



Staying Competitive- Using Lean and Six Sigma to Eliminate Waste

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Lean Enterprise Center

- One of ten Research Centers and Institutes housed at the University of Southern Mississippi
- One of seven centers within the Manufacturing Extension Partnership of Mississippi
- Mission – To provide MS businesses (with an emphasis on manufacturers) with continuous improvement training and implementation services that will generate impact in the form of bottom-line cost reduction, top-line growth, and environmental sustainability.





Continuous/Process/Quality Improvement Methodologies have many titles

Lean Manufacturing

Six Sigma

Demand Flow Technology

Total Quality Management (TQM)

Just In Time Manufacturing (JIT)

Zero Defect Manufacturing





The Goal

A continuous improvement program's goal is to improve the effectiveness and efficiency of an organization.

Effectiveness – meeting and exceeding the needs and requirements of the customer.

Efficiency – the time, cost, or value of the activities that lead to customer satisfaction.





What's this all about?

No matter what buzz word is used to title your improvement program, it's all about :

- **managing change** in order to create a
- **culture** of people constantly
- **eliminating wasteful** activities in order to be
- spending more of that precious time **creating value** for customers, resulting in
- greater profits and **long term success** in the marketplace





Lean Manufacturing/Enterprise

Lean concepts apply to

- “pure” manufacturing, as in tangible products
- service industries
- government organizations
- healthcare
- education
- any endeavor with limited time and resources





Lean=Eliminating Waste

Waste

- The elements of production that add no value to the product or service
- Only adds cost and time

Things to remember about waste

- Waste is really a symptom rather than a root cause of a problem
- Waste points to problems within the system



Defining Lean

“A systematic approach to identifying and eliminating waste (non-value-added activities) through continuous improvement by flowing the product at the pull of the customer in pursuit of perfection.”

“A structured approach to common sense.”





Definition of Value Added

Value Added

Any activity that increases the market form or function of the product or service. (These are things the customer is willing to pay for.)

Non-Value Added

Any activity that does not add market form or function or is not necessary. (These activities should be eliminated, simplified, reduced, or integrated.)





Lean is Market Driven

Traditional Thinking

Cost + Profit = Price

Lean Thinking

Price – Cost = Profit





Lean is Market Driven

If your competitor gets better and you don't, you're going to get less!!

The 3 C's driving process improvement:

Competition

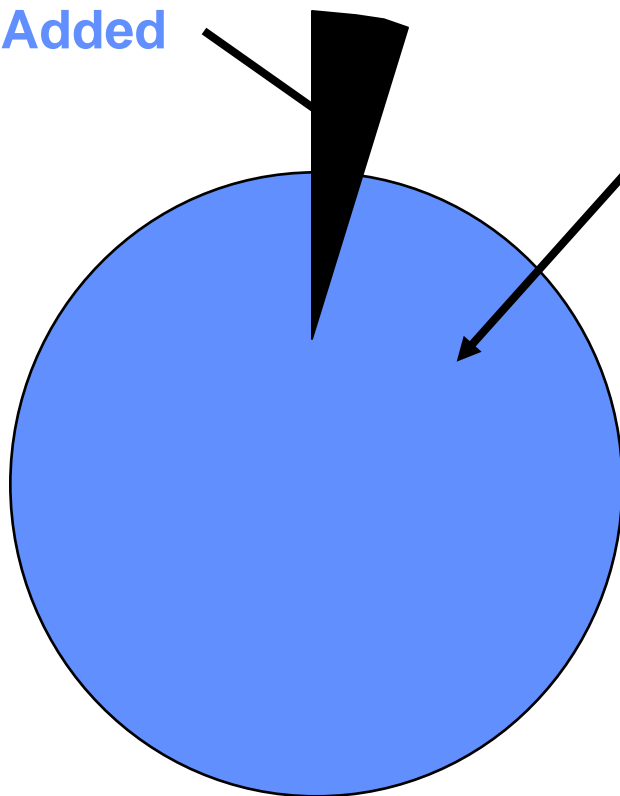
Complexity

Cost



Lean = Eliminating the Wastes

Value
Added



Non-Value Added

- Overproduction
- Waiting
- Transportation
- Non-Value Added Processing
- Excess Inventory
- Defects
- Excess Motion
- Underutilized People

Typically 95% of all lead time is non-value added





Lean Building Blocks=Waste Eliminating Tools

Continuous Improvement

Pull/Kanban

Cellular/Flow

TPM

Quality at Source

POUS

Quick Changeover

Standardized Work

Batch Reduction

Teams

5S System

Visual

Plant Layout

Value Stream Mapping





How do I find the Waste?

- **Value Stream Mapping (VSM)** – following the production of a product or delivery of a service from start to finish (raw material to the customer). This includes all steps (both value added and non-value added).
- **Current State VSM** – Mapping a product the way you currently produce it. This represents a normal, as-is flow of material through your processes.
- **Future State VSM** – A new plan to flow material through your processes based on eliminating the waste identified in the current state. A blue print for operations going forward.





I've found waste, How do I Eliminate it?

■ Kaizen Activity

Kaizen – Japanese term for continuous and incremental improvement

Kaizen Event – Rapid improvement exercise on the shop floor with focus on eliminating waste and/or improving flow in a specific area or system. Typically 2 to 5 consecutive days with small group of people who can make the necessary changes right then.

The key is to take action! It is too easy to be talked out of improving!





Six Sigma or 6 σ

What is it?

6 σ is a methodology that utilizes a family of data driven tools focused on Reducing Variation

“War on Variation”





Six Sigma = Eliminating Variation

- **Virtually every process exhibits some variation if the unit of measure is small enough!**
- **Key is to eliminate causes of the variation to make the process more consistent and predictable.**





Six Ingredients of 6σ

- **Genuine focus on the customer needs**
- **Data and fact driven tool**
- **Process focus**
- **Proactive management**
- **Collaboration without boundaries**
- **Drive for perfection, tolerate failure**





Literally, what is Six Sigma?

“ σ ” is the 18th letter in the Greek alphabet and is used to express standard deviation or amount of Variation in a group or population of data.





Defects Per Million Opportunities (DPMO)

When a process is operating at a Six Sigma level, fewer than 3.4 “defects per million opportunities”





Standard Deviation or σ (sigma)

$$\sigma = \sqrt{\frac{\sum (X - \bar{X})^2}{n - 1}}$$

Measures the variability of a group or population of items.

The greater the value of σ , the more variation in the group





Taking Measurements

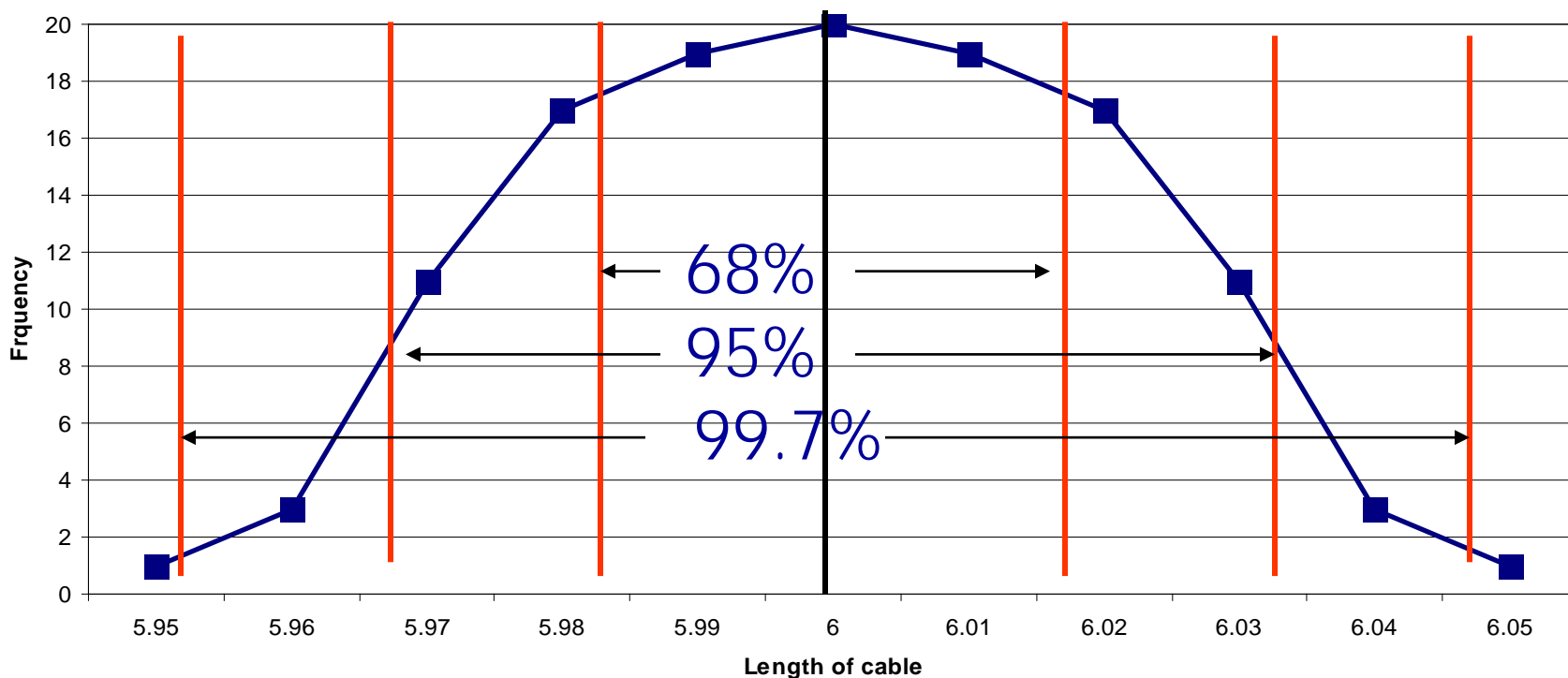
122 Cables

They all look 6" long





Distribution of Cable Lengths

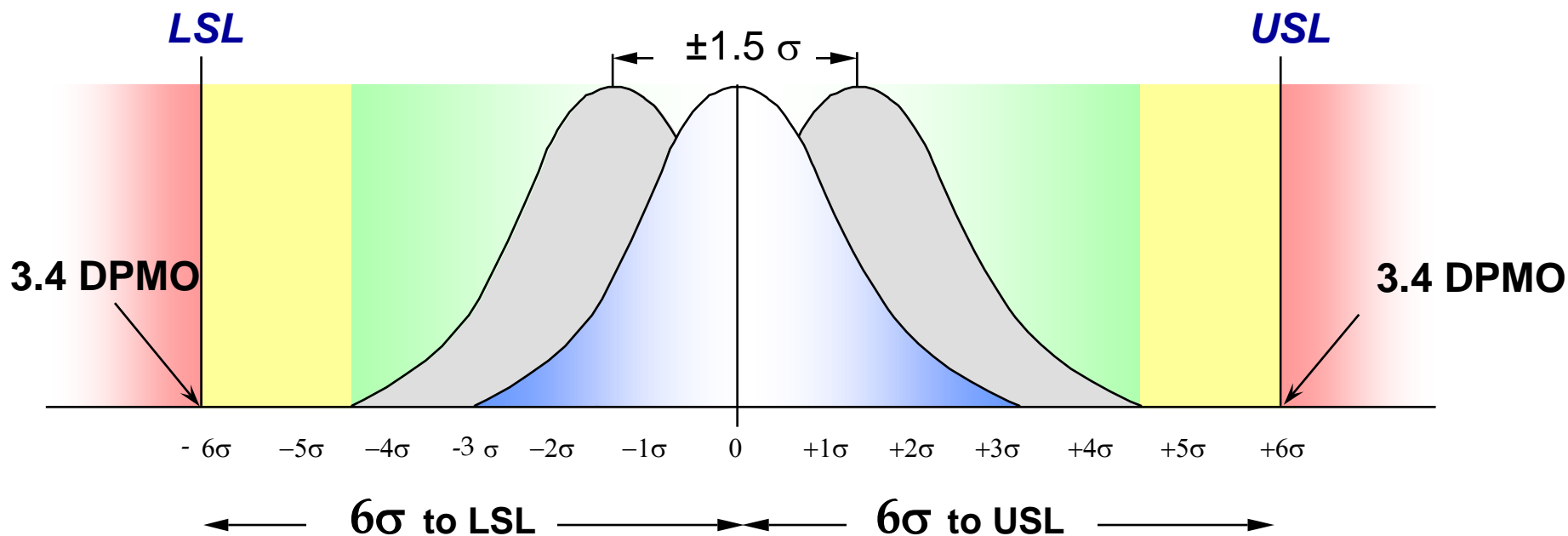


68% of the parts between $\pm 1 \sigma$
95% of the parts are between $\pm 2 \sigma$
99.7% of the parts are between $\pm 3 \sigma$





Six Sigma Quality



A slight shift in a process that is 6σ capable will still not result in out of spec product





Impact of Six Sigma level

Sigma Level	% Non-Defective	Defects per million
2	69.1%	308,537
3	93.32%	66,807
4	99.379%	6,210
5	99.9767%	233
6	99.99966%	3.4

As Six Sigma capability goes up, defects do down





Isn't 99% good enough?

Why Six Sigma?

99% means:

- One hour of unsafe drinking water/month
- Two unsafe landings at O'Hare Airport each day
- 16,000 lost pieces of mail/hour
- 20,000 incorrect drug prescriptions/year
- 500 incorrect surgical operations/week
- 50 newborn babies dropped each day by doctor
- 22,000 checks per hour deducted from the wrong accounts





Continuous Improvement **DMAIC** Strategy for solutions!

Define the problem and what the customers require.

Measure the defects and process operation.

Analyze the data and discover the problems cause.

Improve the process to remove the cause.

Control the process to make sure defects don't recur.





The Goal of Six Sigma

DETERMINE THE
DESIRED
PERFORMANCE
LEVEL

Y

(per the customer)

IDENTIFY THE
DRIVERS OF THIS
PERFORMANCE

X

(effectiveness and efficiency)

$$Y = f (X_1, X_2, X_3, X_4, \dots, X_N)$$





The Focus of Six Sigma Thinking

- **Six Sigma focuses on:**

- The customer – critical to quality characteristics (CTQ's)
- Data driven improvements
- The inputs (X's) of the process
- Reducing or eliminating defects
- Reducing variation
- Increasing process capability

- **To efficiently drive improvements, the focus must be on the inputs (X's) to the process**





Why Lean/Six Sigma?

Mass production methods of the early 1900's will not work in today's globally competitive economy.

The internet has revolutionized business and the way goods and services are sold for virtually every consumer in the world.

Unless you're a monopoly, the market is setting the prices for most products and services. Continuous reduction in waste along with enhanced quality efforts, through programs like Lean and Six Sigma, will help organizations improve processes and compete globally.





How do YOU Begin a Lean/Six Sigma Transformation ?

- It all starts at the top!...and must be completely embraced by all levels of the organization down to the shop floor.
- Lean/Six Sigma methodology must be identified as critical to achievement of organizational goals
- Educate and train employees on Lean and Six Sigma principles and concepts...start changing the culture
- Discover how value (and waste) moves through your processes en route to the customer...then change it for the better. Value Stream Mapping (VSM)
- Use the VSM results to Implement waste eliminating techniques (Lean House); Use the DMAIC methodology for Six Sigma projects
- Continuously run Kaizen Events with active participation from ALL employees to eliminate waste and promote culture change
- Repeat all of these steps all the time....it never ends!

