

Saurabh Chandak Mechanical Engineering



Contents

- Understanding Six Sigma
- History of Six Sigma
- Six Sigma Methodologies & Tools
- Roles & Responsibilities
- Practical Insights
- Cost Benefit Analysis

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Six Sigma – Basic Terminology

• The term "Sigma " is used to designate the distribution or spread about the mean (average) of any process or procedure.

• For a business or manufacturing process, the sigma value is a metric that indicates how well that process is performing.

• The higher the sigma value, the better. Sigma measures the capability of the process to perform defect-free-work.

• A **defect** is anything that results in customer dissatisfaction.

Overview of Six Sigma

It is a Philosophy

- Anything less than ideal is an opportunity for improvement
- Defects costs money
- Understanding processes and improving them is the most efficient way to achieve lasting results
 It is Statistics
 6 Sig

It is a Process

 To achieve this level of performance you need to:
 Define, Measure, Analyse, Improve and Control

6 Sigma processes will produce less than 3.4 defects per million opportunities

Measuring Process Performance

The pizza delivery example

• Customers want their pizza delivered fast!





Guarantee = "30 minutes or less"

What if we measured performance and found an average delivery time of 23.5 minutes?
On-time performance is great, right?
Customers must be happy, right?

Customers do <u>not</u> feel averages!

How often are we delivering on time? Answer: Look at the variation!



• Managing by the average doesn't tell the whole story. The average *and* the variation *together* show what's happening.

Reduce Variation to Improve Performance How many standard deviations can you "fit" within customer expectations?



• Sigma level measures how often we meet (or fail to meet) the requirement(s) of our customer(s).

Performance Standards

The Sigma value indicates how often defects are likely to occur. The higher the sigma value, the less likely a process will produce defects.



Putting Six Sigma in Perspective! <u>Six Sigma</u> quality (< 3.4 DPMO).

Airline passenger safety ~ 8.2 σ

 Currently at 2.6 DPMO (incidents per million takeoffs and landings)

• Airline baggage handling $\sim 3 \sigma$



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History of Six Sigma



Where can Six Sigma be applied?





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Six Sigma: Changing the Decision-Making Process

Decision-Making Growth Path

- 1. Intuition, gut feel, I think ...
- 2. We have **Raw Data** and look at it.
- 3. We make graphs/charts of the data.
- 4. We use advanced statistical tools to evaluate the data.

Types of Problems You Will Normally Solve

Simple

Complex

- Six Sigma is a data-driven (not intution) method that we use to improve the performance of our products and processes in any functional area
- A team based approach to solving complex problems

DMAIC - simplified

- **D**efine
 - What is important?
- Measure
 - How are we doing?
- Analyze
 - What is wrong?
- Improve
 - Fix what's wrong
- Control
 - Ensure gains are maintained to guarantee performance





D Define

Measure

Analyze

I Improve

C Control 6/10/2012 • VoC - Who wants the project and why ?

The scope of project / improvement (SMART Objective – Specific, Measurable, Achievable, Relevant, Timely)

Key team members / resources for the project

Critical milestones and stakeholder review

Budget allocation



D Define

Measure

Analyze

Improve

C Control 6/10/2012

Ensure measurement system reliability

- Is tool used to measure the output variable flawed ?

Collect data

- How many data points do you need to collect ?
- How many days do you need to collect data for ?
- What is the sampling strategy ?
- Who will collect data and how will data get stored ?





Improve

Reduce the number of KPIVs by applying various tools

Don't focus on symptoms, find the root cause

Conduct DOE to finalize KPIVs



D Define

Measure

Analyze

I Improve

C Control 6/10/2012 Present recommendations to process owner.

- Pilot run - Formulate Pilot run.
- Test improved process (run pilot).
- Analyze pilot and results.
- Develop implementation plan.
 - Prepare final presentation.
 - Present final recommendation to Management Team.



D Define

M Measure

Analyze

Improve

C Control 6/10/2012 Don't be too hasty to declare victory.

How will you maintain to gains made?
 Change policy & procedures

- Change drawings
- Change planning
- Poka Yoke
- Training

Knowledge Sharing, Six Sigma Database

The Funneling Effect



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Six Sigma Roles: Belts

- Green Belt Applies quality and statistical tools; drives continuous improvement; 20-40% time allocation to Six Sigma; completes minimum 3 projects for certification
- Black Belt 100% dedicated to Six Sigma, develops teams; known as a change agent; completes minimum 5 projects in 2 years for certification
- Master Black Belt Conducts belt training, coaches, mentors, ensures project achievement; known as an expert in Six Sigma; 2 year program





Well Supported Team Structure



Flow of a Typical Six Sigma Project



 Hopper – Database that holds potential projects; all projects must pass through the hopper and be evaluated by the company's management, in advance

 Duration - Parameters allow a 4-6 month duration (DMAIC) or a 6-9 month duration (DFSS) for a project to be completed



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Use common sense – Some tools may not be applicable to your project

Don't set too ambitious deadlines

Deadline is dead line !

On-line help can be useful but practical experience is must

"Nurse, get on the internet, go to SURGERY.COM, scroll down and click on the 'Are you totally lost?' icon."

Why Six Sigma Works

- Team approach Operator/process owner involvement, opinions are heard, democratic approach. Unlike Head or MD taking decisions without consulting the middle management/process owners
- Respect understanding human nature
- Well defined focused approach
- Visibility to top management an increased emphasis on strong and passionate management leadership and support.
 - A special infrastructure of "Champions," "Master Black Belts," "Black Belts," "Green Belts", etc. to lead and implement the Six Sigma approach.
- Fresh set of eyes

• Data driven decision making – effective statistical tools.

Harvesting the Fruit of Six Sigma

Sweet Fruit Design for Six Sigma

Bulk of Fruit Process Optimization

Low Hanging Fruit Basic Tools

Ground Fruit Logic and Intuition

Types of Savings

Hard Savings:

Cost Reduction

- Energy Saving
- Raw Material saving
- Reduced Rejection, Waste, Repair

Increased Revenue

- Increased production
- Reduced cycle time
- Quality Improvement

Cash flow improvement

Reduced cash tied up in inventory

Cost and Capital avoidance

Reduced maintenance/rework costs

Types of Savings

Soft Savings:

Customer Satisfaction / Loyalty
Employee Satisfaction

Cost of Six Sigma Project

Direct Payroll

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Full time (Black Belts, Master Black Belts)
 Indirect Payroll

 Time by executives, team members, data collection

Training and Consulting

Black Belt course, Consultant charges etc.

Improvement Implementation Costs

 Installing new solution, IT driven solutions etc.

References.....

• <u>The Six Sigma Way</u> (ISBN 0-07-135806-4) by Pande, Neuman, and Cavanaugh

• <u>The Power of Six Sigma (ISBN 0-7931-4434-5</u>) by Subir Chowdhury

- <u>Six Sigma</u> (ISBN 0-385-49437-8) by Harry and Schroeder.
- <u>The Six Sigma Handbook</u> (ISBN 0-07-137233-4) by Pyzdek is more technical and becoming the 'handbook' for Black Belts.

Thanks