

# Quality Engineering and Management

## Lecture VI

### Designing Quality Products and Processes

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# Designing Quality Products and Processes

## Product development

*Translates customer expectations for functional requirements into specific engineering and quality characteristics.*

# Designing Quality Products and Processes

## Phases of product development

- Concept
- Prototype design
- Prototype construction
- Pre-production
- Early – full scale production
- Full scale production

# Designing Quality Products and Processes

## Quality function deployment (QFD)

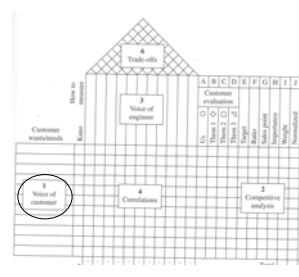
Product design matrix  
house of quality

six steps for building house of quality

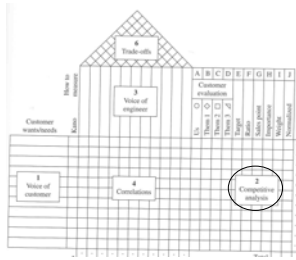
# Quality Function Deployment (QFD) House of Quality



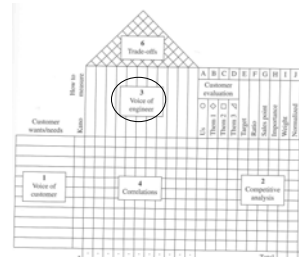
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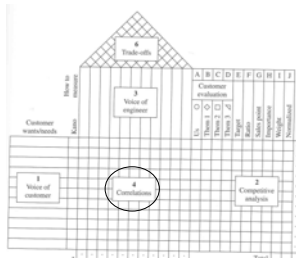
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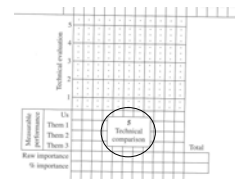
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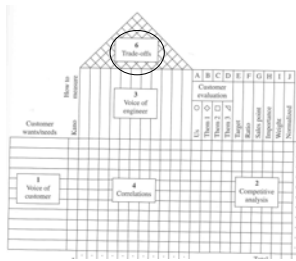
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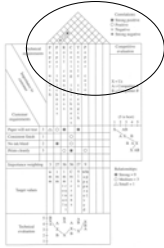
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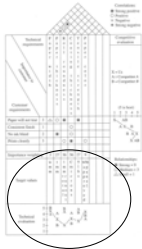
## Quality Function Deployment (QFD) House of Quality



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## Quality Function Deployment (QFD) House of Quality



## Taguchi Philosophy & Methods

### Philosophy

*Taguchi did for "on-line" process control*

*what*

*Deming did for "inspection"*

## Taguchi Philosophy & Methods

### Philosophy

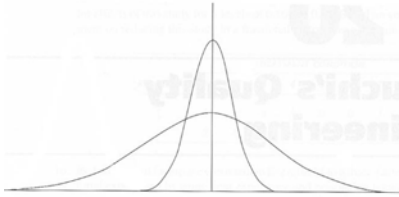
*"Robust" design*

*Robust product*

*Robust process*

## Tagachi Philosophy

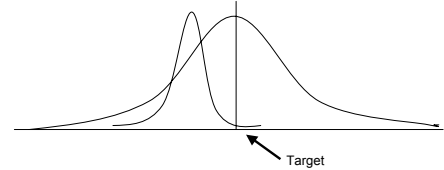
**Understanding variation in its own right**



## Tagachi Philosophy

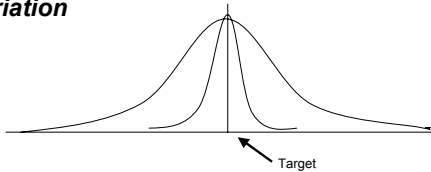
**Goal : two separate dimensions**

**“On target” and “Low variation”**



## Tagachi Philosophy

**Goal : To have a product that is “on target” with a minimum amount of variation**



## Tagachi Methods

**Measure of “Robustness”**

**Signal-to-noise ratio**

**A measure of how close the design is to the optimum “performance” of a product or process.**

## Tagachi Methods

**Parameter Design**

**Control factors**

**Noise factors**

## Design of Experiments for Product & Process Design

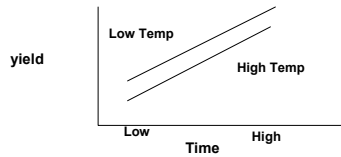
**Exploratory vs. confirmatory studies**

**Descriptive statistics**

**Inferential statistics**

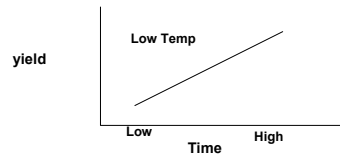
## Design of Experiments for Product & Process Design

### Multivariate studies Comparison with sequential two-way tests



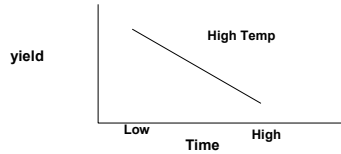
## Design of Experiments for Product & Process Design

### Multivariate studies Comparison with sequential two-way tests



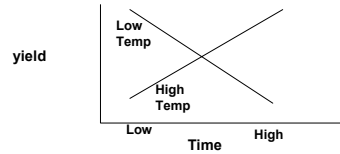
## Design of Experiments for Product & Process Design

### Multivariate studies Comparison with sequential two-way tests



## Design of Experiments for Product & Process Design

### Multivariate studies Comparison with sequential two-way tests



## Design for Six Sigma

### Process Improvement Methodologies DMAIC

**Define** - project objectives

**Measure** - data required for decisions

**Analyze** - to identify improvement needs

**Improve** - by implementing

**Control** - by monitoring effectiveness

## Design for Six Sigma (DFSS)

### Other Process Improvement Methodologies

**DMADV** - Define, Measure, Analyze, Design, Verify

**DCCDI** - Define, Customer Concept, Design, Implement

**IDOV** - Identify, Design, Optimize, Validate

**DMEDI** - Define, Measure, Explore, Develop, Implement

## ***Reliability***

***The ability of a product to perform  
a required function  
under stated conditions  
for a stated period of time***

## ***Reliability***

### ***Four implications of an reliability analysis***

- 1. Quantification of reliability in terms of probability***
- 2. A statement defining successful product performance***
- 3. A statement defining the environment in which the equipment must operate***
- 4. A statement of the required operating time between failures.***