Quality Function Deployment(QFD) in Product Development

Development of QFD

- QFD was developed in Japan in the late 1960s by Professors Yoji Akao and Dr. Shigeru Mizuno
- Mitsubishi Heavy Industries
  - Kobe Shipyards in 1972
- Toyota Minivans – considering 1977 as Base
  - 1979 - 20% Reduction In Start-Up Costs
  - 1982 - 38%
  - 1984 - 61%
- Dr. Clausing, Xerox, 1984
- ……Later in other Manufacturing and Service Industry

Quality Function Deployment(QFD) is a method for translating Customer Needs/Wants into the design and manufacturing of a product

A definition for QFD:

A system for translating customer requirements into appropriate company requirements at each stage from research and product development to engineering and manufacturing to marketing/sales and distribution

QFD deploys ‘Voice of the Customer’ through out the organisation

QFDs House of Quality

An analogy for illustrating the QFD structure is a house of Quality (HOQ)

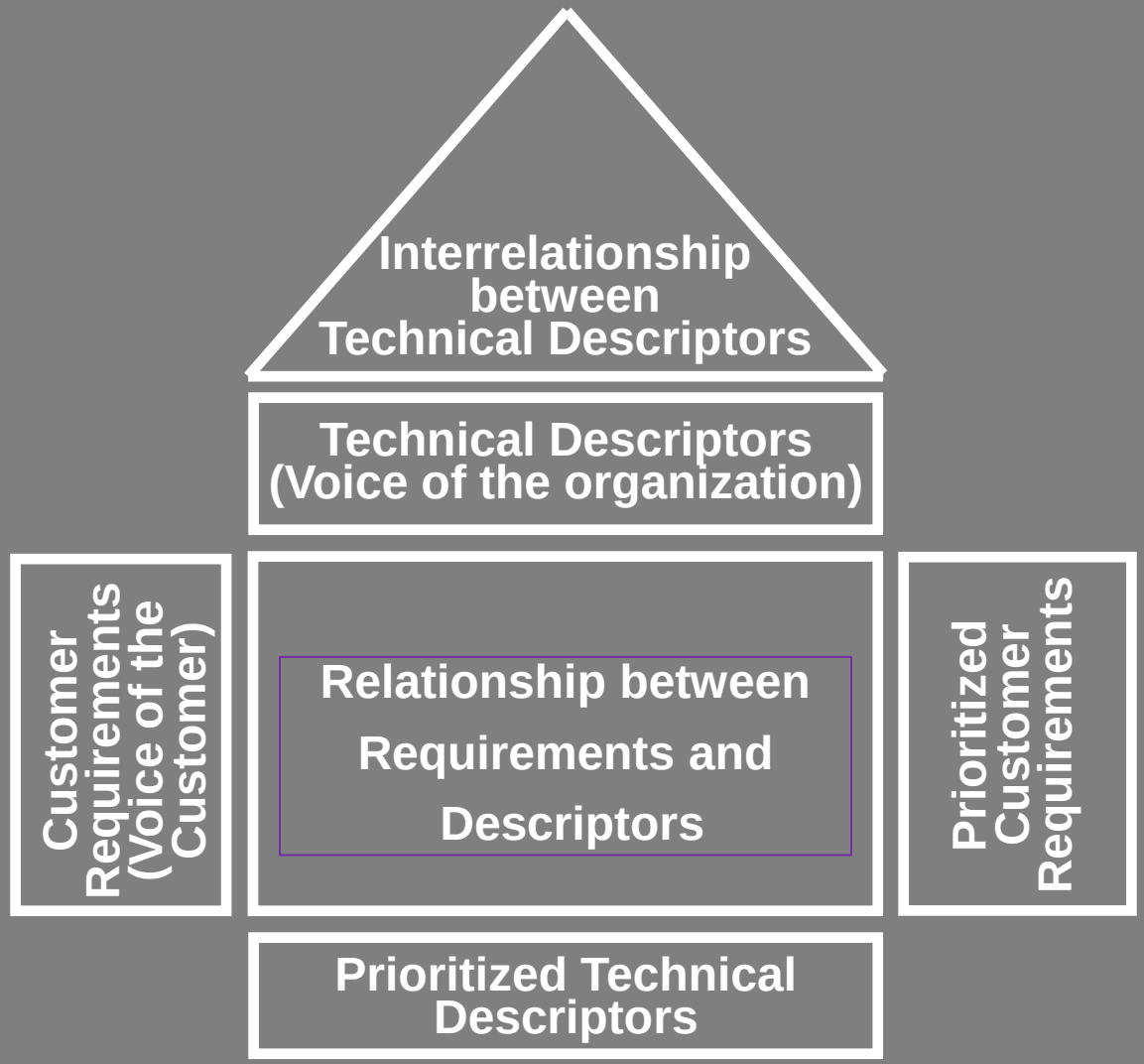
The HoQ depends on a multifunctional team for the inputs from the customer and translate the information into a set of customer needs/ wants known as the Voice of the Customer (VOC).

The VOC and benchmarking with select competing products determines the prioritized features of the new or improved product that will respond to the VOC.

Why use QFD in Product Development

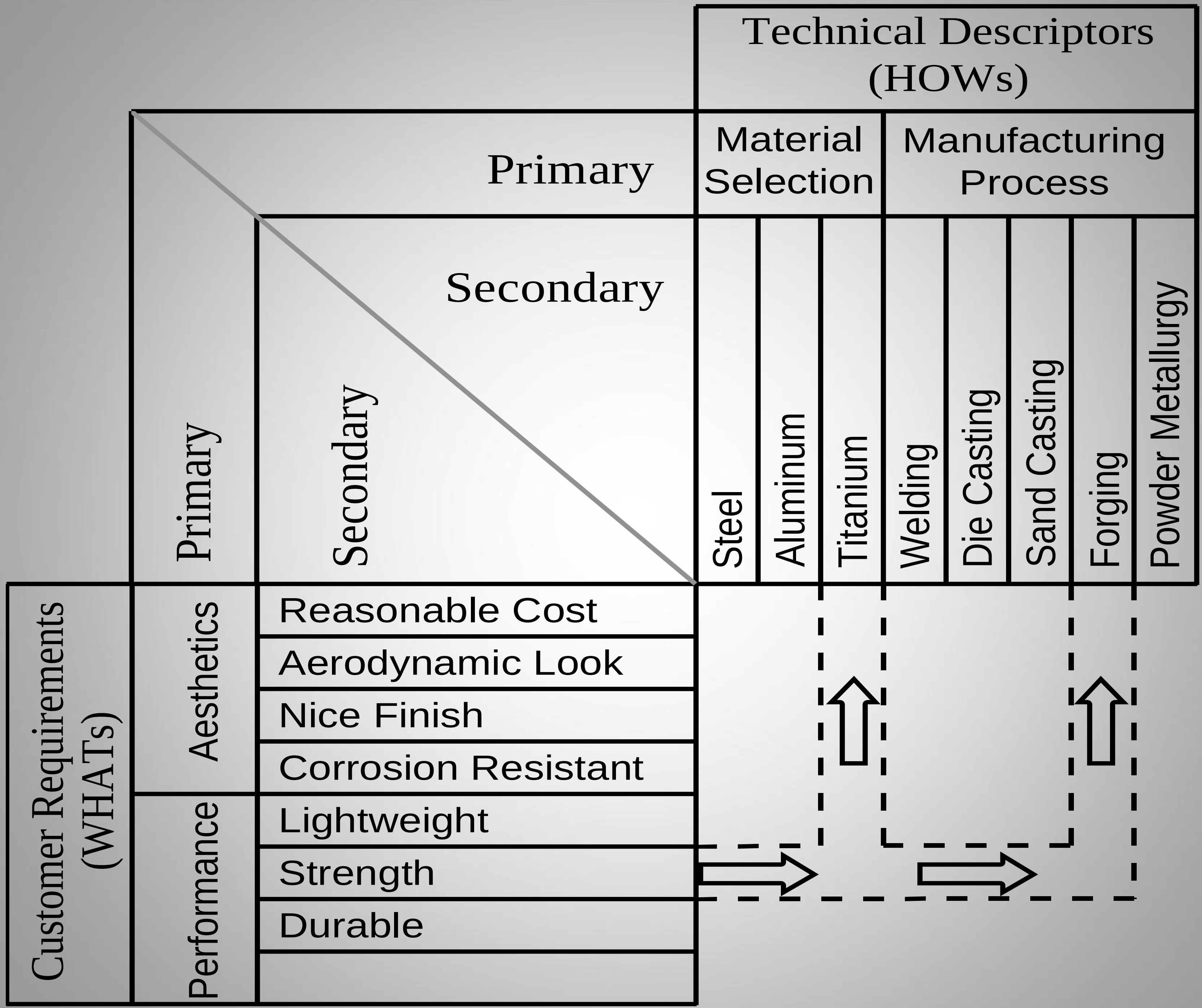
- Structured method of obtaining information and presenting it
- Preserves everything as documented and written
- Reduced chance of oversights during design process
- Shorter Product Development Cycle Time
- Reduced Start-Up Costs
- Fewer Engineering Changes and Modifications and ‘Revisions’
- Creates environment conducive to Teamwork
- Consensus Decisions
- Surfaces Missing Assumptions
- Reduces post introduction problems
- Projects future application opportunities

House Of Quality in QFD



Constructing a House Of Quality

- List down Customer Requirements (What's)
- List down Technical Descriptors (How's)
- Determine Relationship (What's & How's)
- Determine Interrelationship (How's)
- Competitive Assessments
- Prioritise Customer Requirements
- Prioritise Technical Descriptors



Technical Descriptors
(HOWs)
Primary
Material Selection
Manufacturing Process
Secondary
Primary
Secondary
Steel
Aluminum
Titanium
Welding
Die Casting
Sand Casting
Forging
Powder Metallurgy
Customer Requirements
(WHATs)
Aesthetics
Performance
Reasonable Cost
Aerodynamic Look
Nice Finish
Corrosion Resistant
Lightweight
Strength
Durable

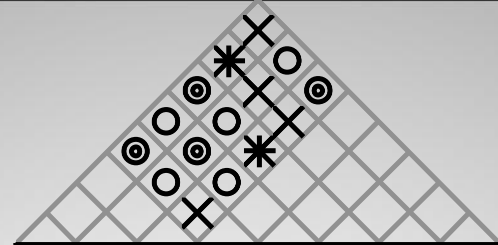
Customer Requirements (WHATs)		Technical Descriptors (HOWs)	Material Selection			Manufacturing Process				
Primary	Secondary		Steel	Aluminum	Titanium	Welding	Die Casting	Sand Casting	Forging	Powder Metallurgy
Aesthetics	Reasonable Cost		◎	◎	△	◎	○	◎	○	△
	Aerodynamic Look			△	△	△	◎	○	○	◎
	Nice Finish		○	◎	◎	△	◎	△	○	◎
	Corrosion Resistant		△	◎	◎	△	○	○	○	○
Performance	Lightweight		△	◎	◎					△
	Strength		◎	○	◎	△	○	○	◎	△
	Durable		◎	○	○	△	◎	○	◎	○

Relationship between Customer Requirements and Technical Descriptors WHATs vs. HOWs

+9	◎	Strong
+3	○	Medium
+1	△	Weak

Interrelationship between Technical Descriptors (correlation matrix)
HOWs vs. HOWs

+9	◎	Strong Positive
+3	○	Positive
-3	✕	Negative
-9	✱	Strong Negative



Customer Requirements (WHATs) — Primary	Secondary	Steel	Aluminum	Titanium	Welding	Die Casting	Sand Casting	Forging	Powder Metallurgy
		Material Selection			Manufacturing Process				
Aesthetics	Reasonable Cost	◎	◎	△	◎	○	◎	○	△
Aesthetics	Aerodynamic Look		△	△	△	◎	○	○	◎
Aesthetics	Nice Finish	○	◎	◎	△	◎	△	○	◎
Aesthetics	Corrosion Resistant	△	◎	◎	△	○	○	○	○
Performance	Lightweight	△	◎	◎					△
Performance	Strength	◎	○	◎	△	○	○	◎	△
Performance	Durable	◎	○	○	△	◎	○	◎	○
Performance									

Technical Descriptors (HOWs): Primary — Material Selection, Manufacturing Process; Secondary — Steel, Aluminum, Titanium, Welding, Die Casting, Sand Casting, Forging, Powder Metallurgy

Relationship between Customer Requirements and Technical Descriptors
WHATs vs. HOWs

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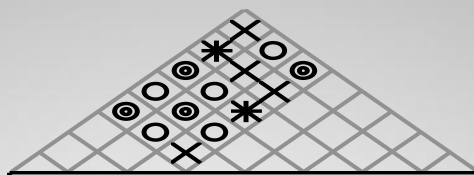


Relationship between Customer Requirements and Technical Descriptors
WHATs vs. HOWs

+9	◎	Strong
+3	○	Medium
+1	△	Weak

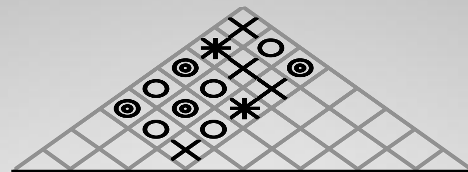
Technical Descriptors (HOWs)

Customer Requirements (WHATs) — Primary	Secondary	Material Selection: Steel	Material Selection: Aluminum	Material Selection: Titanium	Manufacturing Process: Welding	Manufacturing Process: Die Casting	Manufacturing Process: Sand Casting	Manufacturing Process: Forging	Manufacturing Process: Powder Metallurgy	Our Product	A's Product	B's Product
Aesthetics	Reasonable Cost	◎	◎	△	◎	○	◎	○	△	3	4	2
	Aerodynamic Look		△	△	△	◎	○	○	◎	4	5	3
	Nice Finish	○	◎	◎	△	◎	△	○	◎	4	5	3
	Corrosion Resistant	△	◎	◎	△	○	○	○	○	4	4	2
Performance	Lightweight	△	◎	◎					△	3	4	2
	Strength	◎	○	◎	△	○	○	◎	△	3	3	4
	Durable	◎	○	○	△	◎	○	◎	○	3	3	4

Customer Competitive Assessment

Interrelationship between Technical Descriptors (correlation matrix)
HOWs vs. HOWs

+9	◎	Strong Positive
+3	○	Positive
-3	✕	Negative
-9	✱	Strong Negative



Relationship between Customer Requirements and Technical Descriptors
WHATs vs. HOWs

+9	◎	Strong
+3	○	Medium
+1	△	Weak

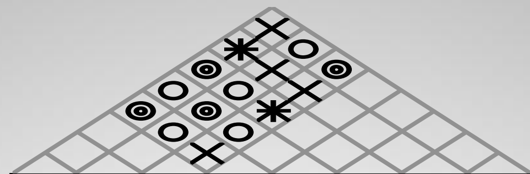
Technical Descriptors (HOWs)

Customer Requirements (WHATs): Primary	Secondary	Material Selection: Steel	Aluminum	Titanium	Manufacturing Process: Welding	Die Casting	Sand Casting	Forging	Powder Metallurgy	Customer Competitive Assessment: Our Product	A's Product	B's Product
Aesthetics	Reasonable Cost	◎	◎	△	◎	○	◎	○	△	3	4	2
	Aerodynamic Look		△	△	△	◎	○	○	◎	4	5	3
	Nice Finish	○	◎	◎	△	◎	△	○	◎	4	5	3
	Corrosion Resistant	△	◎	◎	△	○	○	○	○	4	4	2
Performance	Lightweight	△	◎	◎					△	3	4	2
	Strength	◎	○	◎	△	○	○	◎	△	3	3	4
	Durable	◎	○	○	△	◎	○	◎	○	3	3	4

Technical Competitive Assessment	Steel	Aluminum	Titanium	Welding	Die Casting	Sand Casting	Forging	Powder Metallurgy
Our Product	0	5	0	0	5	0	0	0
A's Product	0	0	5	0	5	0	0	0
B's Product	5	0	0	4	0	0	0	0

Interrelationship between Technical Descriptors (correlation matrix) HOWs vs. HOWs

+9	◎	Strong Positive
+3	○	Positive
-3	×	Negative
-9	✱	Strong Negative



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Technical Descriptors (HOWs)

Customer Requirements (WHATs): Primary	Secondary	Material Selection: Steel	Material Selection: Aluminum	Material Selection: Titanium	Manufacturing Process: Welding	Manufacturing Process: Die Casting	Manufacturing Process: Sand Casting	Manufacturing Process: Forging	Manufacturing Process: Powder Metallurgy	Customer Competitive Assessment: Our Product	Customer Competitive Assessment: A's Product	Customer Competitive Assessment: B's Product	Importance to Customer	Target Value	Scale-up Factor	Sales Point	Absolute Weight and Percent
Aesthetics	Reasonable Cost	◎	◎	△	◎	○	◎	○	△	3	4	2	8	4	1.3	1.5	16
	Aerodynamic Look		△	△	△	◎	○	○	◎	4	5	3	5	4	1	1.5	8
	Nice Finish	○	◎	◎	△	◎	△	○	◎	4	5	3	5	4	1	1	5
	Corrosion Resistant	△	◎	◎	△	○	○	○	○	4	4	2	2	4	1	1	2
Performance	Lightweight	△	◎	◎					△	3	4	2	7	4	1.3	2	18
	Strength	◎	○	◎	△	○	○	◎	△	3	3	4	5	3	1	1	5
	Durable	◎	○	○	△	◎	○	◎	○	3	3	4	3	3	1	1	3

Prioritized Customer Requirements

		Steel	Aluminum	Titanium	Welding	Die Casting	Sand Casting	Forging	Powder Metallurgy
Technical Competitive Assessment	Our Product	0	5	0	0	5	0	0	0
	A's Product	0	0	5	0	5	0	0	0
	B's Product	5	0	0	4	0	0	0	0
Degree of Technical Difficulty		1	6	9	4	7	3	6	9
Target Value		5	5	5	4	5	0	0	0
Absolute Weight and Percent		168	227	193	92	162	122	132	125
Relative Weight and Percent		251	401	303	167	213	203	165	171

Prioritized Technical Descriptors

Prioritized Technical Descriptors

Absolute Weight & Percent

$$a_j = \sum_{i=1}^{n} R_{ij} c_i$$

R is Relationship Matrix
c is Customer Importance

- Relative Weight & Percent

$$b_j = \sum_{i=1}^{n} R_{ij} d_i$$

R is Relationship Matrix
c is Customer Absolute Weights

A Four-Phase QFD