Done"**
- **Failure to Integrate and Implement QFD**

THE "STATIC" QFD

- **Review Current Status**
  - **At Least Quarterly**
  - **Monthly on 1 Yr Project**
  - **Weekly on Small Projects**



		HOW 1	HOW 2	HOW 3	HOW 4	HOW 5	HOW 6	HOW 7	
		↑	↓	↓	↑	↓	↓	○	
Need 1	5	H	L			L		M	65
Need 2	5			H					45
Need 3	3				M	M	L		21
Need 4	4		H						36
Need 5	2			L				M	8
Need 6	4	M			L	H			52
Need 7	1			L			M		4
		3 lbs	12 in.	3 mils	40 psi	3	8 atm	1 mm	
		57	41	48	13	50	6	21	

Boy Am I Ever Glad That's Done

POINTS TO REMEMBER

- **The process may look simple, but requires effort.**
- **Many entries look obvious—after they're written down.**
- **If there are NO "tough spots" the first time:**
  - **IT PROBABLY ISN'T BEING DONE RIGHT!!**
- **Focus on the end-user customer.**
- **Charts are not the objective.**
  - **Charts are the means for achieving the objective.**
- **Find reasons to succeed, not excuses for failure.**
- **Remember to follow-up afterward**

KEY THOUGHT

QFD is a Valuable Decision Support Tool, Not a Decision Maker