Chapter 3-3

Philosophy, Structure, and Voice of the Customer
Six Sigma Defined

- **Six Sigma** (σ) is a customer focused, well defined problem solving methodology supported by a handful of powerful analytical tools.
- **Continuous improvement** is driven by the execution of carefully selected projects. The goal of the Six Sigma approach is to take small steps forward and no steps backward.
Customers are the center of GE's universe: they define quality. They expect performance, reliability, competitive prices, on-time delivery, service, clear and correct transaction processing and more. In every attribute that influences customer perception, we know that just being good is not enough. Delighting our customers is a necessity. Because if we don't do it, someone else will!
Voice of the Customer

The "voice of the customer" is a process used to capture the requirements/feedback from the customer (internal or external) to provide the customers with the best in class service/product quality. This process is all about being proactive and constantly innovative to capture the changing requirements of the customers with time.

The "voice of the customer" is the term used to describe the stated and unstated needs or requirements of the customer. The voice of the customer can be captured in a variety of ways: Direct discussion or interviews, surveys, focus groups, customer specifications, observation, warranty data, field reports, complaint logs, etc.
Voice-of-the-customer is

a crossfunctional, systems approach to gathering data on customer needs and perceptions of performance, that translates this data into useful information, highlighting opportunities to respond and foster extraordinary customer experience.
Definition of Customer

• Anyone whose success or satisfaction depends on one’s actions
• Analyze Customer Needs
• Prioritize customer needs.

Gather the Voice of the Customer
Control Limits Define “Voice of the Process” and Specification Limits Define “Voice of the Customer”

- Control limits represent “voice of the process”: Upper control limit (UCL) and lower control limit (LCL)
  - Derived statistically using process or product data
  - Help determine whether the process is stable
- Specification limits represent “voice of the customer”: Upper specification limit (USL) and lower specification limit (LSL)
  - Represent goals, requirements, or targets
  - Help determine whether the process is capable
Quality Function Deployment

- Is a structured method that is intended to transmit and translate customer requirements, that is, the
  - **Voice of the Customer**
- through each stage of the product development and production process, that is, through the product realization cycle.
- These requirements are the collection of customer needs, including all satisfiers, exciters/delighters, and dissatisfiers.
QFD Defined

- 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.
When to Use QFD

- Poor communications and expectations get lost in the complexity of product development.
- Lack of structure or logic to the allocation of product development resources.
- Lack of efficient and/or effective product/process development teamwork.
- Extended development time caused by excessive redesign, problem solving, or fire fighting.
History of QFD

- Developed By 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
Kano Model Categorizes Needs

Must Be Needs
- The needs are expected by the customer.
- Lack of fulfillment results in customer dissatisfaction while fulfillment will not particularly satisfy the customer.

More is Better
- Satisfaction is directly proportional to meeting the needs of the customer.

Delighters
- Customers are not dissatisfied with their absence but pleased when present.
It is critical that the **Must Be** and **More is Better** features are present before **Delighters** become effective in attaining a leadership position.
What Customers Want

Garvin’s Eight Dimensions
- Performance
- Features
- Conformance
- Aesthetics
- Reliability
- Durability
- Serviceability
- Perceived Quality
Dimensions of Service Quality

- **Reliability**: consistency, error-free dependability
- **Responsiveness**: willingness to help the customer
- **Tangibles**: environment for the service presented
- **Competence**: the right skills and knowledge required
- **Courtesy**: supplier’s behavior
- **Security**: freedom from danger or risk
- **Access**: ease of making contact
- **Communication**: understandable to the customer
- **Empathy**: adopting the customer’s viewpoint
Quality Function Deployment’s House of Quality

- Establishes the Flowdown
- Relates WHAT’S & HOW’S
- Ranks The Importance
Building the House

• The next set of slides explains how to construct the house of quality.
• It is presented as reference.
Building the House of Quality

1. Identify customer attributes
2. Identify design attributes / requirements
3. Relate the customer attributes to the design attributes.
4. Conduct an evaluation of competing products.
5. Evaluate design attributes and develop targets.
6. Determine which design attributes to deploy in the remainder of the process.
1. Identify Customer Attributes

- These are product or service requirements *IN THE CUSTOMER’S TERMS.*
  - Market research;
  - Surveys;
  - Focus groups.
- “What does the customer expect from the product?”
- “Why does the customer buy the product?”
- Salespeople and technicians can be important sources of information – both in terms of these two questions and in terms of product failure and repair.
- Often these are expanded into secondary and tertiary Needs/Requirements.
Customer Requirements

- "Voice of Customer" (VOC)
- Are “whats”
- Expressed in customer’s own language
- Qualitative, vague, ambiguous, incomplete, inconsistent
- Group session
- Categorization and organization
2. Identify Design Attributes.

- Design attributes are expressed in the language of the designer / engineer and represent the TECHNICAL characteristics (attributes) that must be deployed throughout the DESIGN, MANUFACTURING, and SERVICE PROCESSES.

- These must be measurable since the output will be controlled and compared to objective targets.

- The roof of the house of quality shows, symbolically, the interrelationships between design attributes.
3. Relating Customer & Design Attributes

- Symbolically we determine whether there is NO relationship, a WEAK one, MODERATE one, or STRONG relationship between each customer attribute and each design attribute.
- The purpose is to determine whether the final design attributes adequately cover customer attributes.
- Lack of a strong relationship between a customer attribute and any design attribute shows that the attribute is not adequately addressed or that the final product will have difficulty in meeting the expressed customer need.
- Similarly, if a design attribute does not affect any customer attribute, then it may be redundant or the designers may have missed some important customer attribute.
4. Add Market Evaluation & Key Selling Points

- This step includes identifying importance ratings for each customer attribute AND evaluating existing products/services for each of the attributes.
- Customer importance ratings represent the areas of greatest interest and highest expectations as expressed by the customer.
- Competitive evaluation helps to highlight the absolute strengths and weaknesses in competing products.
- This step enables designers to seek opportunities for improvement and links QFD to a company’s strategic vision and allows priorities to be set in the design process.
5. Evaluate Design Attributes of Competitive Products & Set Targets.

- This is USUALLY accomplished through in-house testing and then translated into MEASURABLE TERMS.
- The evaluations are compared with the competitive evaluation of customer attributes to determine inconsistency between customer evaluations and technical evaluations.
- For example, if a competing product is found to best satisfy a customer attribute, but the evaluation of the related design attribute indicates otherwise, then either the measures used are faulty, or else the product has an image difference that is affecting customer perceptions.
- On the basis of customer importance ratings and existing product strengths and weaknesses, targets and directions for each design attribute are set.
6. Select Design Attributes to be Deployed in the Remainder of the Process

- This means identifying the design attributes that:
  - Have a strong relationship to customer needs,
  - Have poor competitive performance,
  - Or are strong selling points.

- These attributes will need to be deployed or translated into the language of each function in the design and production process so that proper actions and controls are taken to ensure that the voice of the customer is maintained.

- Those attributes not identified as critical do not need such rigorous attention.
### TECHNICAL REQUIREMENTS

<table>
<thead>
<tr>
<th>CUSTOMER IMPORTANCE</th>
<th>Performance measures</th>
<th>Size of range</th>
<th>Technical details</th>
<th>PLANNING MATRIX</th>
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<tr>
<td>Meets European standards</td>
<td>Harness strength</td>
<td>Webbing strength</td>
<td>No. of colors</td>
<td>No. of sizes</td>
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<tr>
<td>Easy to put on</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comfortable when hanging</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>Fits over different clothes</td>
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<tr>
<td>Accessible gear loops</td>
<td>3</td>
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<td></td>
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<tr>
<td>Does not restrict movement</td>
<td>5</td>
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<td>Lightweight</td>
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<td>Safe</td>
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<tr>
<td>Attractive</td>
<td>2</td>
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</table>

### TECHNICAL PRIORITIES

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<th></th>
<th>54</th>
<th>81.2</th>
<th>63</th>
<th>23.4</th>
<th>70.2</th>
<th>191.6</th>
<th>98.6</th>
<th>30</th>
<th>612</th>
<th>Total (100%)</th>
<th>38</th>
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</thead>
</table>

### PERCENTAGE OF TOTAL

| | 9 | 13 | 10 | 4 | 12 | 31 | 16 | 5 | | |

### DESIGN TARGETS

<p>| | | | | | | | | | | | |</p>
<table>
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<tr>
<th></th>
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</thead>
<tbody>
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<td>250</td>
<td>5</td>
<td>4</td>
<td>4mm</td>
<td>1</td>
<td>4</td>
<td></td>
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<tr>
<td>Competitor A's product</td>
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<td>321</td>
<td>3</td>
<td>5</td>
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<td>4</td>
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<td></td>
</tr>
<tr>
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<td>6</td>
<td>4</td>
<td>3mm</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

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**Key to interrelationship matrix symbols**

- Strong interrelationship
- Medium interrelationship
- Weak interrelationship

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**Key to roof / correlation matrix symbols**

+ Positive / Supporting
- Negative / Tradeoff

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Sample House of Quality © Dr. A. J. Lowe 2000
Expanded House of Quality

Adapted from QFD Chapter in 1st Edition of Manufacturing Engineering Handbook
What's

- This is a list of what the customer wants or what is to be achieved. When the "Expanded House of Quality" is used with end user requirements, these would be customer statements about what they want to see in the product.
- **Hint:** A common problem is that a lot of customers tend to state their requirements in terms of a possible solution. It is important that you understand the true requirement rather than accepting customer statements at face value.
Hows

- This is a list of what your company can measure and control in order to ensure that you are going to satisfy the customer's requirements. Typically, the entries on this list are parameters for which a means of measurement and a measurable target value can be established. Sometimes HOWs are also known as Quality Characteristics or Design Requirements.

- **Hint:** It is best to try to keep these entries as concept-independent as possible. Failure to do this will lock you into a particular design solution that will almost never be what you would arrive at if you do QFD correctly. For example, if you were developing the lock for a car door you might be tempted to define HOWs such as "Key insert force" and "Key turn torque". These both imply that the lock will be key actuated. You will have immediately eliminated concepts such as combination locks that might have security and cost advantages for your particular application. A better HOW might be "Lock/Unlock Work" which could be measured for both key operated or combination operated locks.
Whys

- Conceptually, this is a list that describes the current market. It is a way of explaining why this product needs to exist. It indicates what data will be used to prioritize the list of WHATs.

- Commonly included are lists of the customer groups your product must satisfy and their importance relative to each other. Also included are lists of products that will compete with yours in the marketplace.
How Muches

- This list is used to specify how much of each HOW is required to satisfy the WHATs. Commonly it contains a listing of the products on which testing will be performed. This testing helps establish realistic target values for the HOWs.
- It also includes entries where the priority of each of the HOWs can be established. In general,
- WHYs and HOW MUCHes are very similar.
  - WHYs lead to the importance of the WHATs
  - HOW MUCHes document and refine the importance of the HOWs.
**Whats vs. Hows**

- This is a relationship matrix that correlates what the customer wants from a product and how the company can meet those requirements. It is the core matrix of QFD.
- Relationships within this matrix are usually defined using a strong, medium, weak, or none scale. If a HOW is a strong measure of compliance with a WHAT, then the WHAT and HOW are strongly correlated.
- Similarly, if a HOW provides no indication as to whether your product complies with the WHAT, there is probably no relationship.

Filling and analyzing this matrix will likely take a large portion of the time you spend in QFD meetings.
Whats vs. Whys

- This is a relationship matrix that is used to prioritize the WHATs based upon market information. Usually, the data in this matrix consists of ratings on how important different customer groups perceive each of the WHATs to be.

- Ratings of how well competitive products are perceived to meet each of the WHATs can also be included here. Averaging the stated importance ratings and factoring in where your product is perceived relative to your competition helps establish the overall importance of each WHAT.
Hows vs. How Muches

• This is a relationship matrix that helps you decide what the next step in the project should be. Typically, this matrix includes calculated values which identify the relative importance of each of the HOWs.

• Also included is information about how your competition performs relative to each of the HOWs. This information can lead you to establish realistic and measurable target values which, if met, will ensure that you meet the customer's requirements.
Hows vs. Hows

- This matrix forms the roof of the "Expanded House of Quality" and gives it its name. It is used to identify the interactions between different HOWs.
- The relationships in this matrix are rated as Strong Positive, Positive, Negative, Strong Negative, and None.
  - If two HOWs help each other meet their target values, they are rated as Positive or Strong Positive.
  - If meeting one HOW's target value makes it harder or impossible to meet another HOW's target, those two HOWs are rated with a Negative or Strong Negative relationship.
Six Sigma Philosophy and Organization

A brief synopsis of the key points of the six sigma philosophy that Green Belts and Black Belts are expected to be knowledgeable of.
What Distinguishes Six Sigma from the Other Quality Improvement Methods?

a. The use of Greek in its name
b. Better marketing
c. The use of statistics
d. Justifying improvements in the language of management

Does the name Mikel Harry ring a bell?
Savings

- A jet engine distributor added approximately $1 million in annual revenue.
- A hospital increased captured revenue by over half a million annually and save over $300,000 yearly by reducing no show and cancellation rates for procedures.
- A soft drink company decreased time for Engineering Change Notice from 56 days to 7 days
More Savings

• A hospital reduced the time required to provide timely information about lab tests and saved over $140,000 annually.

• A drug store chain reduced inventory of perishable pharmaceuticals by $173 million per year.

A telecommunications company saved $5.2 million annually by improving the scheduling system for technician dispatches.
Six Sigma Structured Approach

- Six Sigma involves a series of steps designed to lead the organization through the gauntlet of process improvement. Major steps include:
  - Define
  - Measure
  - Analyze
  - Improve
  - Implement
  - Control (Standardize and Validate)
Memory Trip

- Can you remember back to your first science class and the scientific method?
- Are there any similarities between the scientific method and DMAIIC?
Define

The first step is to define. This includes identifying the problem and setting the scope. It also includes the following:

- Identifying customers and requirements?
- Determining the outputs?
- Determining the inputs?
- Determining what is critical
- Determining what to measure
- Determining what we want to accomplish

Tools sometimes used

- Process Analysis
- Flow Charting
- Check Sheets
- Pareto Analysis
- Cause and Effect Diagrams
- FMEA (Failure Mode Effects Analysis)
The second step is to **measure**

- Identify and verify critical quality characteristics
- Estimate current capability
- Determine where you are relative to desired objectives
Measure

• Process Capability
  – Percent Nonconforming
  – Capability Indices
• Measurement Systems Analysis
• Cost of Quality
  – Appraisal
  – Detection
  – Failure
Analyze

- The third step is to **analyze**. This makes sense out of the data that is collected during measure.
- This shows the amount of improvement that might be possible to make the critical quality characteristic “best in class.”

**Possible Tools**
- Descriptive Statistics
- Inferential Statistics
- Probability
In order to improve, possible improvements are evaluated in a logical and planned fashion.

- Design of Experiments
  - ANOVA
  - Factorial
- Simulation
- Cost Justification
- FMEA
- Project Management
- Correlation
- Regression
  - Linear
  - Multivariate
Sources of Improvements

- Best Practices
- Ideas from Other Projects
- Brainstorming
- Mind Mapping
- Performance Targets
- Benchmark Ideas
- "Discoveries" During Analysis
- Six Thinking Hats Technique
- Project Goals
- Root Causes

Generate Improvement Ideas

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Implement

- Improvements are implemented in a logical and planned fashion
- A project plan is developed and managed
Control

• The final stage is control. In the control phase measures have been implemented and steps are taken to make sure improvements are maintained. We also validate that the improvement...the reduction in variation...has actually occurred and the suggested benefits have been “seen.”

• Some Tools
  - Statistical Process Control
  - Cost of Quality
  - Cost Analysis
  - ISO 9000
**DMAIIC Overview**

**DEFINE THE OPPORTUNITY**
- Improve on what matters most to the client
- Significantly impact the bottom line

**MEASURE THE CURRENT PERFORMANCE**
- Map the process, gather initial performance data and determine current “Sigma” level
- Obtain client input, factors Critical to Quality (CTQ)

**ANALYZE THE CURRENT PROCESSES**
- Perform cause-effect analysis to determine reasons for gaps in performance

**IMPROVE PROCESS EFFICIENCY**
- Determine breakthroughs, design future state: new process, new “Sigma” level
- Create dashboards, scorecards and plans

**IMPLEMENT IMPROVEMENTS**
- Execute plans, overcome barriers
- Transition to the new process

**CONTROL AND ADJUST NEW PROCESSES**
- Measure improvements and breakthroughs
- Report dashboard, scorecard data and client feedback

**Client Driven, Consistent, Metrics Focused, Results Oriented**
Implementation Strategy

- Top Management Support and Participation
- Project Identification
- Resource Allocation
- Data Based Decision Making
- Measurement and Feedback
Implementation

The process of implementing Six Sigma must be a top down approach. Responsibility must lie with senior management. Senior management must drive the process through the organization. Elements of this include careful selection of projects, allocation of resources, and decisions based on the measurements.
Top Management Support / Participation

Leaders of successful Six Sigma implementations make it a top priority. They devote enormous amounts of thought, energy, time, and personal resources to making sure the Six Sigma succeeds.

In effect, they challenge employees.

"Would you tell me please which way I ought to go from here?" asked Alice. "That depends a good deal on where you want to get to," said the Cat. "I don't much care," said Alice. "Then it doesn't matter which way you go," said the Cat.
Six Sigma “Challenge”

- Senior leadership establishes its Six Sigma vision, customer satisfaction promise, goal, and new measurement indices
- This vision should fit within context of existing quality policy
- Establishes the common goal of reducing variability
Develop Structure

Six Sigma has used the language
- Steering Committee
- Champion
- Yellow Belt
- Green Belt
- Black Belt
- Master Black Belt
- Master Black Belt Trainer

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Steering Committee

- Identifies projects
- Identifies black belts
- Allocates resources
- Monitors progress
- Reviews effectiveness
- Establish implementation strategy and policies
Champions

- Key management personnel who provide support, resources, and encouragement for the process
- Champions require a more in-depth understanding of the methods used, especially the measurements and the interpretation of the process measurements
Green Belt

A green belt is an introductory participant in the process. Green belts understand concepts of problem solving, data collection, data interpretation, variation, process capability, and cost analysis.
Black Belt

- Black belts are “thoroughly” trained individuals knowledgeable of all the analysis tools
- Black belt training is typically structured around a project where the analysis tools are applied as part of the training
Black Belt

Black belts perform the following tasks:

- Teach
- Coach
- Transfer knowledge
- Identify opportunities
- Influence the organizational use of the Six Sigma methods
Master Black Belt

- The master black belt has demonstrated proficiency by documenting saving in excess of a predetermined amount. Master black belts also are competent teachers.
- Title is one given as recognition for outstanding performance or as the result of additional training, including train the trainer.
Outside-In Thinking

Six Sigma requires us to look at our business from the customer’s perspective, not ours. In other words, we must look at our processes from the outside-in. By understanding the transaction lifecycle from the customer’s needs and processes, we can discover what they are seeing and feeling. With this knowledge, we can identify areas where we can add significant value or improvement from their perspective.
Data Based Decision Making

- Obtaining a return on your Six Sigma investment requires that you make use of the information you obtain.
- In successful Six Sigma organizations both strategic and operational decisions are guided by facts and data.
- EOE
Summary

Six Sigma Process

- Define
- Measure
- Analyze
- Improve
- Implement
- Control/Standardize

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