

The Six Sigma Principle

To provide reliable, consistent, dependable products to your customers

- 1 Defects
- 2 Variability
- 3 The customer

If variation can be **reduced**, then there is less chance for defects to occur.

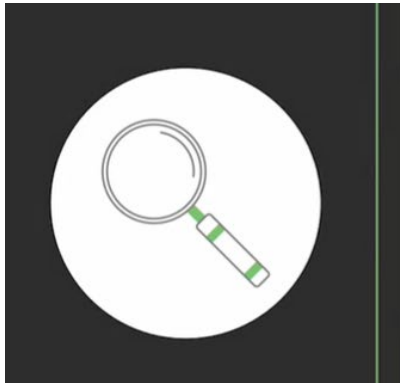
Six Sigma in Statistics

- 0.5 of design tolerance
- 1.5 standard deviations from the target

Six Sigma Certifications

- Green Belt
- Black Belt
- Master Black Belt

Why Lean?



Lean

The elimination of all non-value-added activities (waste)

Examples of Waste

- Unnecessary steps or activities
- Rework
- Waiting time
- Unnecessary movement of people or material
- Excess inventory

and excess inventory.

Lean Facilitators

- Empowered employees
- Cross-trained workers
- Flexible equipment
- Efficient layouts

Lean Facilitators

- Standard processes
- Just-in-time delivery
- Rapid setup/changeover



The Elegant Solution

Where a maximum effect is achieved with the smallest and simplest effort

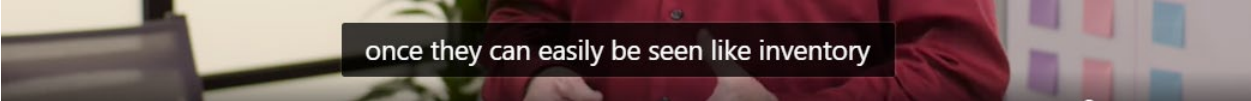
Why Lean Six Sigma?

Lean
Principles

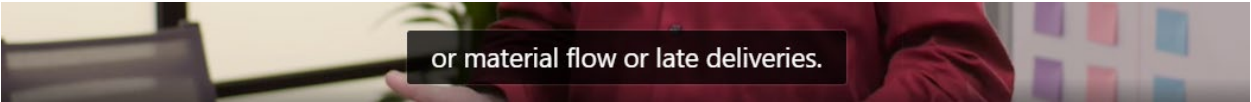


Six Sigma
Methodology

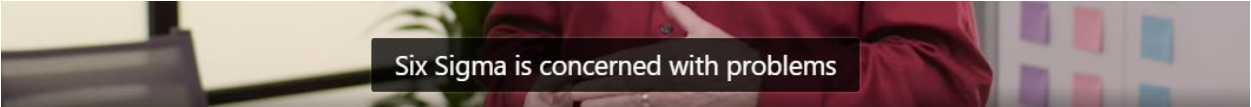
Lean addresses visible problems and processes



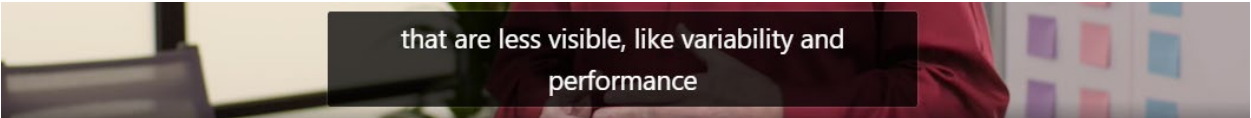
once they can easily be seen like inventory



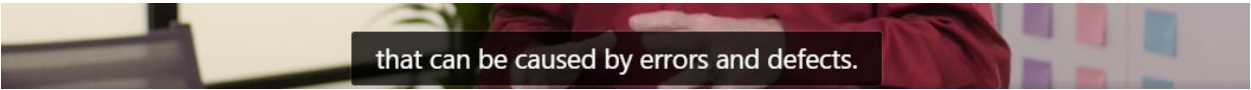
or material flow or late deliveries.



Six Sigma is concerned with problems



that are less visible, like variability and performance



that can be caused by errors and defects.

Which of the following quotes best represents "the lean approach?"

✔ You are correct!

We will not put into our establishment anything that is useless." Henry Ford Sr.

Feedback

Lean is defined as the elimination of all non-value-added activities, or waste.

Six Sigma reduces defects by controlling variability to deliver dependable products to the customer. Compensation is not part of the focus.

DMAIC Methodology

- Define
- Measure
- Analyze
- Improve
- **Control**

in the DMAIC methodology.

The Define Stage

- 1 Conduct process mapping.
- 2 Outline expected accomplishments.
- 3 Develop financial measurements.
- 4 Define the problem.

Always keep the **customer** in mind.

Begin with problems that the **customer** believes are critical.

Determining Throughput

- Utilization rate
- Yield
- Process time

DMAIC Methodology

- Define
- Measure
- **Analyze**
- Improve
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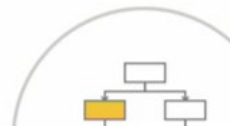
You can't find the solution to a problem until you truly understand why you are having the problem in the first place.

Understand

- **How** the existing process works
- **How** the process should work

Process Mapping Considerations

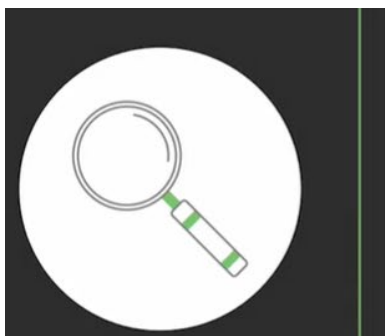
- Time
- Cost
- Yield
- Capacity



Review Data

- Control charts
- Capability charts
- Histograms
- Pareto charts





The Five-Whys Technique

Continuing to ask why until you identify the root cause of a problem

Analyzation Tools

- Scatterplots
- Time series graphs
- Analysis of variance



DMAIC Methodology

- Define
- Measure
- Analyze
- **Improve**
- Control

and improve the performance measure.

Improvement Tools



Brainstorming



Communicating

brainstorming and communicating.



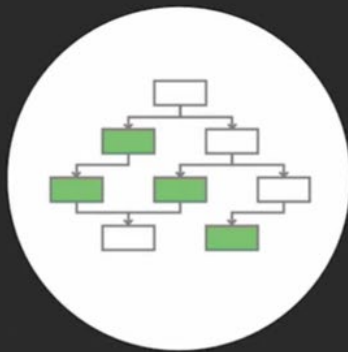
Communicate with everyone involved with the change.



Recognize those affected by the change
and involve them early.



Ensure you have the support of
the process owner.



Follow good project management techniques.

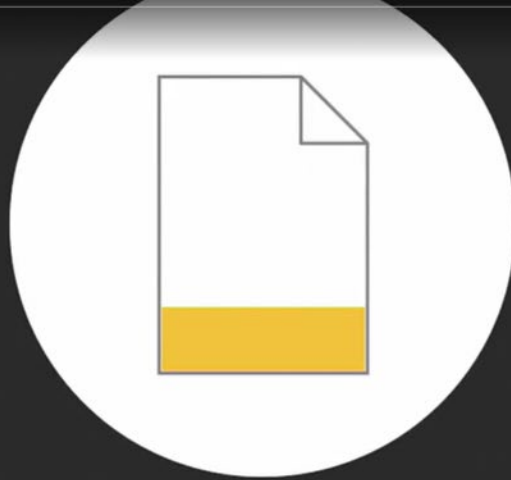
ons

DMAIC Methodology

- Define
 - Measure
 - Analyze
 - Improve
 - **Control**
-

Controls

- Checklists
- Monthly review meetings
- Document updates
- Training



Document all new processes.



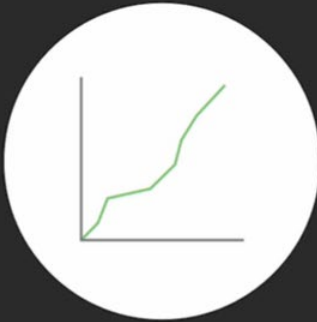
Mistake Prevention

Implementing a procedure that makes it difficult to cause an error



Mistake Proofing

Implementing a procedure that does not allow someone to continue if a mistake is made



Document the gains from improvement.



Existing Process



New Process

DMADV Methodology

- **Define**
- Measure
- Analyze
- Design
- Verify

In the define phase,

DMEDI Methodology

- Define
- Measure
- Explore
- Develop
- Implement



Quality Function Deployment (QFD)

An approach that assists the design, manufacturing, and marketing of a new product and its related processes

Design for Six Sigma (DFSS) Design for Lean Six Sigma (DFLSS)

What are two major tools used in the Improve stage of a Six Sigma project?

✔ You are correct!

brainstorming and communicating

Feedback

The team gathers ideas through brainstorming, proposes a change, then makes sure the change is communicated to everyone involved.

Appropriate tools for the Measure step of Six Sigma include all of the following, except:

✔ You are correct!

qualitative analysis (evaluating employee comments to determine why you're experiencing a problem)

Feedback

Six Sigma is a very quantitative, statistics-based method of analysis.

Eliminate anything that does not provide **value**.

The Toyota Lean Manufacturing Approach

- Determine the value
- Identify the value stream
- Make value flow without interruptions
- Allow the customer to pull value
- Pursue perfection

Lean + Six Sigma

- Waste
- Cycle time
- Inventory

Manufacturing Metrics

- Improved customer service
- Better use of resources
- Reduced inventories
- Higher product quality



Activities and Process Metrics

- Reduced waiting time
- Improved delivery service

Sort

- Ensure that each item in a workplace is in its proper place

Set in Order

- Arrange materials and tools so that they are easy to find when needed

Shine

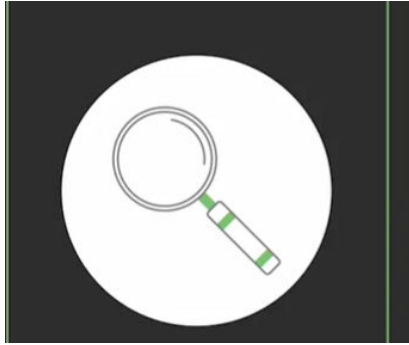
- Keep the work area clean

Standardize

- Establish formal procedures to ensure all steps are performed correctly and consistently

Sustain

- Continue the standardized process through effective training and communication practices



Just in Time

A manufacturing approach where raw materials, components, and subassemblies are delivered to the factory as they are needed for production

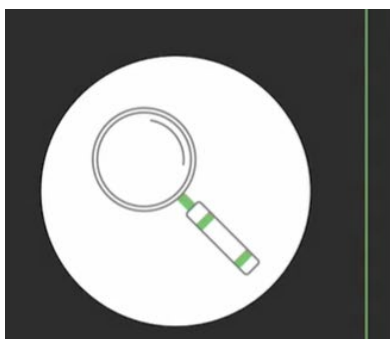


Pull System

When customer demand drives the output of a factory and its internal operations

Just-in-Time Considerations

- Requires an effective delivery system
- Dependent upon standardized work processes

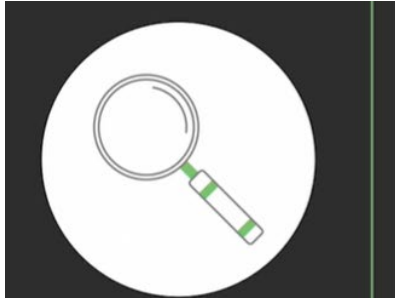


Total Productive Maintenance (TPM)

Maintaining and improving the integrity of production and the quality of systems

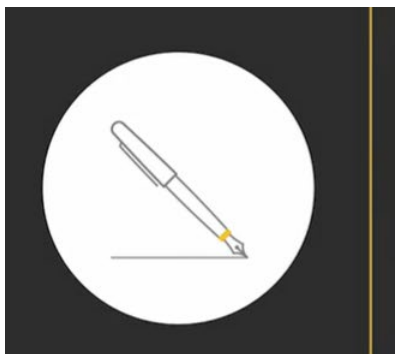
TPM Ensures

- Machines will not break down unexpectedly
- Scheduled maintenance completed in a timely manner



Single-Minute Exchange of Die (SMED)

Reducing the amount of time and cost
for performing a machine setup



"Quality is doing it right when no one is
looking."

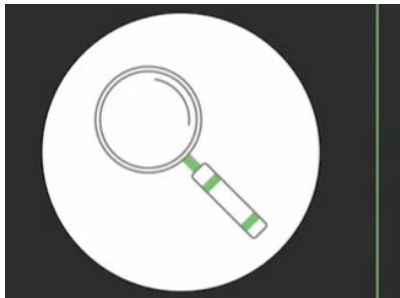
— Henry Ford

Poka-yoke = Foolproof

Quality at the Source Benefits

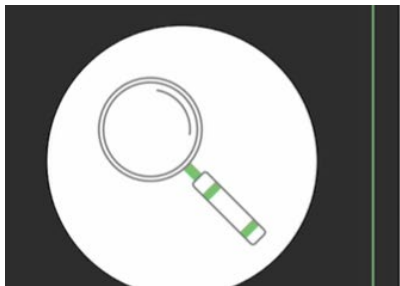
- Throughput time decreased
- Quicker delivery to customers
- Just-in-time delivery

Lean tools help with the reduction of waste and wasteful activities.



Kaizen

Gradual and orderly continuous improvement

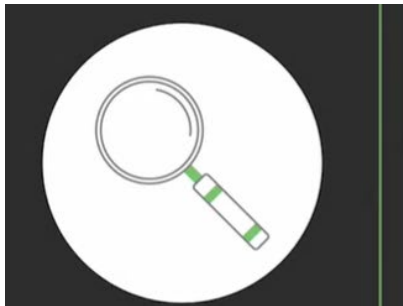


Kaizen Philosophy

You're not trying to make the process perfect; you are trying to make it **a little better.**

Continuous Improvement Approach

- Operating practices and procedures
- Total involvement
- Training



Kaizen Blitz

Expedited improvements made under tight deadlines

Use of a sign or signal to notify each workstation when inventory is needed is called a:

✔ You are correct!

Kanban system

Feedback

A Kanban signals the workstation to produce inventory just in time to the next workstation.

Many of the Lean performance measurements are also metrics of Six Sigma projects. Three of the following choices are good examples of performance measurements. Which is not?

✔ You are correct!

profit

Feedback

Increased profits are a result of Lean Six Sigma projects, but not a metric.

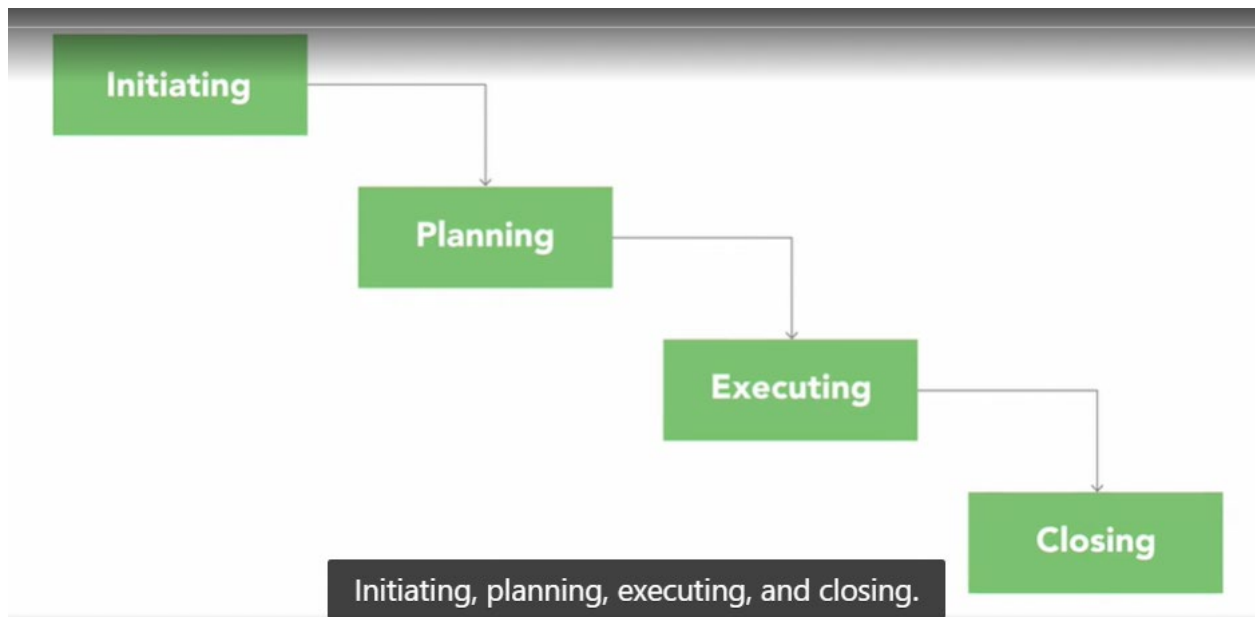
Implementing Lean Six Sigma

Lean Six Sigma Success Criteria

- 1 Leadership from the top
- 2 Skilled team members
- 3 Supporting infrastructure

Leadership must communicate the strategy and demonstrate their support in their daily activities.

Like all projects, Lean Six Sigma goes through four phases



Leadership Responsibilities

- Assignments
- Team coordination
- Performance



Effective communication is critical.



Technical expertise is important.

Half of the work done in a typical service process adds no value in the eyes of the customer.

80% of the delay is caused by 20% of the activities.

Only allow complexity the customer is willing to pay for.

Causes of Inventory Issues

- Poor forecast of demand
- Supplier problems
- Capacity issue
- Transportation company

Supply Chain Projects

- Strategic gaps in performance
- Cost reduction and cost avoidance
- Customer issues
- Regulatory issues
- Safety issues

Successful projects should be replicated throughout the company and its supply chain.

Additional Resources

- [HTTPS://BPTrends.com](https://BPTrends.com)
- *Leading Six Sigma* by Ron Snee and Roger Hoerl

Additional Resources

- [HTTPS://Lean.org](https://Lean.org)
- [HTTPS://Asq.org](https://Asq.org)