Intro to Lean Six Sigma

A practical introduction to the Lean Six Sigma methodology

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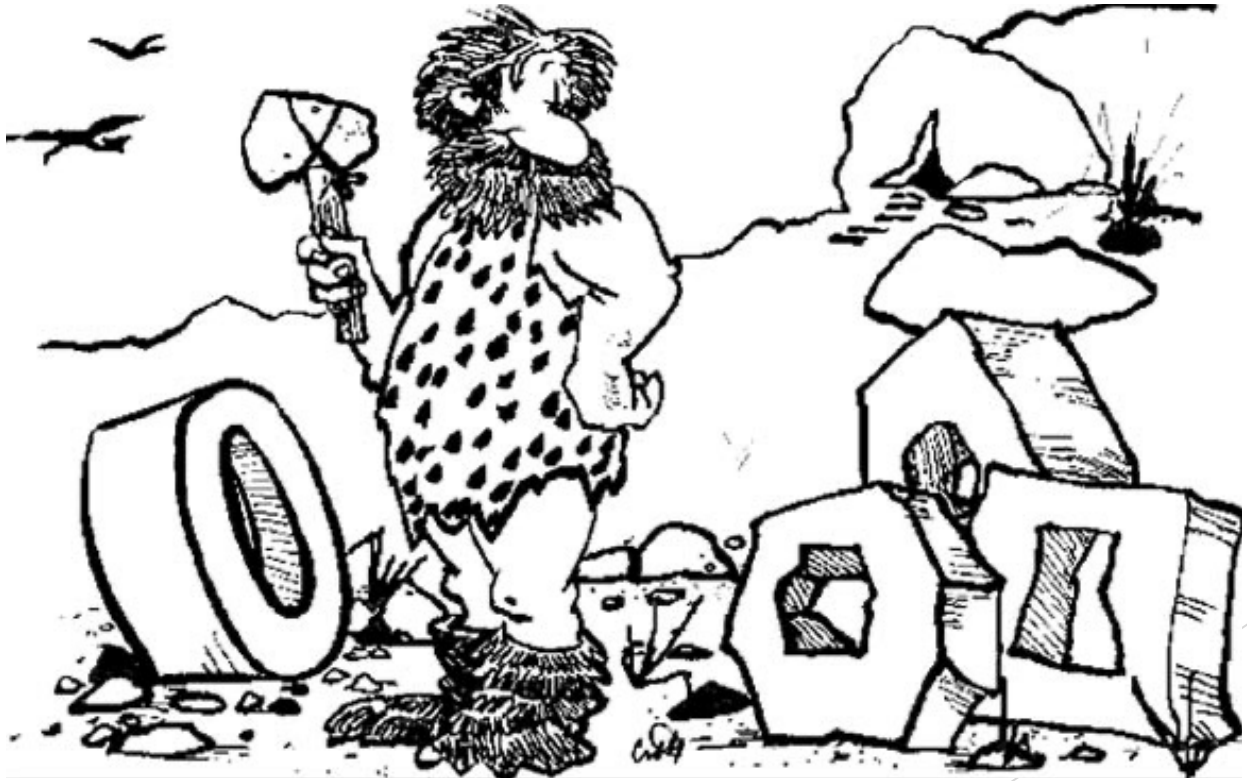
Agenda

- Intro to Continuous Improvement
- Lean Waste Elimination
- Lean Six Sigma



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What you will learn

- The importance of Continuous Improvement.
- How Lean is used to improve processes and eliminate waste.
- How Lean Six Sigma is used to control and eradicate variation.
- Why process variation is undesirable.
- How the DMAIC methodology is used to accomplish Lean Six Sigma objectives.

Intro to Continuous Improvement

Why focus on Continuous Improvement?

Creates Engaged, Accountable & Motivated Employees
Continuous improvement becomes everyone's responsibility while empowering employees to suggest solutions and take the lead in implementing those solutions

Gets Everyone Speaking the Same Language
Creates the opportunity to create standards, establish best practices, and formalize procedures across the organization

Creates Competitive Advantage
As the focus on the customer increases, the understanding of customer needs evolves, and the value of our products and services increase resulting in more competitive offerings

Frees-Up Resources
More efficient processes free up time, people, and resources to focus on new opportunities

Better Acceptance of Change
Employees will become used to the notion of change and will therefore become more open to new ideas and ways of doing things

Improves Customer Service
An improved understanding of the customer leads to increased customer empathy and motivates employees to deliver on customer needs

Lean Methodology

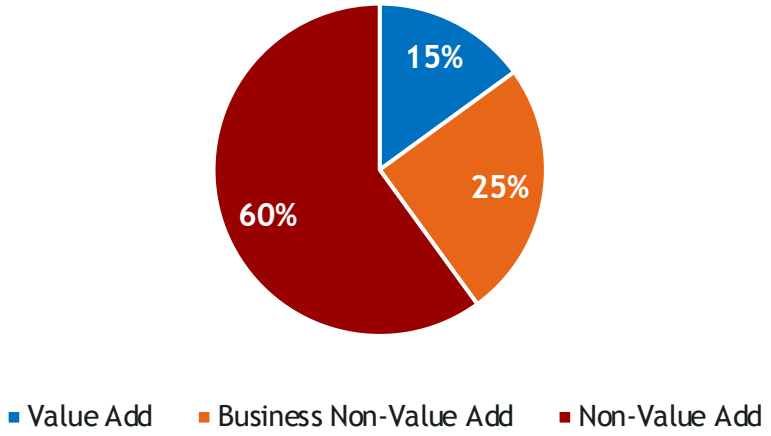
Lean focuses on waste elimination because waste diminishes the value creation process

Lean Theory: The Customer defines **Value**

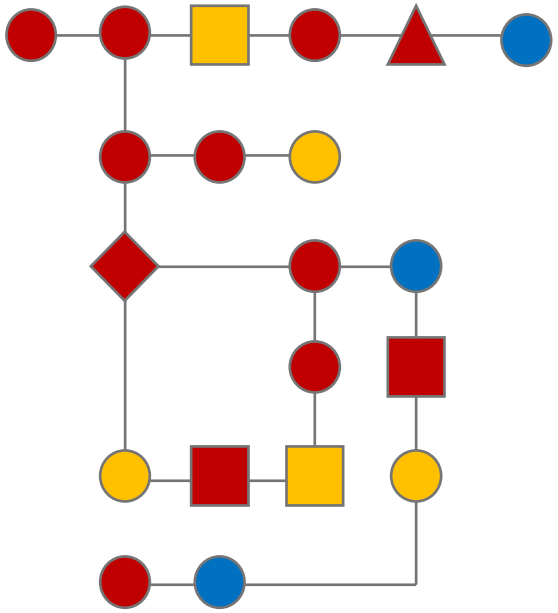
Focus: Eliminate unnecessary steps in the process that fail to deliver customer value.

Measurement: Improved process flow (e.g. improved cycle time, reduced variable costs)

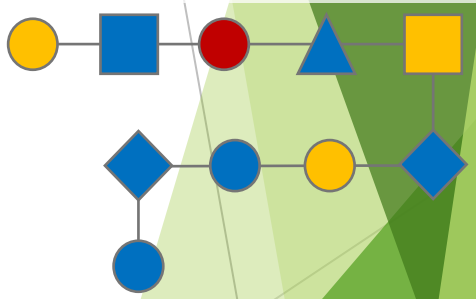
The Distribution of Value in a Process



What most processes look like

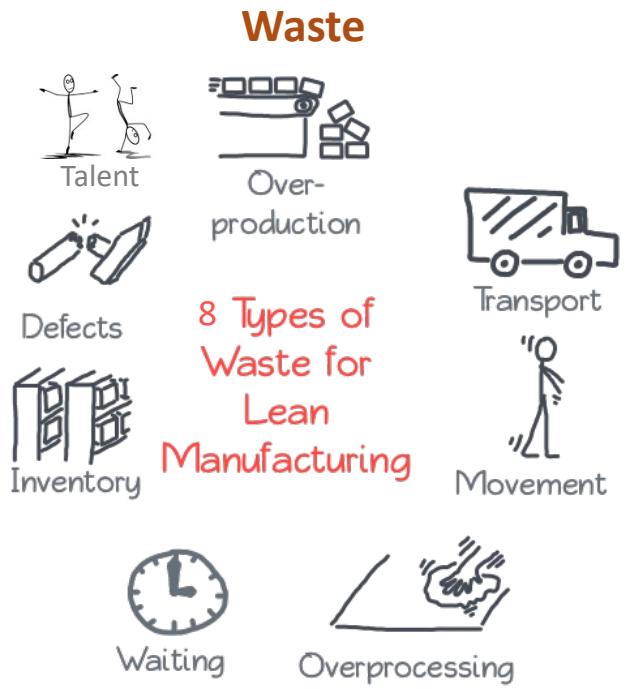


What we wish it would look like



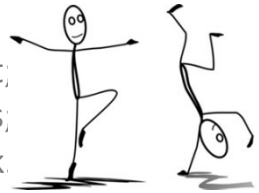
The objective of Lean

The purpose of Lean is to improve process flow and deliver only the output that is valuable to the customer.



A perfect process is one that has no waste and uses a minimum of resources.

The eight types of Muda (Waste)



Underemployment,
Resources doing non-value add tasks,
Shunned front-line feedback

Talent

Over-production

Producing anything earlier or in greater quantities than is needed for immediate consumption

Time, effort and materials used to repair defects

Defects

Transport

Any transportation of materials or work

8 Types of Waste for Lean Manufacturing

Any more than the minimum FGs, WIP, or raw materials needed to satisfy the immediate need

Inventory

Movement

Any unnecessary movement within a work process

Time spent waiting rather than adding value

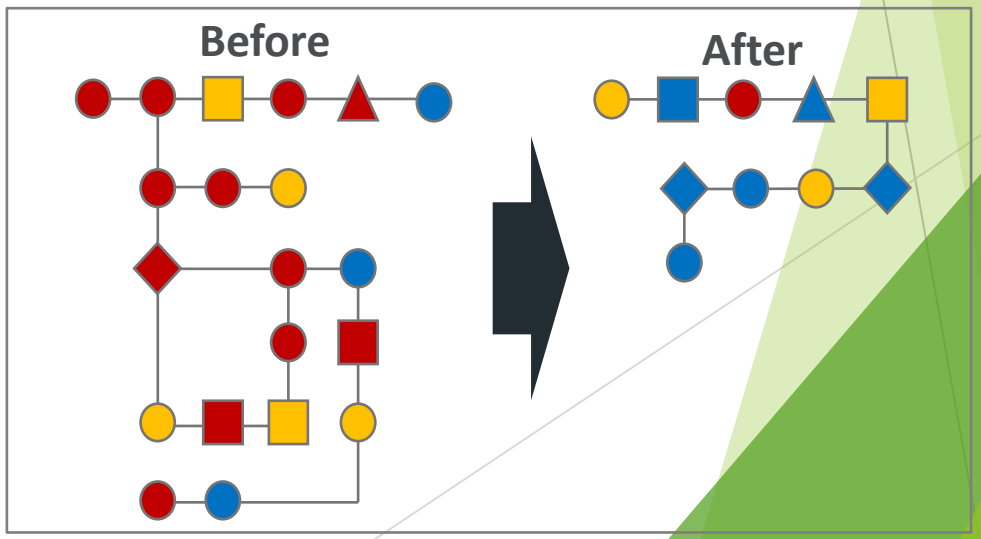
Waiting

Overprocessing

Processing above and beyond what the customer truly needs or values

Main benefits of Lean

1. When we remove Waste, and Non-Value Add activities, we increase Value to the customer.



2. We produce a smooth, even process Flow
3. We use less Resources
4. We make the process more Predictable

Lean Six Sigma

The key Six Sigma concept

Philosophy: (1) The Customer Defines **Quality**. (2) A defect is anything that results in customer dissatisfaction.

Objective: Focus on the Inputs (the X's) to a process to achieve the desired Output (the Y) received by the customer.

Measurement: Reduced defects and process variation (e.g. reduced Defects per Million Opportunities)

Supplier

Whomever provides Input to the process.

Input (X)

Material or data that a process does something with or to.

Process

Activities performed to satisfy customer requirements.

Output (Y)

Product or service that results from an operational process.

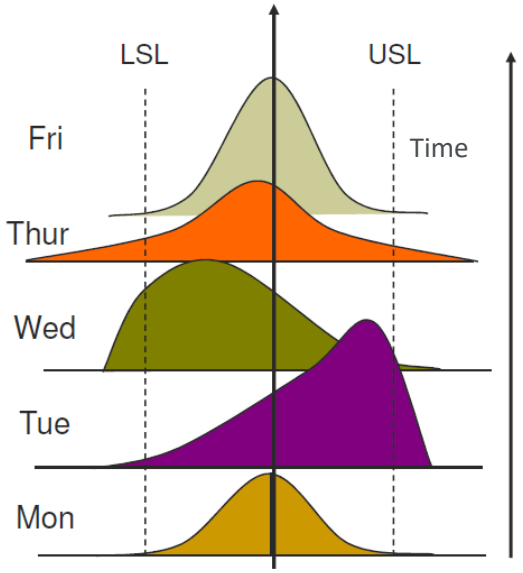
Customer

Recipient of the process output.

Six Sigma creates the opportunity to eliminate risk

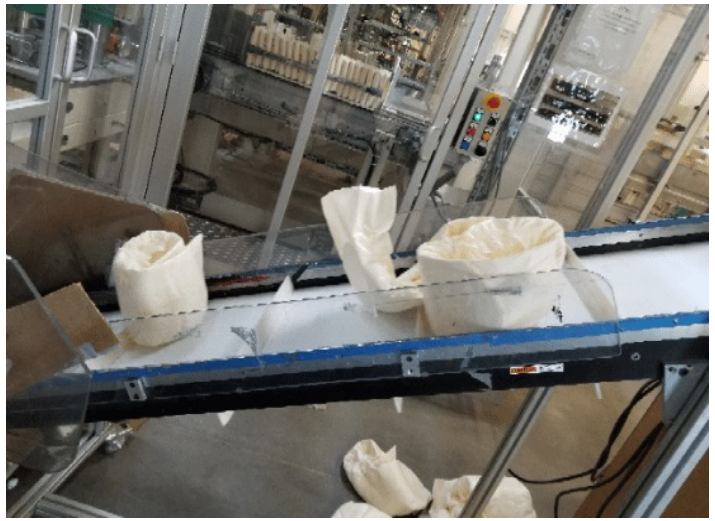
Process Variation

Opportunity for Error



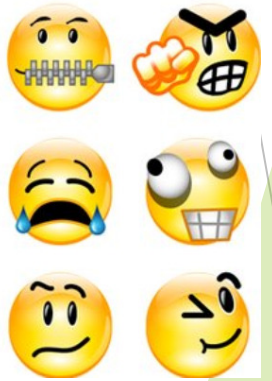
Opportunity for Error

Product Defects



Product Defects

Customer Dissatisfaction



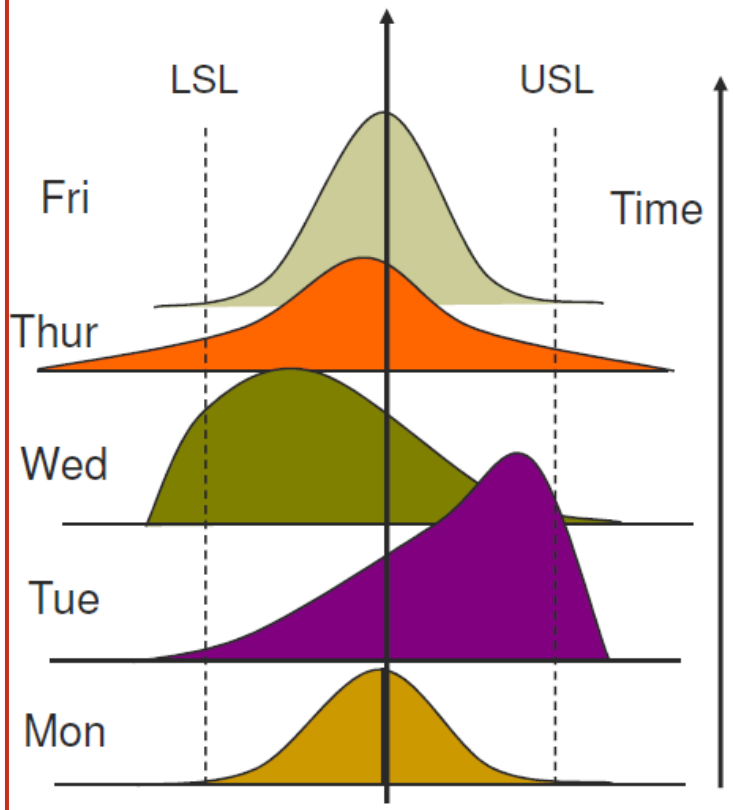
Lean Six Sigma provides the opportunity to eliminate risk

Variation indicates that a process is out of control

Common Cause Variation
Natural, uncontrollable variation resulting from unknown factors. This type of variation is inherent in a process. It can be used to measure process potential when special cause variation is removed.

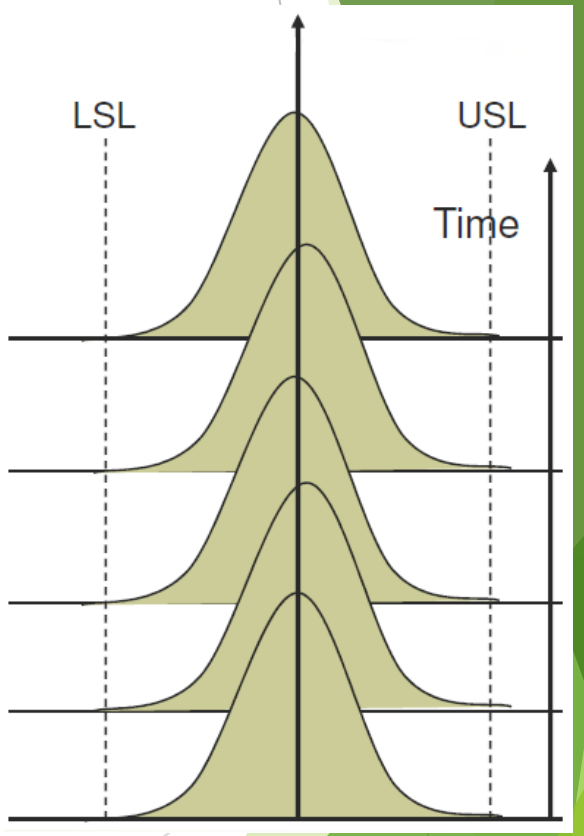
Special Cause Variation
Unusual, sporadic variation resulting from an event, an action, or a series of actions. The causes of variation are external to the process; however, they can be controlled and eliminated.

Out-of-Control Process



- Changing daily performance average
- Excessive variation
- Unstable process output

Controlled Process



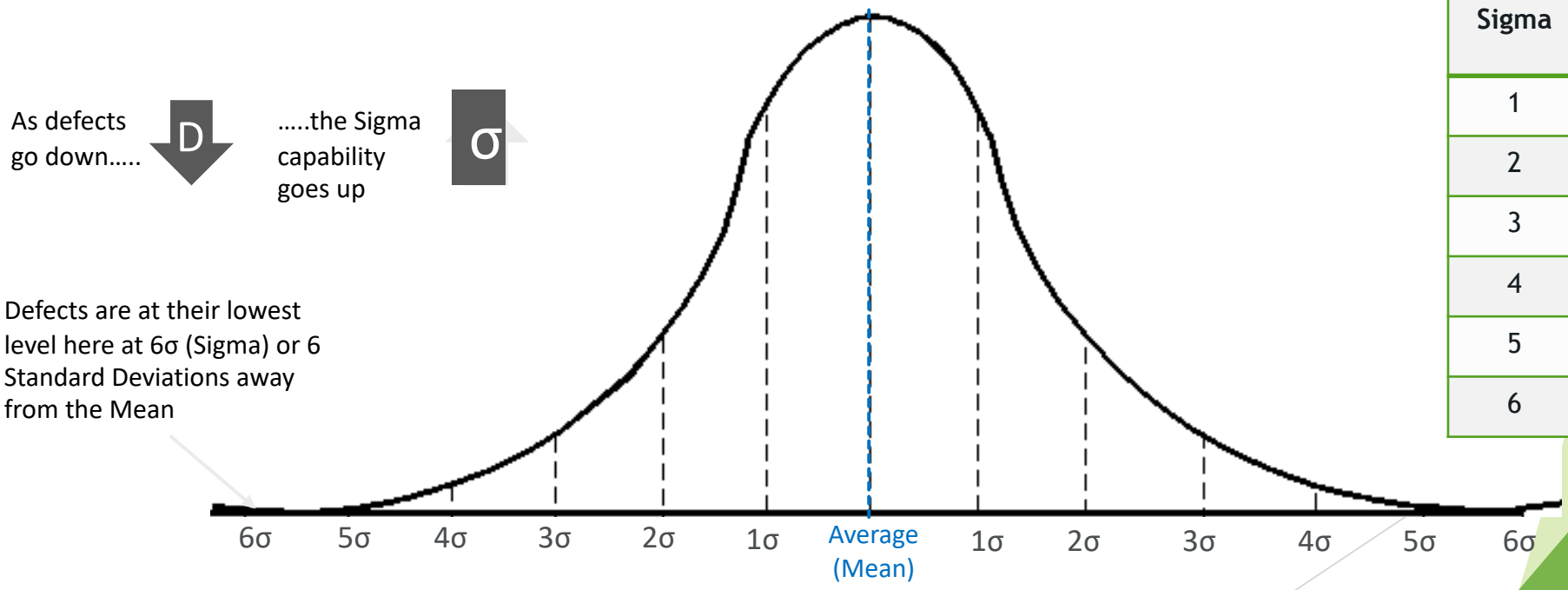
- Stable daily performance average
- Repeatable process output
- Reduced process costs

Six Sigma is measured using standard deviation

Along with DPMO, the Sigma Level is a measure of process capability. It is measured in Standard Deviations from the process mean.

The symbol σ (Sigma) is used to describe variation from the mean of any process or procedure (Sigma σ = Standard Deviation)

- The variation from the mean refers to how far a data point is from the average.
- Sigma Capability (z-value) indicates:
  - How well a process is performing
  - How capable the process is of performing defect-free work



Each sigma level corresponds to a related DPMO

Sigma	Defects Per Million Opportunities (DPMO)
1	690,000
2	308,537
3	66,807
4	6,210
5	233
6	3.4

Six Sigma Example: Amazon's Cyber Monday

6σ

Number of Errors = 125

Avg. Cost/Error = $35

Total Cost = $4,379

5σ

Number of Errors = 8,574

Avg. Cost/Error = $35

Total Cost = $300,104

On Cyber Monday 2013, Amazon processed a whopping 36.8 million orders

Reference: 2018 The Council for Six Sigma Certification

Six Sigma Example: Amazon's Cyber Monday Sigma

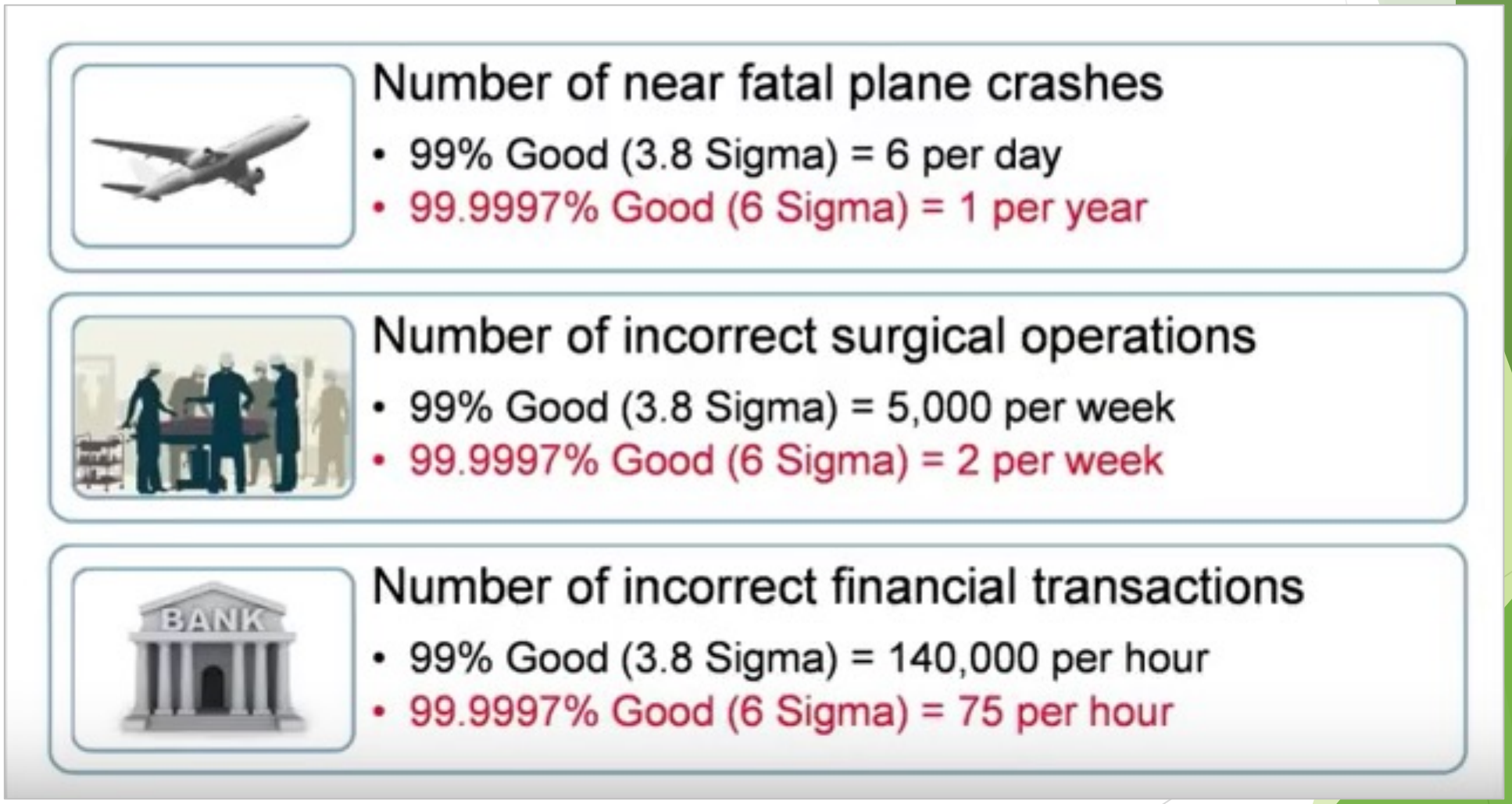
36.8 Million Orders

Sigma Level	Defects per Million Opportunities	Estimated Cyber Monday Defects	Total Cost ($35/Error)
1	690,000	25,392,000	$888,720,000
2	308,537	11,334,400	$396,704,000
3	66,807	2,458,240	$86,038,400
4	6,210	228,160	$7,985,600
5	233	8,574	$300,104
6	3.4	125	$4,379

Every Sigma Level presents a dramatic impact on costs and subsequently customer satisfaction

Reference: 2018 The Council for Six Sigma Certification

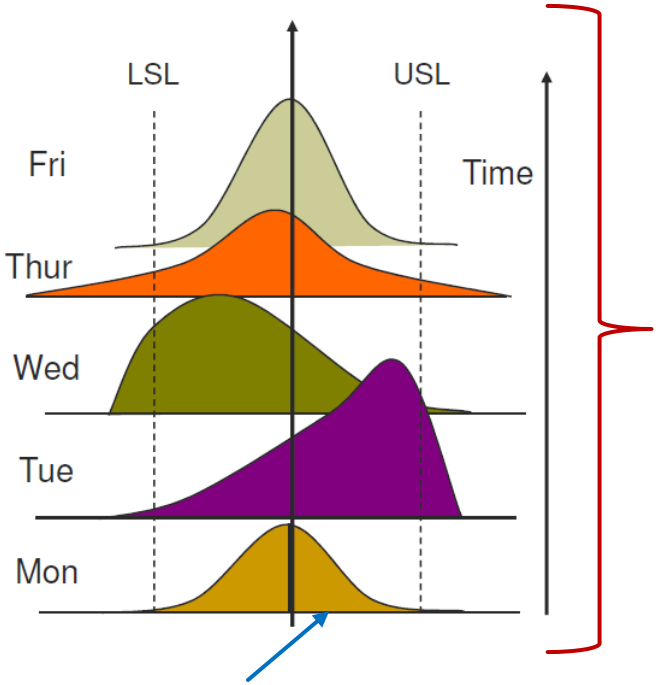
Everyday examples of the need for Six Sigma and having consistent results



Reference: Kyocera Document Solutions Europe, "Introduction to Lean Six Sigma Methodology"

The statistical objective of Six Sigma

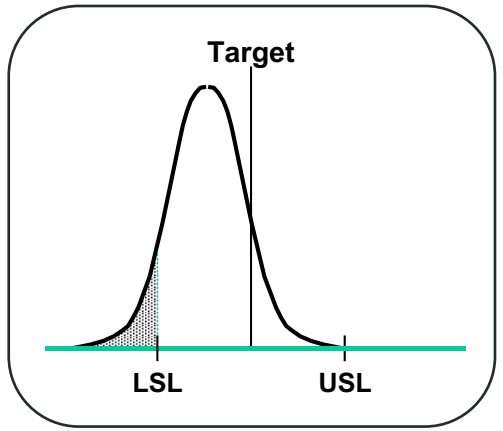
1. Reduce variation
2. Get process output within customer specification



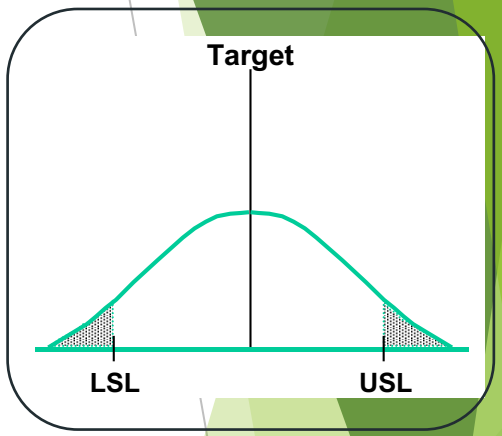
What the customers experience…the variation

What companies report on…the Mean

Process off Target

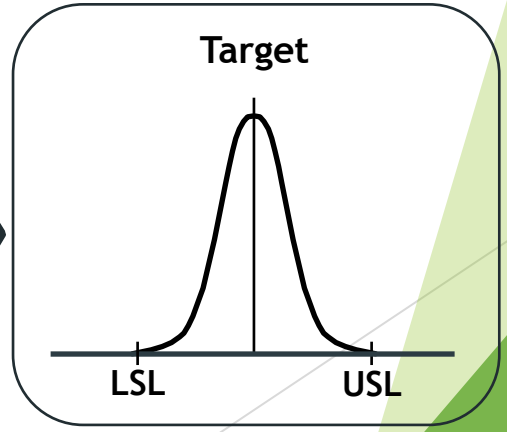


Excessive Variation



Center Process

Reduce Spread



Defects

Customers experience the variation in products and services more than the Mean (average)

The benefits of Six Sigma

1. More Consistent customer output
2. More Predictable processes
3. Reduction in product and service defects
4. Less time and resources spent fixing defects
5. Happier customers
6. Better understanding of how the customer defines Success

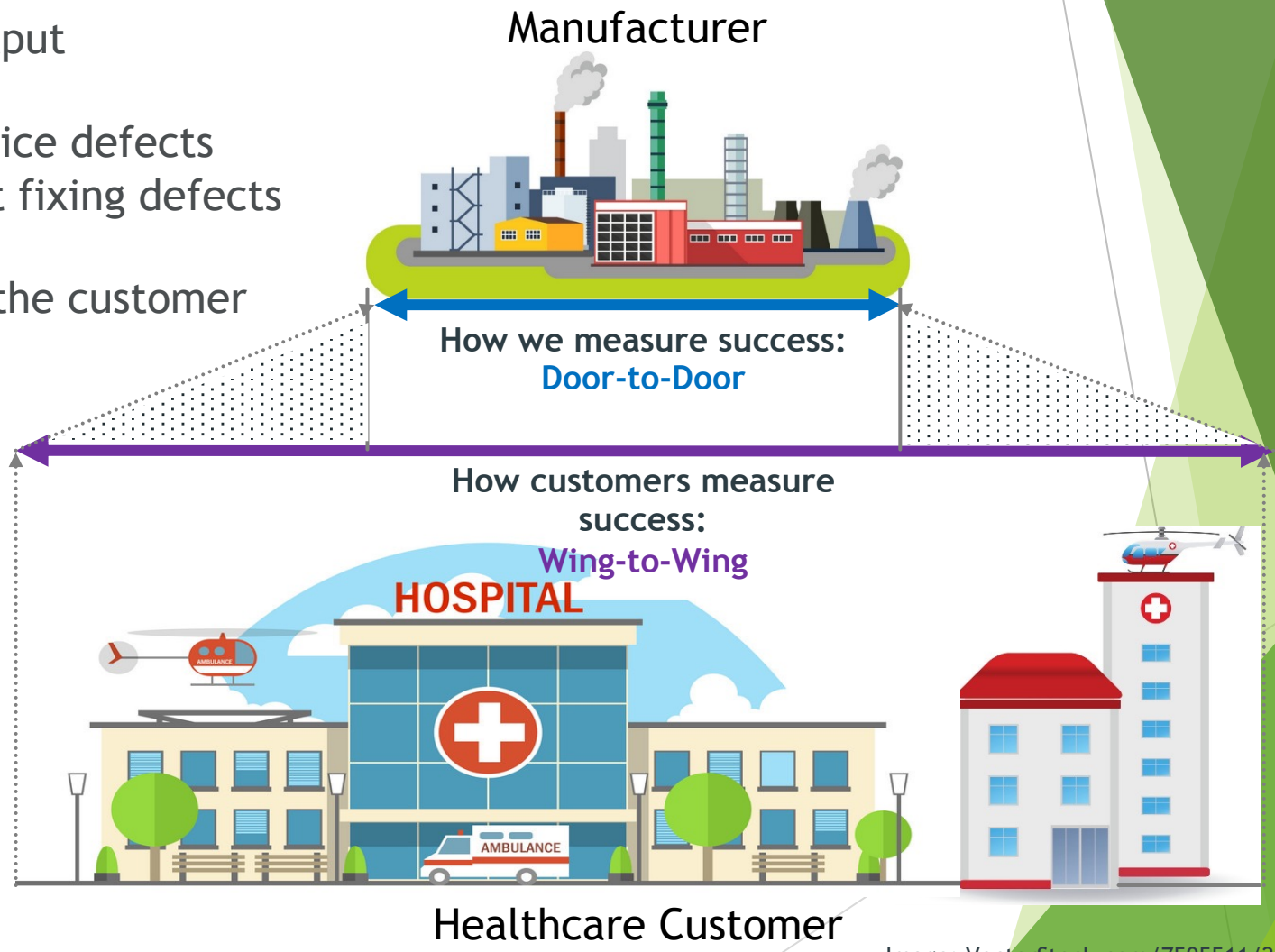


Image: VectorStock.com/7595511/20532180/1110536

There are different types of Lean Six Sigma methodologies

DMAIC: Focuses on improving and reducing defects for an existing process, product or service.

DFSS: "Design For Six Sigma" overcomes the DMAIC limitation of only improving an existing product, process or service. The method is used when the product, process or service is *initially* being designed OR being completely *re-design* from the ground up. Therefore, DFSS is NOT used for process improvement for existing processes. Instead, it focuses on defect prevention and on gaining deep insight into customer needs to inform every design decision.

DMADV: This term is used interchangeably with DFSS. The method is also used for the initial design or complete re-design of new service, product or process.

IDOV: This method also focuses on the initial or complete re-design of a product, process or service; however, the method focuses heavily on articulating customer needs.

Lean Six Sigma uses (DMAIC) methodology

What are customer expectations of the process?	Define	Identify customer CTQs and tie them to business needs
How do we measure performance today?	Measure	Select relevant product characteristics and establish the performance measure
Why, when & where do defects occur?	Analyze	Explore the factors that contribute to the CTQ and define the root cause behind process defects
How can we fix the process and eliminate defects?	Improve	Select issues that must be fixed, identify variation, and establish performance specs
How could we ensure that the process stays fixed?	Control	Use statistical process controls to monitor the implemented solution, ensure that it is sustainable & that the improvement goal has been met

An example of using Lean Six Sigma DMAIC

The "Y" | Performance Measure | Critical x's | Improved x(s) | Controlled x's

Define

What are customer expectations?

On-time delivery
LSL – 5 mins
USL – 15 mins

Target – 7 mins

Measure

How do we measure performance today?

2017-18 On-Time Deliveries

Day	Frequency
Mon	15%
Tue	50%
Wed	85%
Thu	90%
Fri	40%
Sat	25%
Sun	95%

Baseline: 57% On-Time
Performance Mean: 20 mins

Analyze

What are the potential causes of defects?

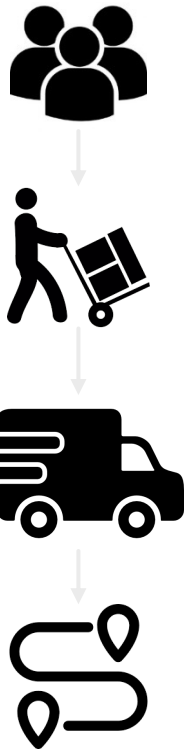
Process Inputs

- Driver
- Fright Type
- Load Type
- Load Size
- Distance
- Travel Time
- Route

Root Cause Identified

Route Variation
Performance Standard
95% On-Time

What is the process?



Improve

How can we fix the process and eliminate defects?

Design Experiments

Right Turns Only

Left Turns Only

Eliminate Routes

Eliminate Contracts

Control

How could we ensure that the process stays fixed?

Monitor Solution

Control Variation

Note: The numbers on this slide are fictional and should not be used in any real world example.

Doing a Lean Six Sigma Project

PHASE 1: Discovery – Define (D), Measure (M) & Analyze (A)

Understand Problem

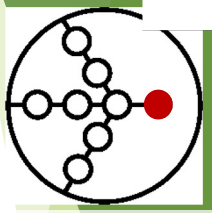
Pinpoint Product or Service (Y)

Define Customer Expectations & Project Goals

Raw Material (x)
Equipment (x)
Man Power (x)
Environment (x)

Identify Causal Factors (X's)

Collect Data & **Measure** Process Performance



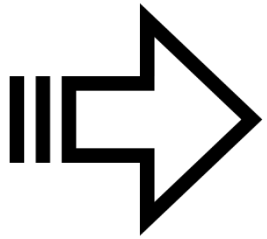
Analyze Root Cause: The Statistically Significant (x)

PHASE 2: Experimentation, Implementation & Control – Improve (I) & Control (C)

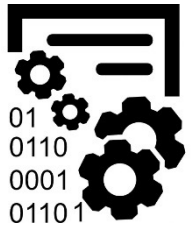
Design Experiments

Test Changes & Measure Outcomes

Select Change Delivering Desired Customer Outcome



Implement Change to **Improve** Customer Outcome (Beta Testing)



Collect Data & Monitor Outcomes

Implement **Controls** to Maintain Change

Key Takeaways

What Lean Six Sigma “is” and “is not”

Is

- A focus on customer needs
- A way of solving problems
- A data-driven decision making approach
- A way of helping your constituents be successful at their jobs
- Methodical approach to identifying opportunities for improvement

Is Not

- An elixir for all problems
- A replacement for engineering, scientific, or process knowledge
- Only a set of tools

Some companies fail at using Lean Six Sigma

The shift from focusing on customers to cutting costs

The Story

In 2000, the entrepreneurial culture of innovative product design was replaced by cost cutting Six Sigma strategy.

- Operations streamlined
- Introduction of automated inventory system
- Centralized supply orders (Atlanta)
- Tenured employees replaced by part-time help

The Results

- ✓ Doubled Revenue ($45.74BB to $81.51BB in 5 yrs)
- ✓ Doubled After Tax Net Earnings ($2.58BB to $5.84BB)
- \- Decreased Worker Morale
- \- Negative Customer Sentiment
- \- Plummeted stock price ($65 - $21 in 3 yrs)
- \- Dropped from Top to Bottom among major retailers

Slow growth and profitability in the late 1990s lead to the introduction of a blanket Six Sigma approach in R&D to improve the operating efficiency and financial returns.

- Streamlined the workforce (8,000 people let go)
- Decreased production defects and increased efficiency
- Focused R&D resources on promising projects
- Introduced rigorous performance review process

- ✓ Increased Revenue by 11%
- ✓ Increased Net Income by 21.7%
- ✓ Increased stock price by 38%
- \- Negative impact to culture of innovation
- \- Created employee dissatisfaction*
- \- Reduction in new products in the market by 8%

To be successful at Lean Six Sigma, a premium has to be placed on understanding customer needs…internal & external.

While other companies succeed

Focusing on customer outcomes

The Story

In the 1990's, Lockheed Martin began using Six Sigma to achieve its corporate sustainability goals and have a positive impact on the environmental.

- Sustainability goals became part of the corporate culture
- Designed metrics focused on sustainability & performance
- Developed partnerships to build alternative energy options
- Sought out expanded waste disposal options

The Results

- ✓ $95 million in Savings
- ✓ Reduction in the use of physical space
- ✓ 12% decreased dependence upon energy resources
- ✓ 20% reduction in costs
- ✓ 20% reduction in water usage and carbon emissions
- ✓ 36% decrease in landfill materials

To drive customer success, in 1995 CEO Jack Welch made Six Sigma a part of the way that they did business at GE.

- Hands on executive Six Sigma approach
- 2000 Corporate Goal of becoming a Six Sigma company
- Emphasis on data-driven problem solving
- Black Belt training, annual re-training & mentorship

- ✓ 98% reduction in billing & invoicing issues
- ✓ $1M/yr savings from streamlined contract review process
- ✓ 85% reduction in imaging time at hospitals
- ✓ 27% improvement in customer service response times
- ✓ Improved responsiveness to regulatory agencies

Lean Six Sigma is more than a quality check…It is a way of doing business.

How to be Successful at Lean Six Sigma

Socialize Benefits Early
Share project benefits across the business & include project stakeholders early to increase participation & adoption.

Clearly Define the Problem
Obtain a deep understanding of the customer needs, environment and goals so that the solution would add to their success.

Leverage Kaizen & Lean
Not everything has to be a Lean Six Sigma project. Kaizen & Lean could be used for quick wins and known solutions.

Identify & Mitigate Risk Early
Identifying risk and bottlenecks early prevent changing scope and increased timelines.

Institute Performance Dashboard
Actively keep a constant eye on performance metrics to quickly identify and deal with unexpected variation.

Obtain Post-Implementation VOC
Direct feedback from users of the process output is a form of process improvement input.

Appoint Process Owners
Process owners keep a watchful eye on active processes so that they would be able monitor variation post-project closure and keep the process in control.

Maintain Continuous Improvement Mindset
Make Lean Six Sigma a part of the way that we do business.

Summary

Lean Focuses on:

- The Customer
- The customer's assessment of value
- Increasing flow
- Eliminating waste
- Reducing non-value add tasks
- Mistake Proofing processes

Six Sigma Focuses on:

- The Customer
- The customer's assessment of quality
- Critical to quality characteristics (CTQs)
- Process inputs (Xs)
- Reducing or eliminating defects
- Reducing variation
- Increasing process capability

LEAN SIX SIGMA

Thank you!