Introduction to Green Belt

Six Sigma: Transform data into valuable information

Learning objectives:

Upon completion of the Green Belt training, participants will be able to:

1. Learn the basic Six Sigma concepts.
2. Understand the DMAIC methodology.
3. Apply improvements to all kinds of internal processes (e.g., sales, purchasing, logistics, HR, finance, services, manufacturing, etc.) and make the most out of the available data.

Content

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I. Background

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Productivity and its limitations

The 6 M´s

Manpower (People)
Materials
Methods
Machines
Mother Nature (Environment)
Measurements

Inputs

PROCESSES

Parameters

Products/ Services

Quality
Cost
Response / Delivery time
Safety
Motivation
Social Impact
Environmental impact

Outputs

$$\text{Productivity} = \frac{\text{Outputs}}{\text{Inputs}}$$

2

Limitations to Productivity

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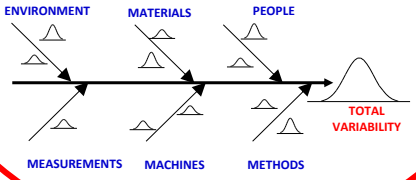
Muri Overburden	Mura Variability	Muda Waste
▪ Overbearing tasks ▪ Work-related stress ▪ High-risk tasks	**Total Variability** ▪ The variation that results from all process inputs	▪ Overproduction ▪ Excess inventory ▪ Defects and Rework ▪ Unnecessary movements ▪ Overprocessing ▪ Waiting and Searching ▪ Transport ▪ Waste of energy ▪ Talent without action ▪ Contamination / Pollution



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Variation around a target value

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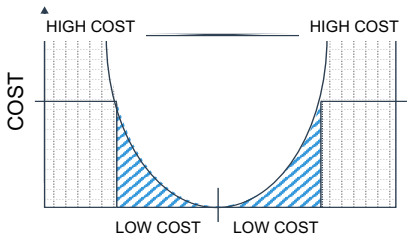
Variation around a target value affects cost in four important ways:

1. Fluctuations around the target value increase the cost of existing operations.
2. Fluctuations around a target value increase the cost of subsequent operations in the process.
3. Variation "bulges" processes in terms of tolerance, resources, raw materials, and the number of units started.
4. Variation decreases the efficiency of a process due to the need for increasing process complexity (e.g. rework or inspection).



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Start of Six Sigma

Bill Smith & Mikel J Harry

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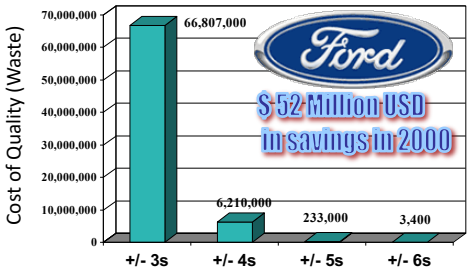
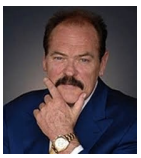
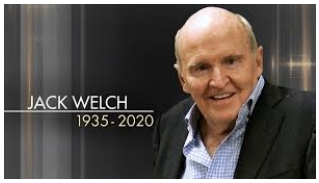
- In 1980, Motorola established a goal to improve quality levels by 10 times over the next 5 years. By 1989, they were able to improve the quality of their products and services by 100 times (as compared to its goal in 1980). Motorola achieved approximately $4.5 billion USD in savings between 1997 and 1999. In recognition of their developing and implementing the Six Sigma initiative, Motorola received the Malcolm Baldrige Quality Award in 1988.
- Allied Signal achieved more than $2 billion in savings from 1994-1999.
- GE achieved more than $3 billion in savings in two years (1998-99).



MOTOROLA





Lean Six Sigma integration

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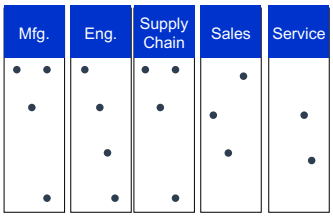
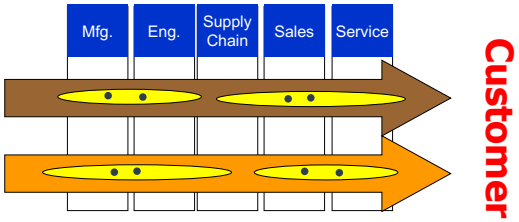
Six Sigma



Lean Six Sigma



= Six Sigma Project
= Activities

- Discrete projects targeting specific problems
- Focus on individual projects
- Reduction of variability to ensure quality and productivity

- Value Stream Map (VSM) processes
- Focus on cross-functional teams
- Reduction of "waste" to ensure quality and speed

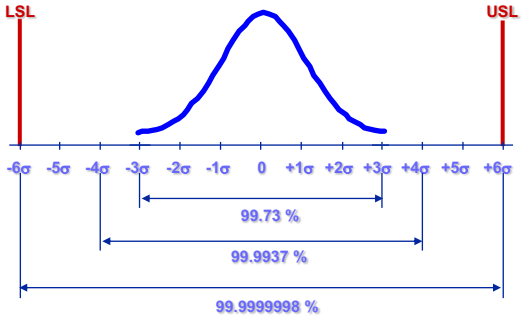
II. What is Six Sigma?

- A **work philosophy**
- A **metric**
- A **goal**

What is Six Sigma?

- As a **work philosophy**, Six Sigma is about the continuous improvement of processes and products supported by the implementation of the DMAIC methodology, which is primarily achieved by applying statistical tools and methods.
- As a **metric**, Six Sigma represents a way of measuring process performance with regard to the level of out-of-spec products and services.
- As a **goal**, a process with a Six Sigma quality level statistically translates to having world-class quality and not producing defective products or services.

Six Sigma Chart



Sigma Level	Defect per million opportunities (DPMO)	Yield
6	3	99.9997%
5	233	99.997%
4	6,210	99.379%
3	66,807	93.32%
2	308,537	69.20%
1	690,000	31%

Other meanings for Sigma levels

Sigma Level	Parts per million (PPM)	Quality Cost	Classification	# of mispelled words
6	3.4	<10% of sales	World-Class	1 in a small bookstore
5	233	10-15% of sales		1 in several books
4	6,210	15-20% of sales	Average	1 in 31 pages
3	66,807	20-30% of sales		1.35 per page
2	308,537	30-40% of sales	Non-competitive	23 per page
1	690,000			159 per page

Harry (1998) & McFadden (1993)

"*Six Sigma* is about solving business problems by *improving processes."* (*Snee 2001*)

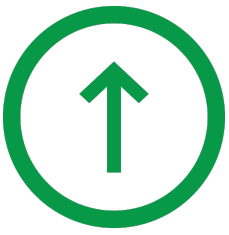
The importance of data

- In recent years, organizations have acquired modern information systems to control all key functions and have generated an enormous amount of **data**.
- These massive amounts of data come from various areas, including:
  - Human Resources
  - Sales
  - Logistics
  - Services
  - Rejects
  - Manufacturing
  - Investments
  - Finance
  - Purchases
  - Marketing
  - Inventory
  - Maintenance

Big Data → **Industry transformation**

Competitive advantages

- **Six Sigma** transforms data into information and valuable decisions, thereby increasing productivity and profitability.



III. Six Sigma methodology

DEFINE

- Define the problem, document the project, select and form the teams, and build leadership support.

MEASURE

- Define and describe the process.
- Evaluate measurement systems.
- Collect and graph data to understand behavior, cycles, and patterns.
- Evaluate process capability and compare it to the objectives.

ANALYZE

- Determine key variables that generate variability and that represent the root causes for the defined problems.

IMPROVE

- Optimize the process and make it robust
- Validate improvements

CONTROL

- Control and monitor the process
- Continuously improve

Six Sigma tools

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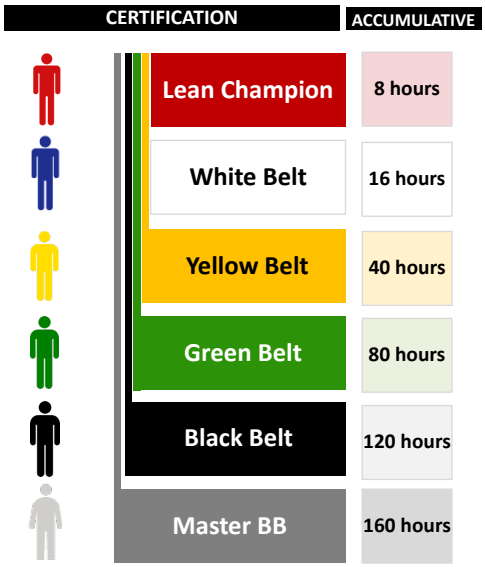
1. Introduction	Introduction to Green Belt
2. Define	Project Definition
	VoC (Voice of the Customer)
	Kano Model
	Critical-to-Quality Tree
	Quality Function Deployment (QFD)
3. Measure and Map	Process Maps
	Measurement Systems Analysis (MSA)
	Basic Statistics
	Sampling
	Histograms
	Process Capability
	Process Performance
4. Analyze	Box Plots
	Multi-Vari Analysis
	Analysis of Variance (ANOVA)
	Correlation
5. Improve	Design of Experiments (DOE)
6. Control	Statistical Process Control (SPC)
	Control Plan

IV. Six Sigma Structure



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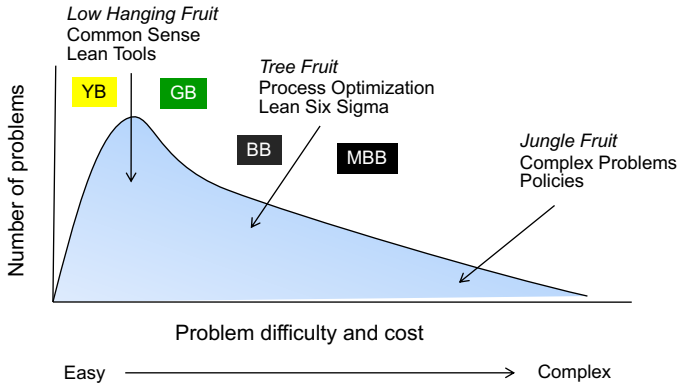
Problem and project selection



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Responsibilities of a Green Belt

10 to 20 GBs for every 100 employees

Experts in the Lean and Six Sigma tools and methodologies.

As an individual contributor

- Maintain a clean and orderly work area and standardize work to ensure speed and quality.
- Utilize both Lean and Six Sigma tools in order to solve problems and implement continuous improvement.

As a team leader

- Be the leader of basic improvement projects and provide specific support for the solution of problems.
- Train Yellow Belts and White Belts.

Knowledge

- Lean tools for speed
- DMAIC Methodology
- Statistical tools for quality, and administrative improvement