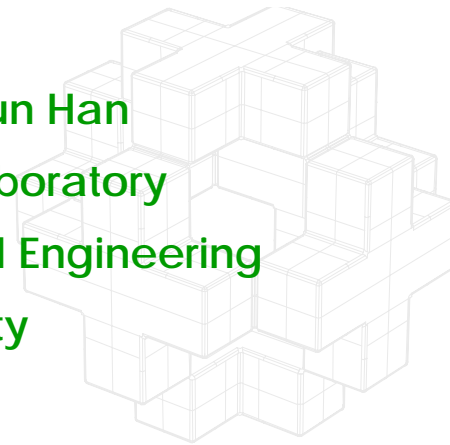
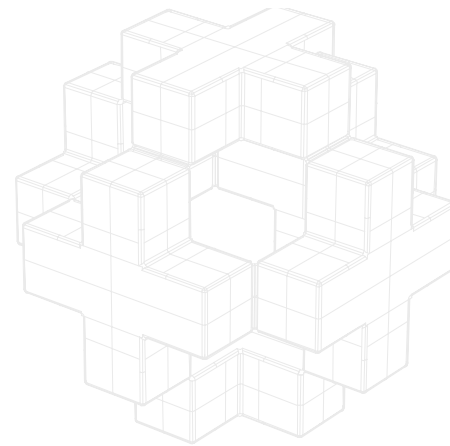

Chemical Product Design

Sungwoo Cho and Chonghun Han
Intelligent Process Systems Laboratory
School of Chemical and Biological Engineering
Seoul National University

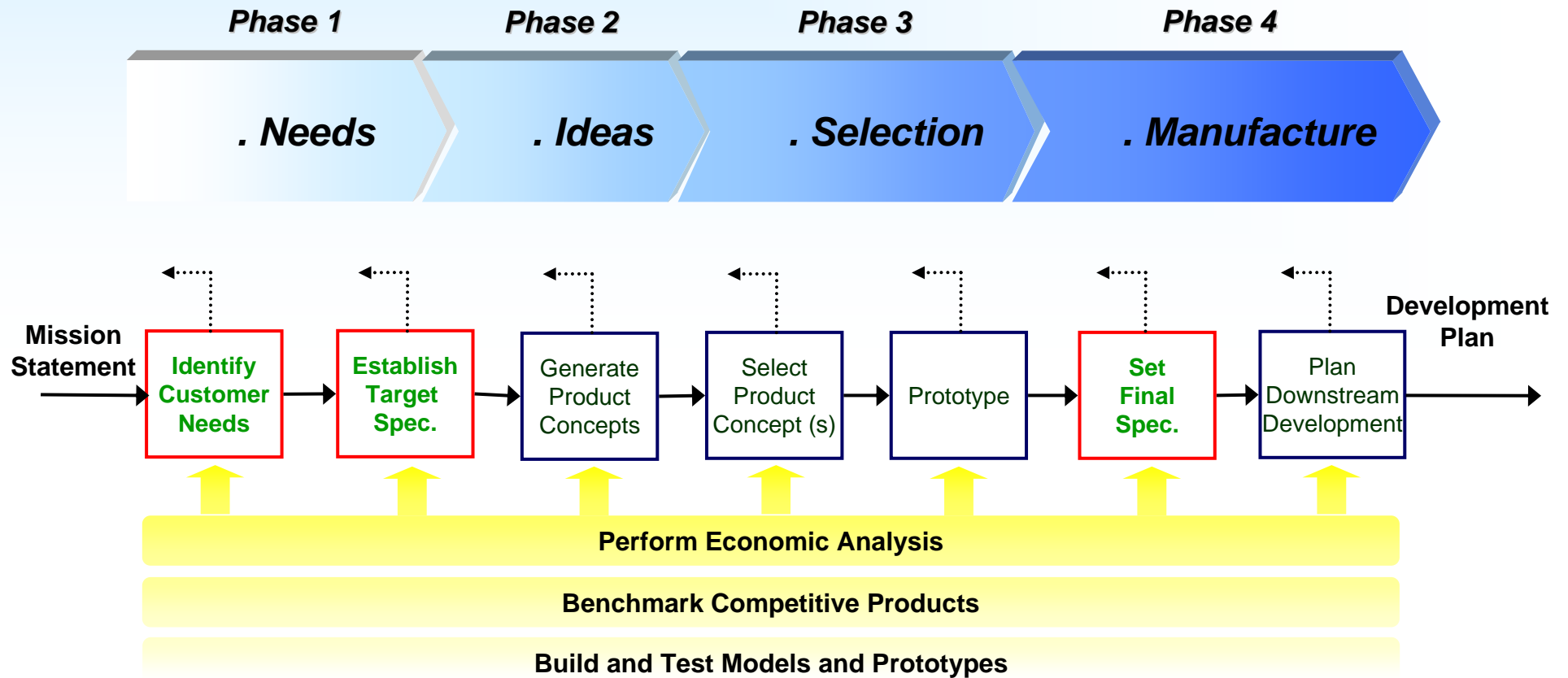


PART VI. Integrate Customer Needs with Product Specifications

- Quality Function Deployment
- Refine Specifications
- Reflect on the Results and the Process



Procedure



Quality Function Deployment

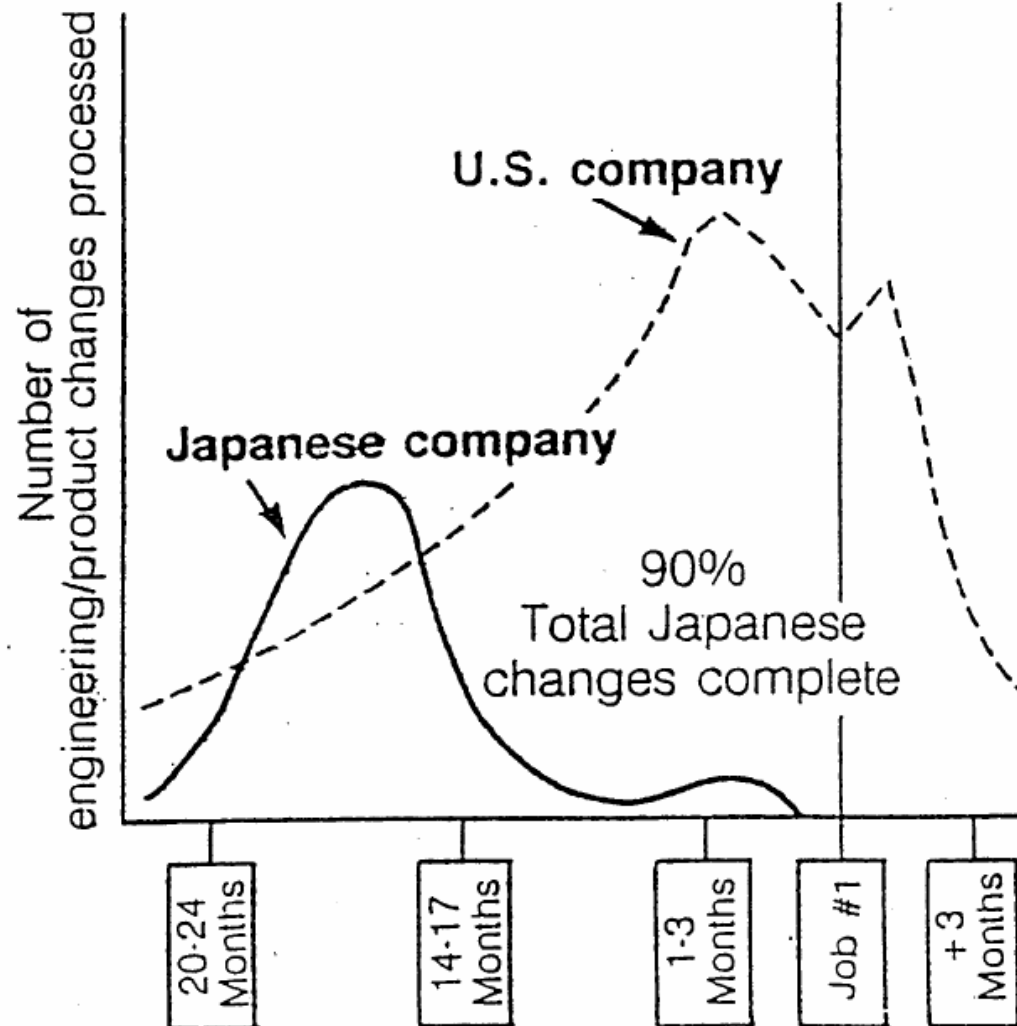
- ❖ **Translate customer requirements into the technical requirements**

for product development and production

- **Planning**
- **Product design and engineering**
- **Prototype development**
- **Production**
- **Sales**

- ❖ **Customer Driven Product Development**

Japanese / U.S. Engineering Change Comparison



Goals and Advantages

❖ **Product-Related Improvements**

- Improved design reliability
- Fewer startup problems
- Warranty claim reduction

❖ **Process-Related Improvements**

- Shorter product development cycle / lead time
- Lower cost to commercialization
- Intangible benefits

❖ **Increase in the Market Share**

History

- ❖ **Created in the late 1960's**
- ❖ **Mitsubishi's Kobe Shipyard Site (1972)**
- ❖ **Toyota (since mid 1970's)**
- ❖ **Ford (since 1985)**
- ❖ **US-based Companies (since mid 1980's)**

- **More than 100 firms including:**

General Motors, Budd, Kelsey Hayes, Motorola, DEC, Hewlett-Packard, Xerox, AT&T,
ITT, NASA, Goodyear, Kodak Eastman, NCR, Procter & Gamble, etc.

- **Annual QFD symposium since 1989**

Applications in 1990's

❖ QFD Applications Presented at Annual QFD Symposium

Year	Manufacturing	Service	Administration	Others
1990	4	1	3	2
1991	2	0	1	3
1992	5	7	5	4
1993	10	12	4	4
1994	15	8	7	2
1995	6	10	7	3
1996	6	4	3	7
1997	7	3	3	3
1998	8	5	5	4
1999	2	4	2	3
Total	65 (33%)	54 (28%)	40 (21%)	35 (18%)

Applications in 1990's (continued)

❖ Manufacturing

- *Automotive, Electronics, Computer, Aerospace, etc.*

❖ Service

- *Healthcare, Education, Hotel, Telecommunications, Energy, etc.*

❖ Administration

- *Strategic planning, Organization/Process Reengineering, Marketing, Human resource management, Auditing etc.*

❖ Others

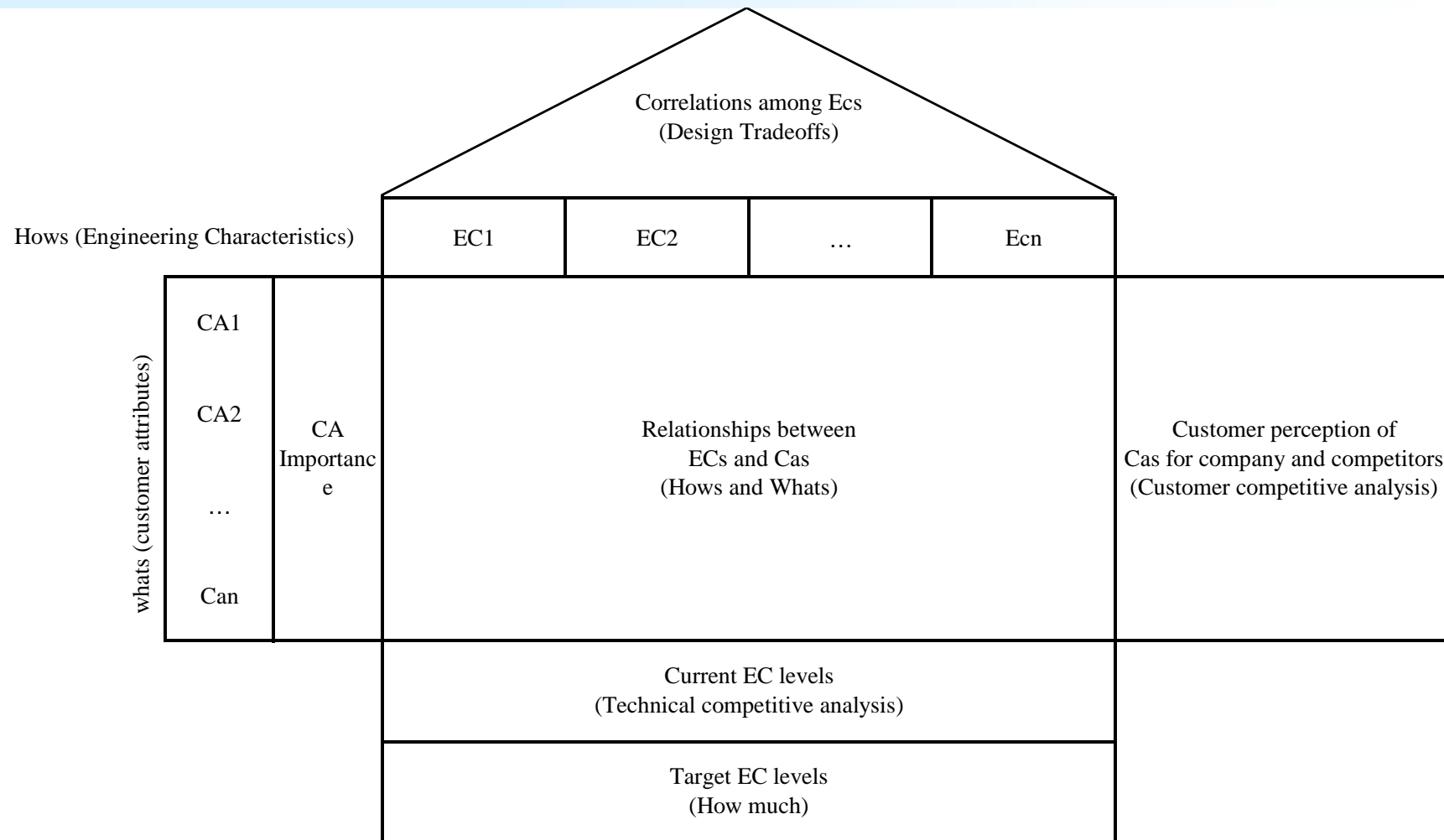
- *Software design, Information systems, Military, Construction industry, Environment, etc.*

House of Quality

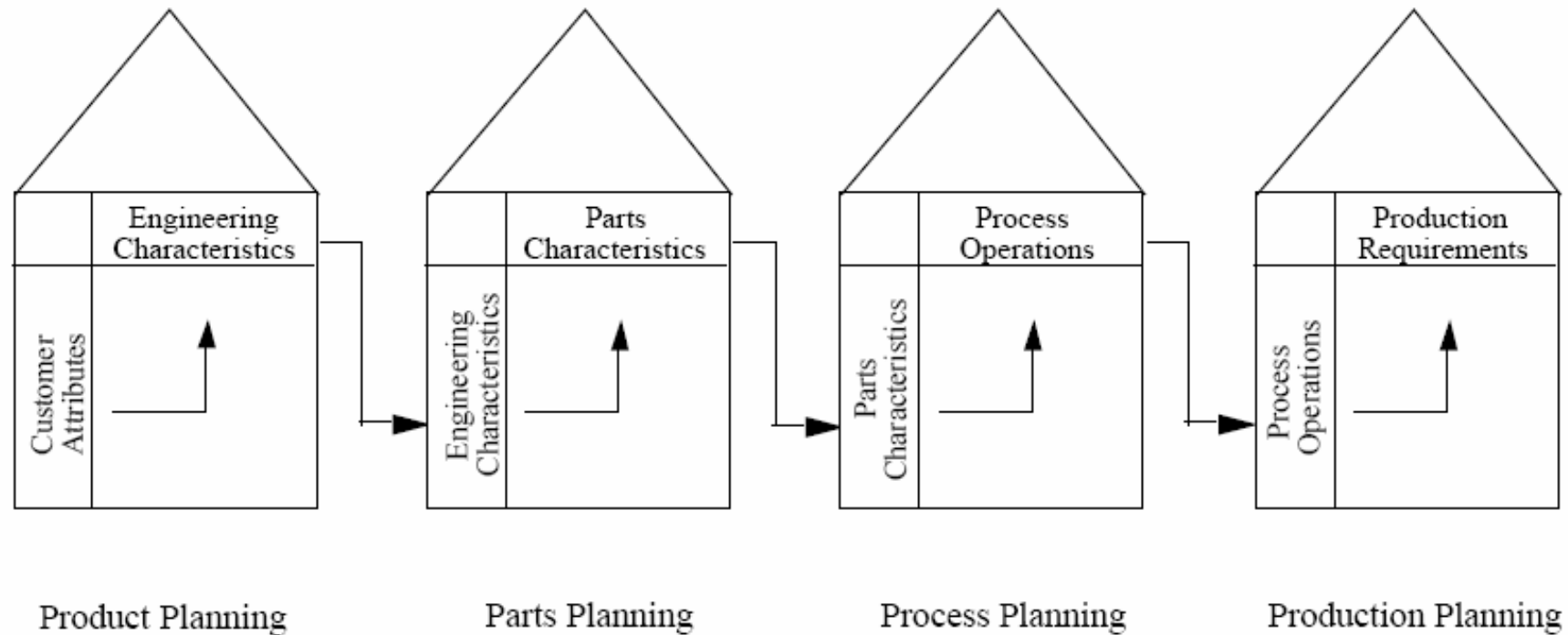
- ❖ **Conceptual Map that Provides the Means for Interfunctional Planning and Communication**
- ❖ **Used as a Tool for Communication and Decision Making.**
- ❖ **Contains Information on**
 - Customer Attributes (CA's) and Their Relative Importance.
 - Current Perceptions of Customer Attributes
(Company's and Competitor's Products)
 - Engineering Characteristics (EC's), How They Affect Customer Attribute Levels

as Well as Each Other
 - Current Measures of Engineering Characteristics Levels
(Company's and Competitors Products)

House of Quality's Schematic Diagram

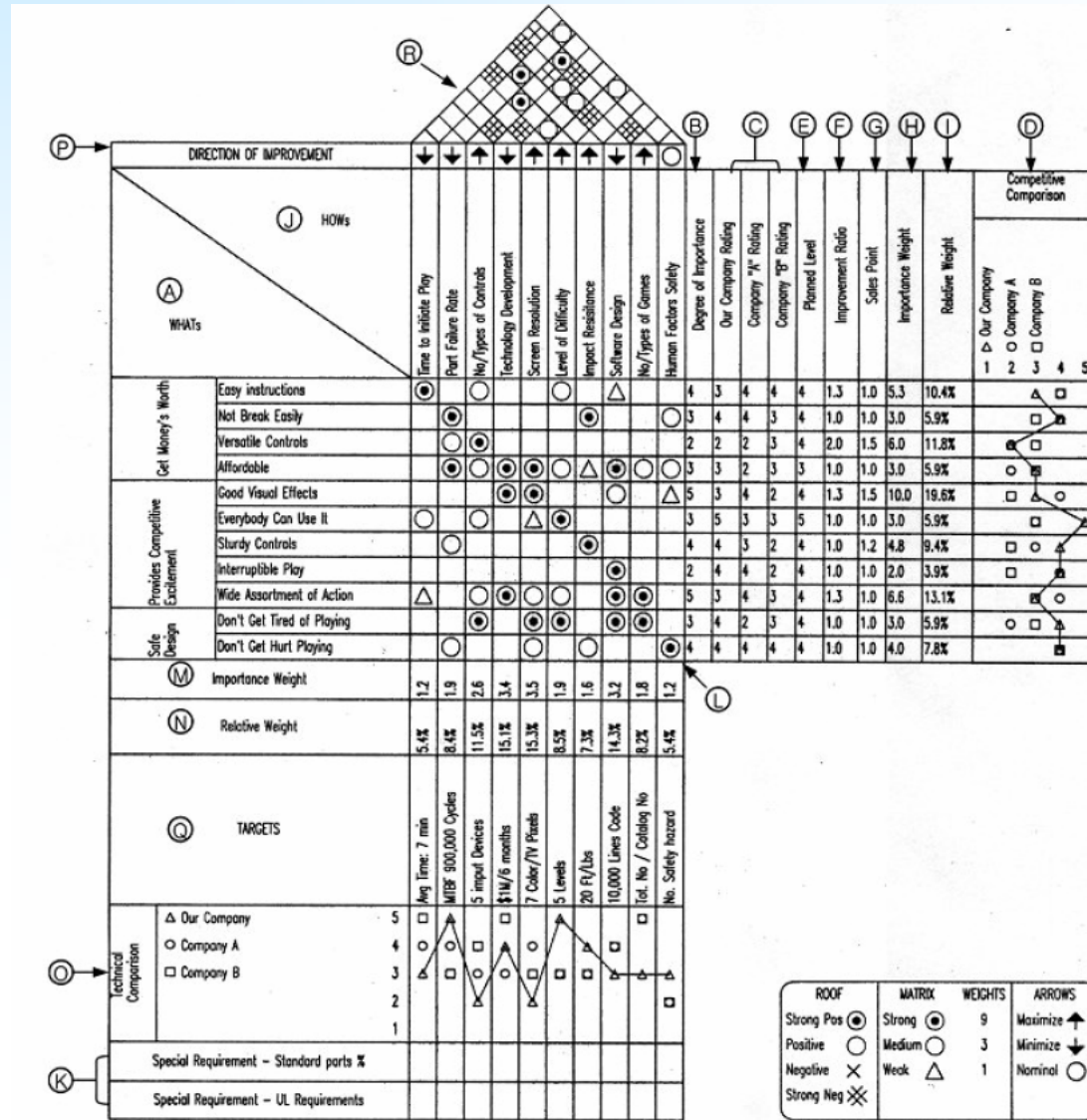


Translation of Customer Requirements



Instruction for Constructing the HOQ (1)

Video Game



Instruction for Constructing the HOQ (2)

Instruction for Constructing the House of Quality

- A
- Customer Requirements
- ❖ Identify all customer groups: internal and external.
 - ❖ Prepare plan for gathering and analyzing accurate information about the customer. Encourage customer participation.
 - ❖ Perform Brainstorming with multifunctional team to establish hierarchical tree of customer requirements.
 - ❖ Transfer requirements tree to House of Quality.
 - ❖ Establish a set of definitions for customer requirements.

- B
- Degree of Importance
- ❖ Identify relative priority based on information and perception of customer.
 - ❖ 1 to 5 scale most often used: higher is better

- C, D
- Competitive Comparison
- ❖ Identify current company's and competitors' capabilities to meet customers' requirements based on marketing and research data.
 - ❖ Use scale 1 to 5: higher is better.
 - ❖ The use of symbols provides visual assistance in comparing company performance.

- E
- Planned Level
- ❖ Set a time in future for planned improvement prior to submitting or implementing the product.
 - ❖ Use scale 1 to 5: higher is better.

- F
- Improvement Ratio
- ❖ Equal to Planned Level / Current company rating (1 to 5).

Instruction for Constructing the HOQ (3)

Instruction for Constructing the House of Quality

- G** Sales Point
- ❖ **Attributes that many generate new business for additional products**
 - ❖ ● = 1.5 value ○ = 1.2 value

- H** Importance Weight
- ❖ **Importance Weight = (Degree of Importance) * (Improvement ratio) * (Sales Point Value)**

- I** Relative Weight (%)
- ❖ **Normalize importance weightings.**

- J** Technical Requirements
- ❖ **Develop list internally to answer the following sentence:**
If I control (a) then I am meeting my customers' objective to (b), where “a” is a possible technical requirements and “b” is a defined customer objective.
 - ❖ **Develop requirements through a brainstorming session with the multifunctional team and create hierarchical diagrams to transfer to the matrix.**

- K** Special Requirements
- ❖ **Compliance requirements.**

- L** Relationship Matrix
- ❖ **Indicate strength of technical requirement to satisfy customer requirements as indicated by symbols**

Instruction for Constructing the HOQ (4)

Instruction for Constructing the House of Quality

M Importance Weight of Technical Requirements
❖ **Importance Weight = Column sum of (Value of Relationship) * (Relative Weight (%) of Customer Requirements)**

N Relative Weight of Technical Requirements (%)
❖ **Normalize row of importance weights.**

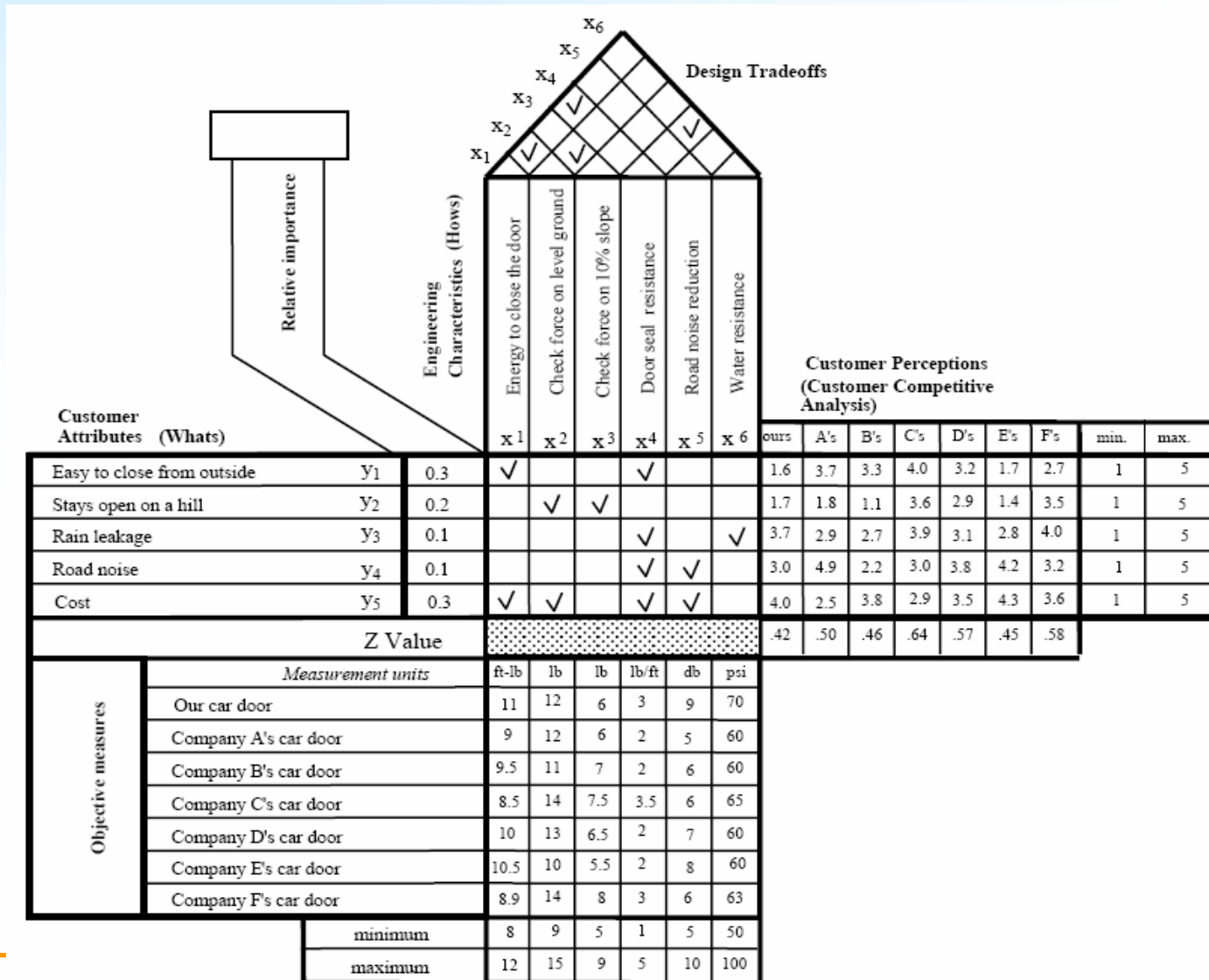
O Technical Comparison
❖ **Identify how well you and competitors are capable of meeting the technical requirements.**
❖ **Use scale 1 to 5: higher is better.**
❖ **Translate numerical values into symbols for visual comparisons.**

P Movement of Target
❖ **Use symbols to indicate desired direction for each corresponding technical requirement target value.**
↑ = increase ↓ = decrease x = meet specified nominal value

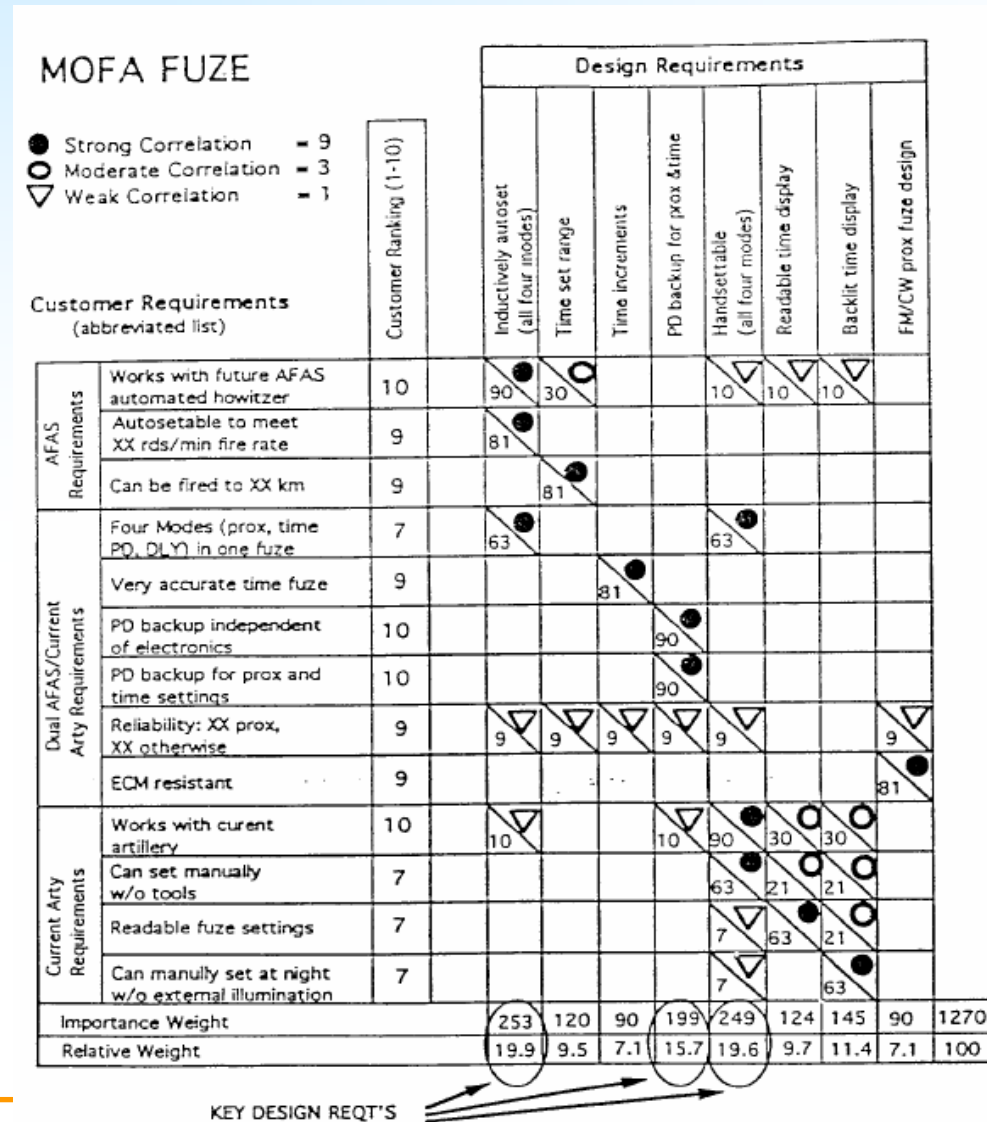
Q Target Values
❖ **Assign specific target values for as many requirements as possible.**
- Define specific goals and ranges for designing and engineers.
- Establish targets for trade studies and analyses.
❖ **Use historical data where possible.**
❖ **These are starting points that can be revised based on detailed analysis**

R Roof – Correlation Matrix
❖ **Identify and compare the interaction of implementing technical requirements to the established target values.**
● = strong positive ○ = positive x = negative □ = strong negative

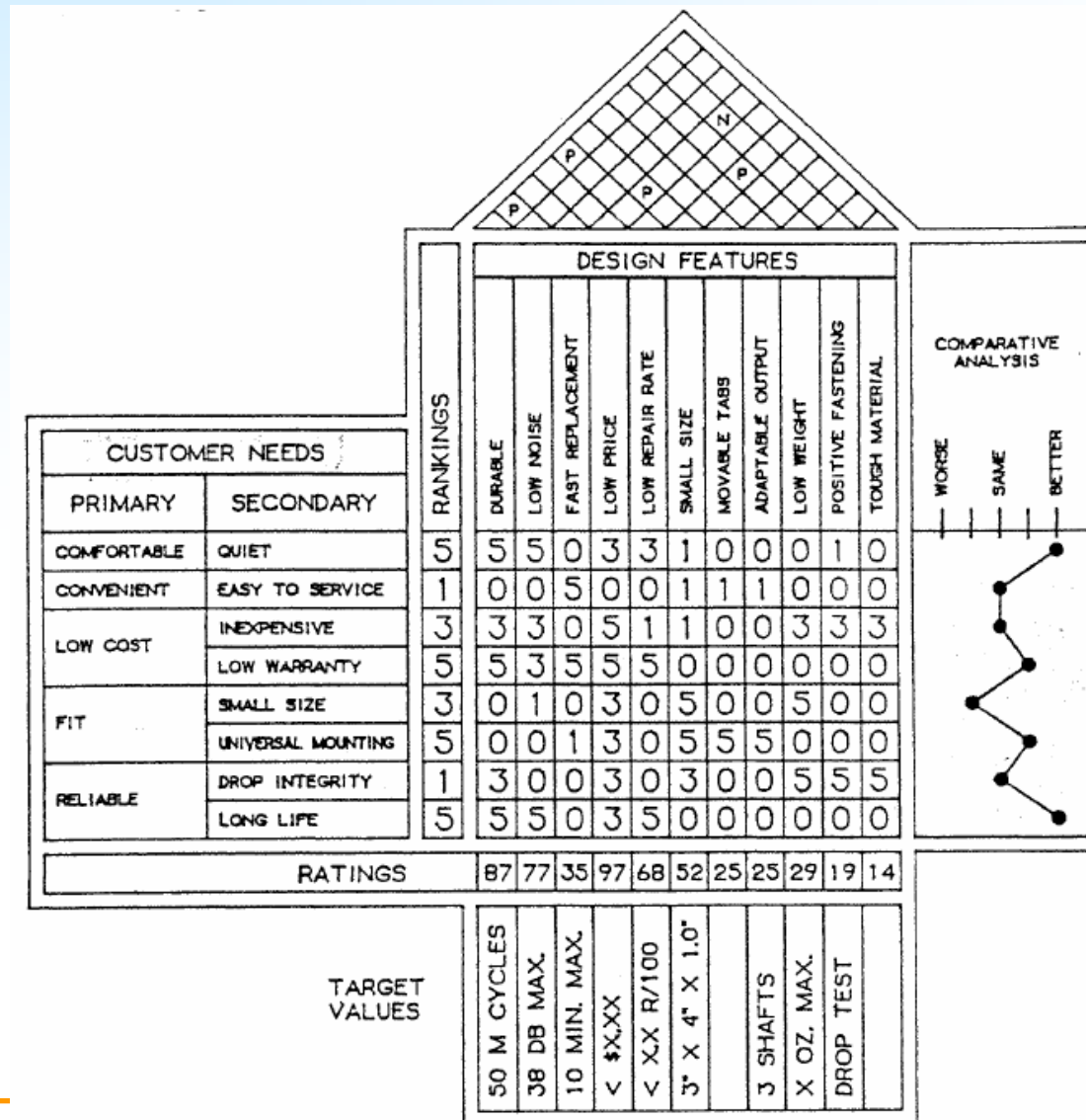
House of Quality: Car Door Example



House of Quality: MOFA FUZE Example



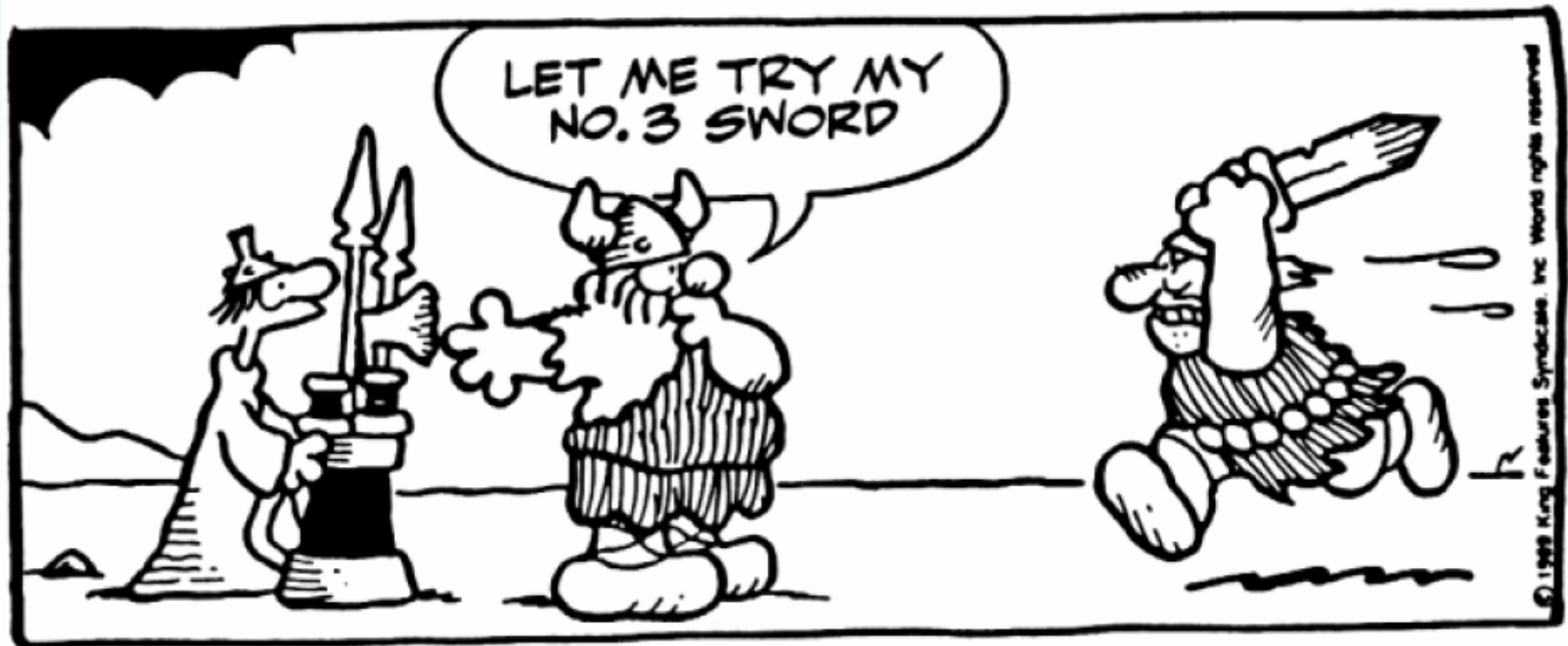
House of Quality: Air Conditioning Control Device



Common Mistakes

- ❖ **Incorrect Focus (QFD Everything)**
- ❖ **Lack of Teamwork**
- ❖ **“Hurry-up and Get-done” Attitude**
- ❖ **Stuck on Traditional Designs**
- ❖ **Inadequate / Changing Priorities**
- ❖ **Too much focus on “Charts”**

"Golf Thinking"



Managing the QFD Process: Points to Ponder

- ❖ **The process may look simple, but requires effort.**
- ❖ **Many of the entries look obvious – after they are written down**
- ❖ **If there aren't some “tough spots” the first time, or probably isn't being done right!**
- ❖ **Charts are not the objective.**

Suggestion for QFD Success

“ There is no magic to QFD; just plenty of intelligent, through work.”

“ QFD is not an easy process. It takes leadership and determination on the part of many people to dedicate the time and energy needed. But, that effort pales in comparison to the effort expended in a poorly planned project. ”

Find reasons to succeed, not excuse for failure !