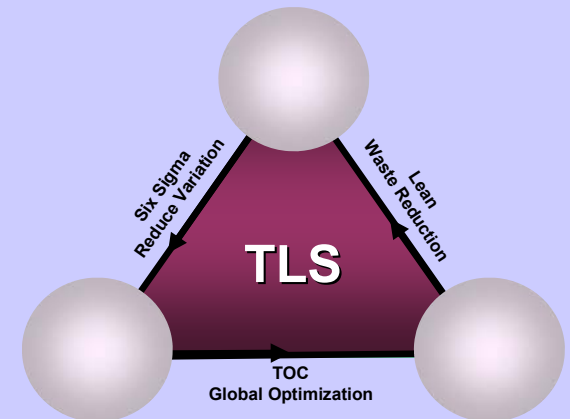




©2007 "TLS Continuous Improvement Trio"

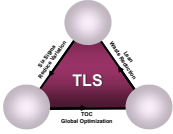
Is It Not The Time To Think Differently?

©2007 **Russ Pirasteh, PhD, MBB, CLM.**  
Global Director –Operations Excellence  
Sanmina-SCI Corporation  
LRS Division  
November, 2007



- **Overview of 3 CPI models**
- **Case study & Designed Experiment–  
Comparing effects of:**
  - **TLS,**
  - **Lean**
  - **Six Sigma**
- **Review study results**
- **TLS introduction**
- **TLS Model and how it works**
- **Lessons learned**

# Why Change?

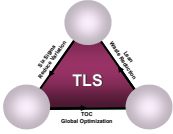


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- Faced with urgency for productivity, quality leadership, and higher profitability.
- Customers are asking for cost reductions while at the same time demanding higher quality levels.
- Firms which are not prepared, could be replaced with rival firms which possess these capabilities.
- This phenomenon results in a race for profitability and survival.
- Who would win this race?



# Why Change?



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**“Only 38% of companies...have been able to reduce costs in 2006....”**

**“Only 38% of companies...have been able to reduce costs in 2006....”**

Establish Inc.

**“20% of warehouse workers describe themselves as actively disengaged from their work...50% say they do just enough work to get by.”**

Gallup Poll

**Typical range of cost of poor quality (COPQ as % of Sales):**

- **Manufacturing:** 20-30%
- **Services:** 30-40%
- **Software:** 40-65%

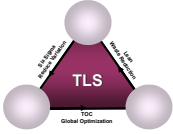
- ASQ & IE Magazines

- **It is critical to reduce waste and defects at all levels to reduce COPQ.**
- **Improve processes.**



# Why Change?

## What are the alternatives?



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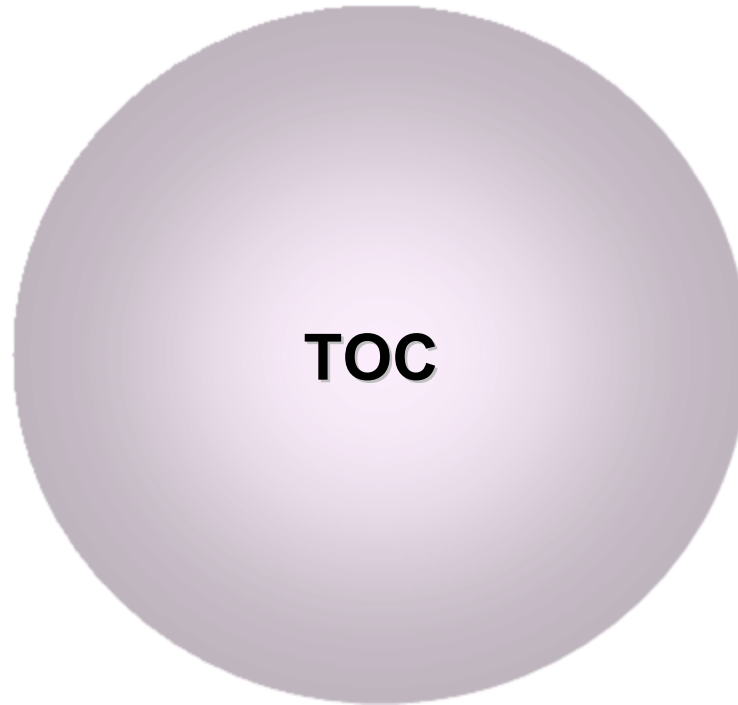
- **In past 25 years great management philosophies have been introduced to continuously improve processes and achieve operations excellence by shifting paradigms and challenging the existing assumptions.**
- **Over 90% of CPI initiatives are:**
  - **Lean**
  - **Six Sigma**
  - **Theory Of Constraints (TOC)**



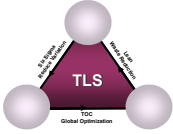
# TOC – Theory Of Constraints



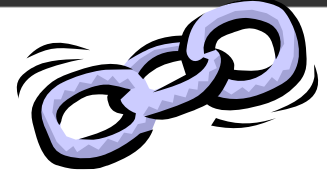
TOCICO 2007 Conference



# TOC – Theory Of Constraints



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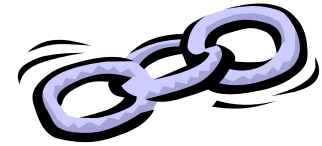
- **Originated and authored by Eliyahu M. Goldratt**
- **Also referred to as "Constraint Management"**
- **Rate of revenue generation (Throughput) is limited by at least one constraint (i.e. a bottleneck).**
- **Only by increasing capability at the Constraint overall throughput will be increased**



# TOC – Theory Of Constraints

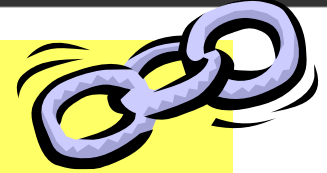


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- **Effective businesses management as a system**
- **When dealing with change:**
  - **Why Change?**
  - **What to Change?**
  - **What to Change To?**



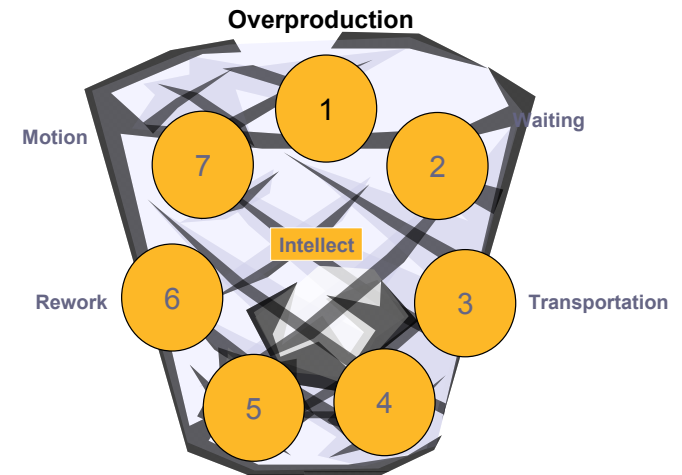


## **TOC 5 - Focusing Steps:**

- 1. Identify the constraint**
- 2. Exploit the constraint**
- 3. Subordinate**
- 4. Elevate the constraint**
- 5. Go back to step 1 and repeat**



- **Toyota Production System**
- **Focusing on reduction of the seven wastes**
  1. **Overproduction**
  2. **Waiting - People, Parts**
  3. **Too Much Inventory**
  4. **Unnecessary Motion**
  5. **Unnecessary Transporting**
  6. **Over Processing**
  7. **Producing Defects or Rework**



“pursues *optimum streamlining* throughout the entire system thorough *elimination of Muda (waste)*, and aims to build *quality* in at the manufacturing process while recognizing the principle of *cost reduction*. It also includes all the accompanying technology necessary to accomplish those aims” -*Taichii Ohno*

## Key lean operation principles include:

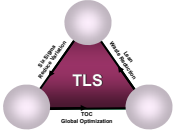
1. Value
2. value-stream (eliminate waste)
3. Flow
4. Pull
5. Perfection

Source: “Lean Thinking”  
Womack and Jones



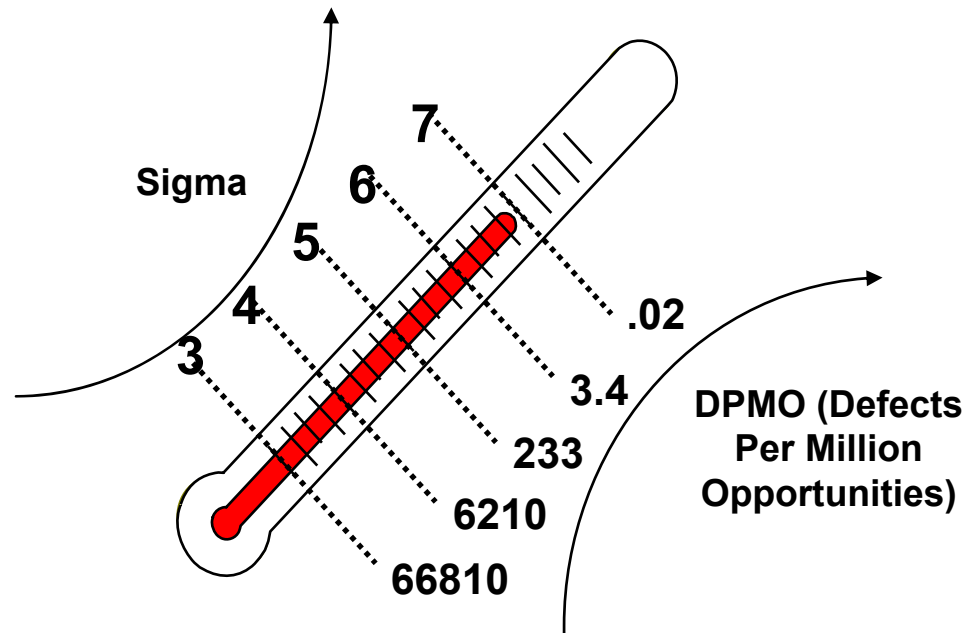
**Six Sigma**

# Six Sigma...

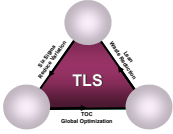


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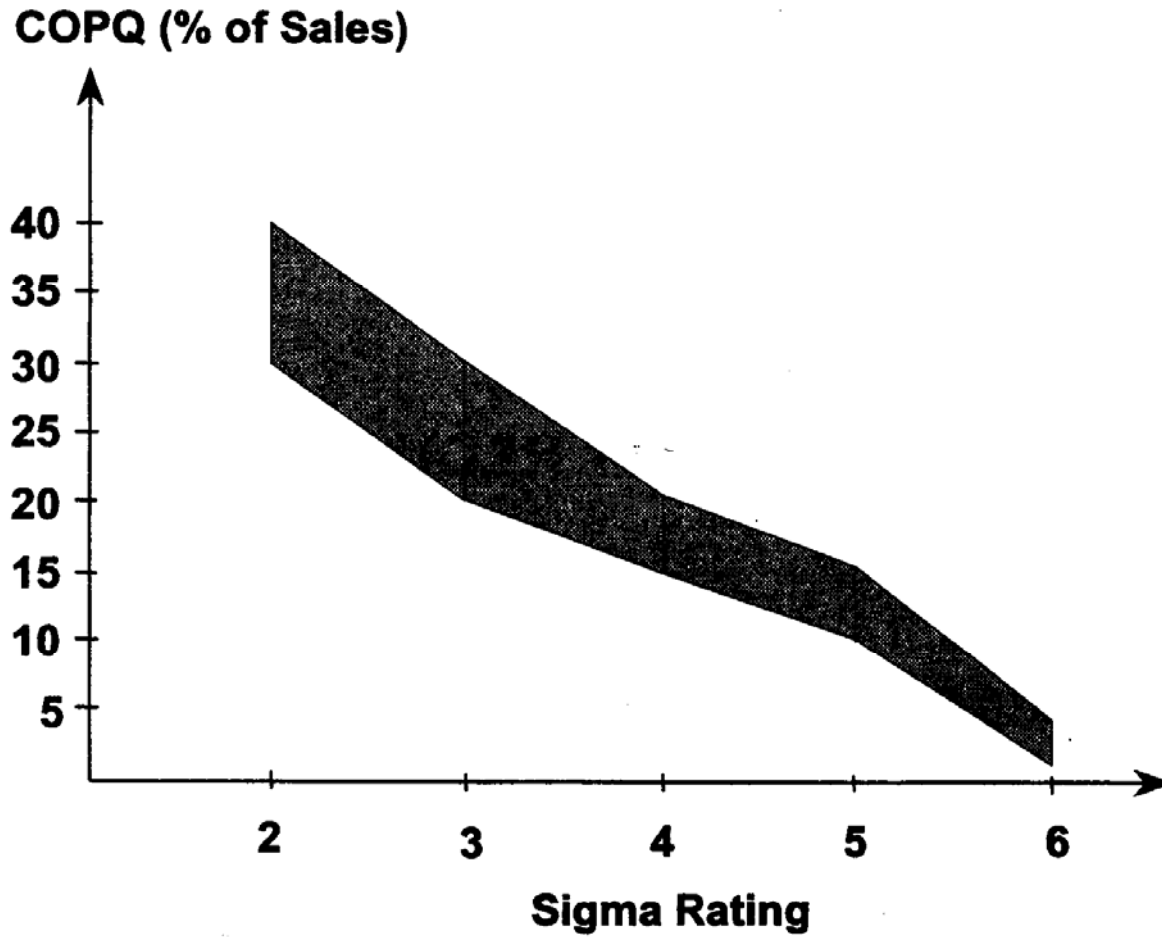
- Pioneered by Bill Smith at Motorola in 1986
- Originally defined as a metric for measuring defects and improving quality
- Defect levels below 3.4 (DPMO)



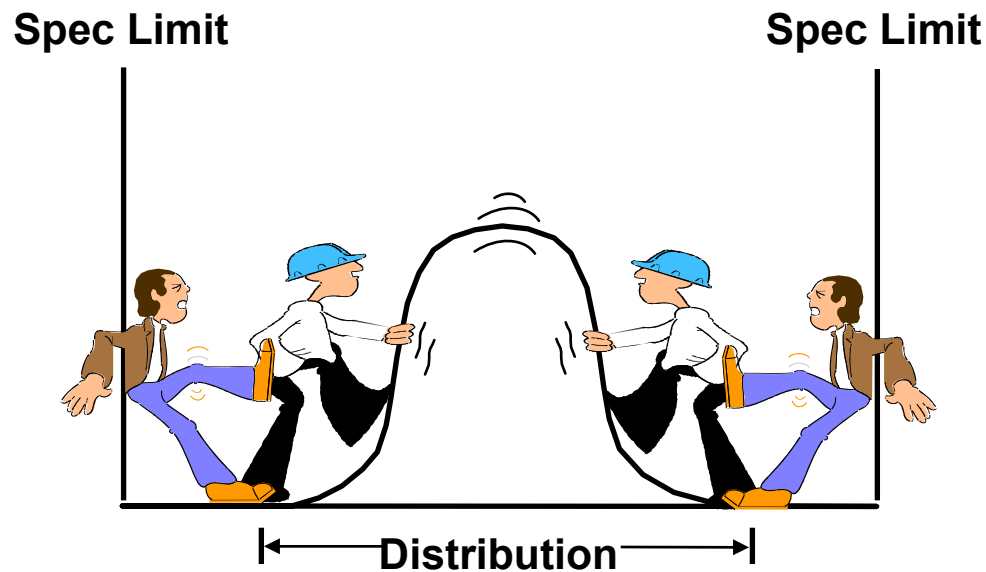
# Six Sigma...



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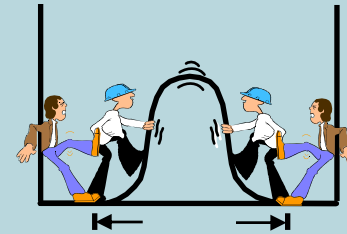


- Aimed to manage process variations that cause defects
  - Unacceptable deviation from the mean or target
  - To systematically work towards managing variation to eliminate those defects



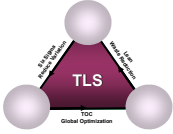
## Six Sigma Approach:

1. Define
2. Measure
3. Analyze
4. Improve
5. Control



- **These continuous improvement approaches have shown considerable tangible impact.**
  - **Toyota**
  - **Motorola**
  - **GE**
  - **GM**
  - **Boeing**
  - **Intel**
  - **US Navy & Air force**

# The Goal...



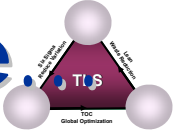
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- “To achieve maximum profit ethically now and in the future...”



- Question:
- Which CPI methodology better allows to maximize profits?

# We embarked in a Study to Explore.

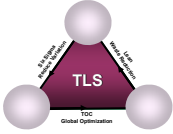


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- **Purpose of the Case Study:**
  - How could we best optimize profits?
- **To achieve that:**
  - Compare and contrast methodologies
  - Evaluate and statistically quantify the impact
- **Deploy the best approach**
  - Higher yields to maximize profits
  - Systematic deployment globally



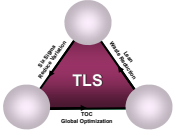
# Initial Condition... Case Study



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- **Lean and Six Sigma had been practiced in the Company for several years.**
- **Both approaches had shown that they were able to prompt operations personnel to work on a series of projects that resulted in cost savings and process improvements.**
- **TLS: an alternative – using synergetic approach.**

# Case Study Objectives

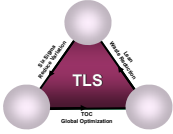


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- Measure and validate effectiveness of:**
  - Lean**
  - Six Sigma**
  - TLS**
  
- Analyze results for statistical significance**
  
- Criteria:**
  - Aggregate contribution to verifiable financial savings**
  - Validate savings**
  - US operations were studied**



# Case Study – Experiment Map



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- **Collect data**
- **Compare**
  - **Lean and Six Sigma**
  - **Lean, Six Sigma and TLS**
- **Using ANOVA as one of analysis tools**
  - **P-Value: 0.05**
  - **Confidence interval: 95%**

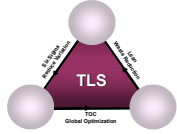




- **Methodology was assigned due to the local preference, experience with a particular methodology and expertise**
  - **Data gathered (Time-years):** **2.5**
  - **Participating plants:** **21**
    - **11 Six Sigma**
    - **4 Lean**
    - **6 TLS**
  - **Team leaders trained:** **211**
  - **Projects completed by all methods:** **101**
- **Each site chose their projects and coached with local experts**
- **Plant size, population, financial standing were mixed**

# Case Study

## ANOVA Comparing Lean with Six Sigma



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### – Hypothesis test for Analysis of Variance (ANOVA):

$$H_o : \mu_1 = \mu_2$$

Avg saving of Lean = Avg savings of Six Sigma

$$H_1 : \mu_1 \neq \mu_2$$

Avg saving of Lean  $\neq$  Avg savings of Six Sigma

### – Original Assumption (Hypothesis):

- Average savings of Lean and Six Sigma approaches are the same

### – Alternative Hypothesis:

- At least one of the approaches has a significantly different average.

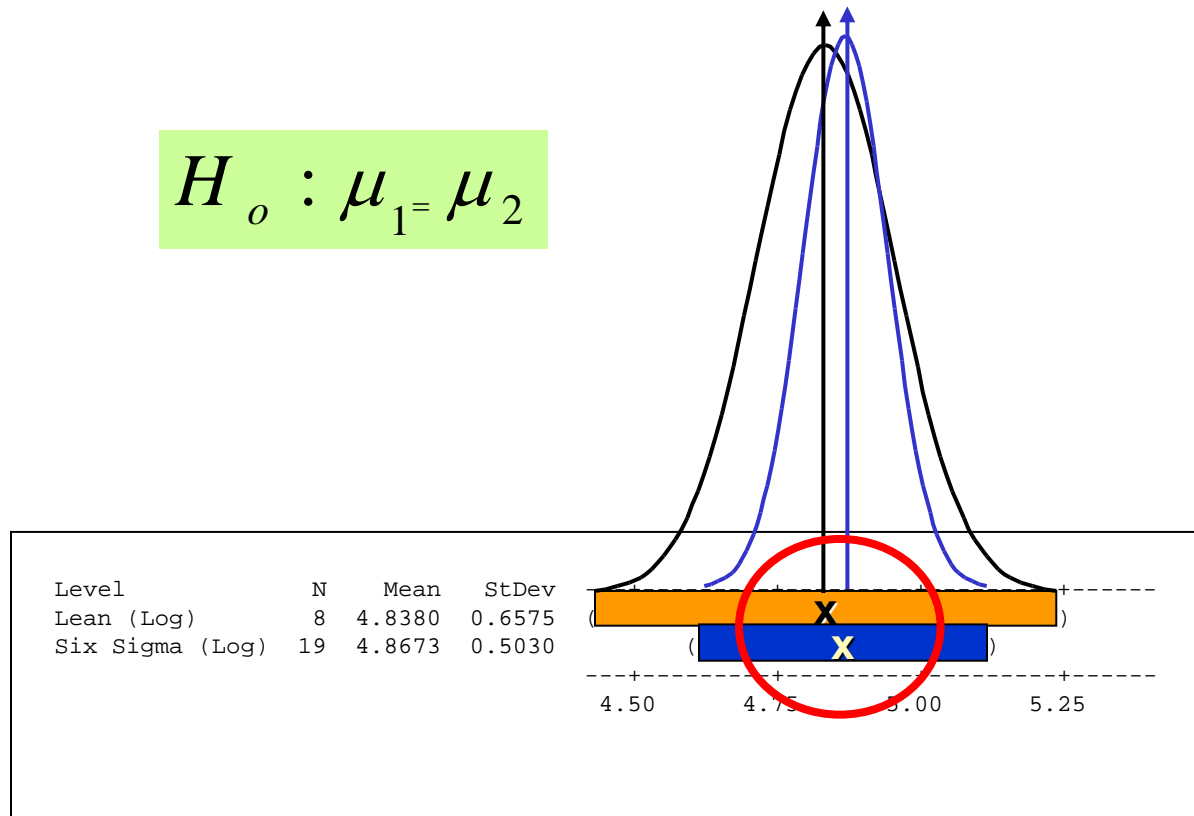
# Comparing Six Sigma With Lean

Individual 95% confidence intervals for Mean Based on Pooled Standard Deviations

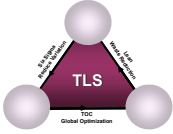


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$$H_o : \mu_1 = \mu_2$$



**P-Value: 0.622: Insignificant difference**



# Is it time to think Differently?

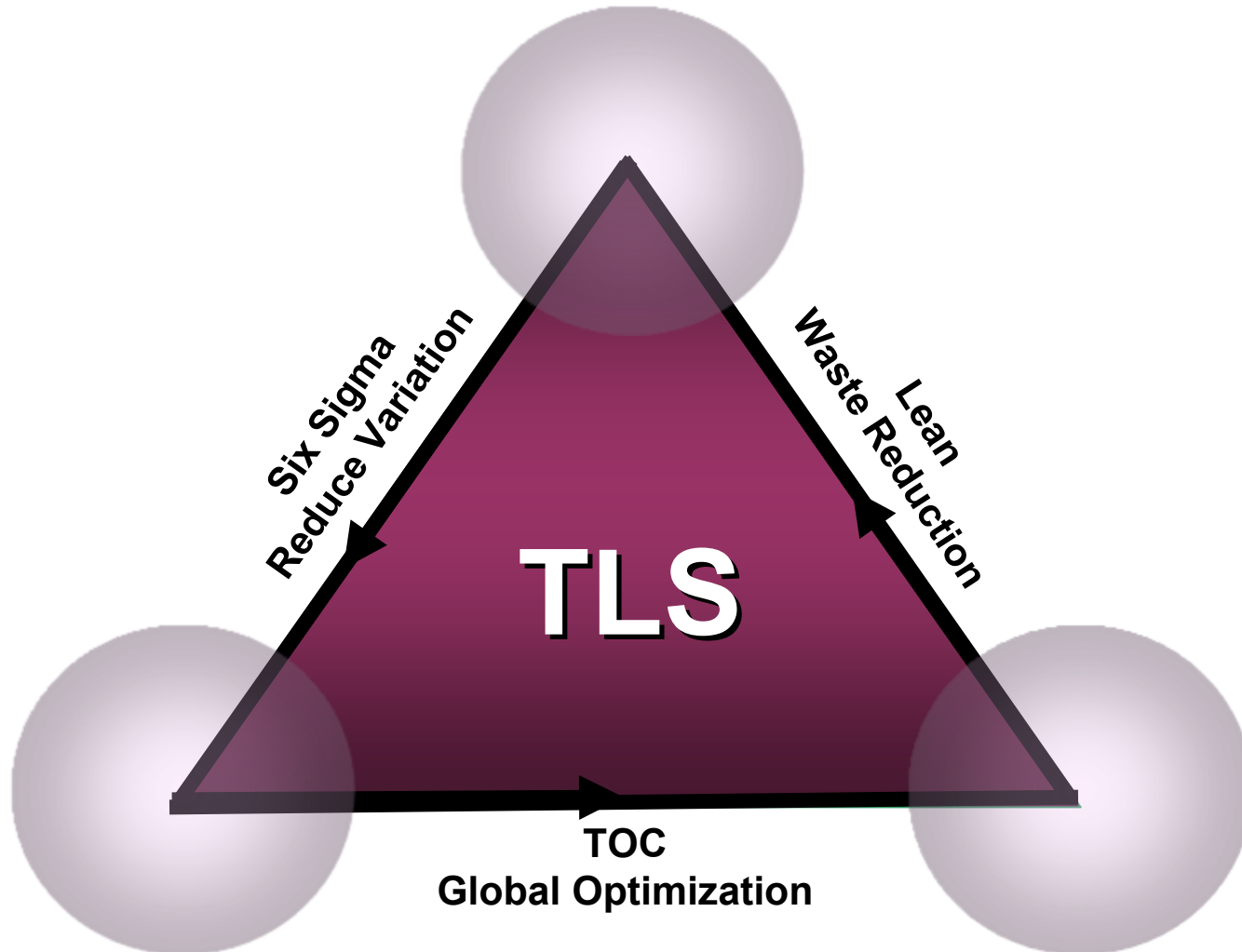


# Next Generation CPI

## TLS TRIO Model



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# Case Study

## Comparing Lean , Six Sigma with TLS



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### – Hypothesis test for ANOVA:

$$H_o : \mu_1 = \mu_2 = \mu_3$$

Avg saving of Lean = Six Sigma = TLS

$$H_1 : \mu_1 \neq \mu_2 \neq \mu_3$$

Avg saving of Lean  $\neq$  Six Sigma  $\neq$  TLS

### – Original Assumption (Hypothesis):

- Average savings of Lean, Six Sigma and TLS approaches are the same

### – Alternative Hypothesis:

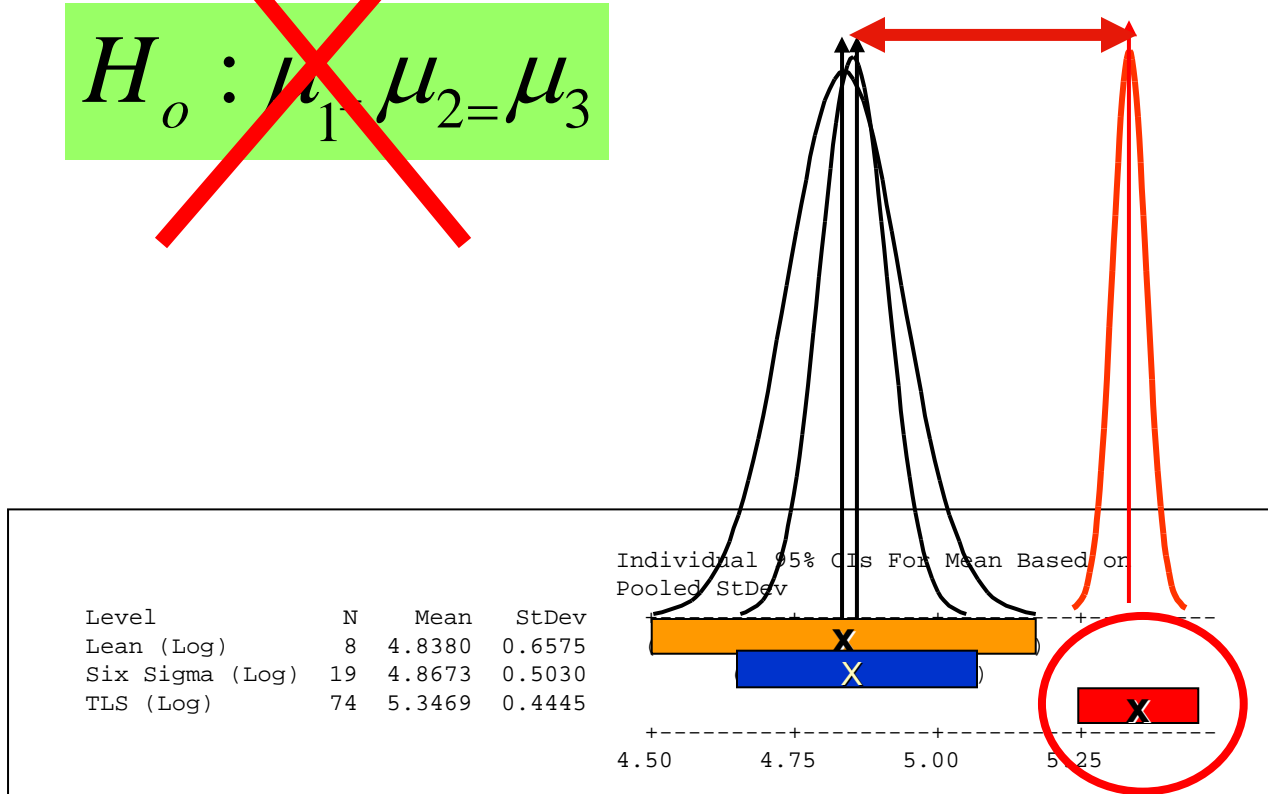
- At least one of the approaches has a significantly different average.

# Comparing Six Sigma With Lean & TLS

Individual 95% confidence intervals for Mean Based on Pooled Standard Deviations

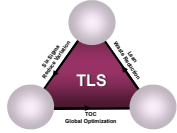
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$$H_0 : \mu_1 = \mu_2 = \mu_3$$



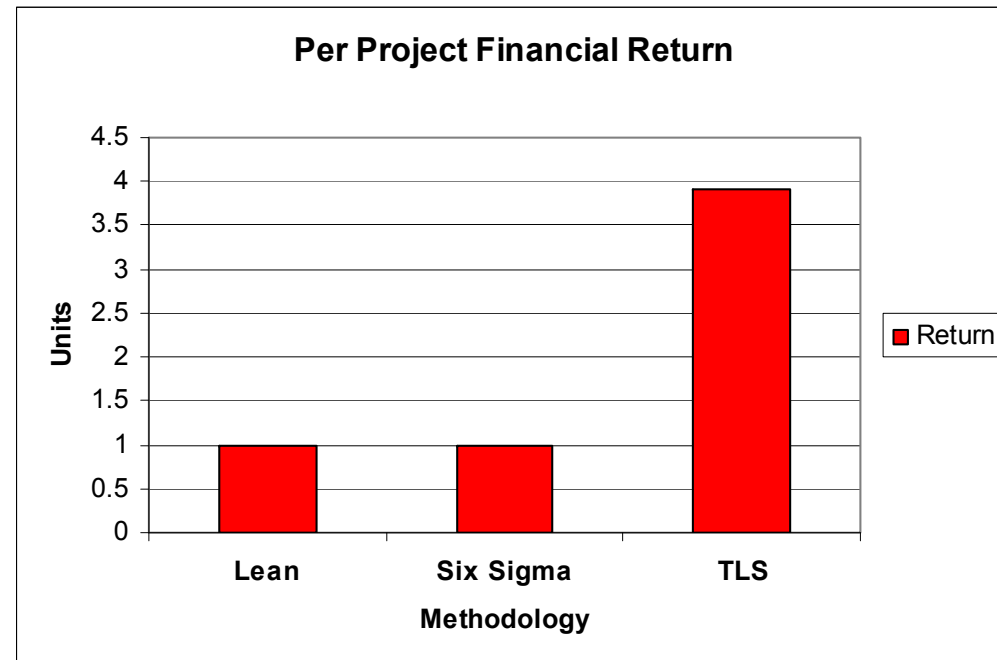
**P-Value: 0.000: Highly Significant difference**

# Case Study - Experiment Findings



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- **TLS, Lean, and Six Sigma all offered benefits**
- **TLS showed 3.9 times greater financial benefit**

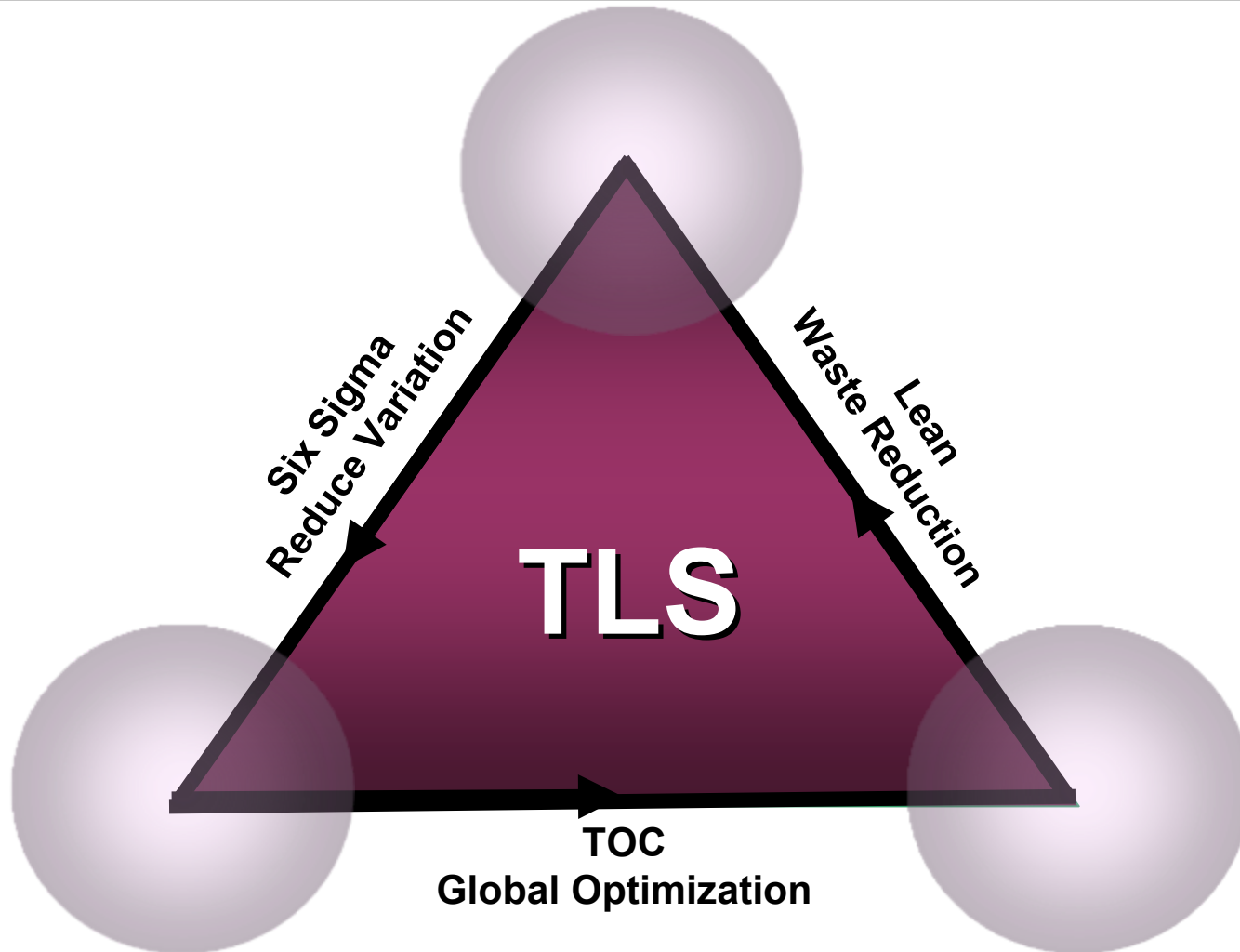


# TLS

## How does it work?



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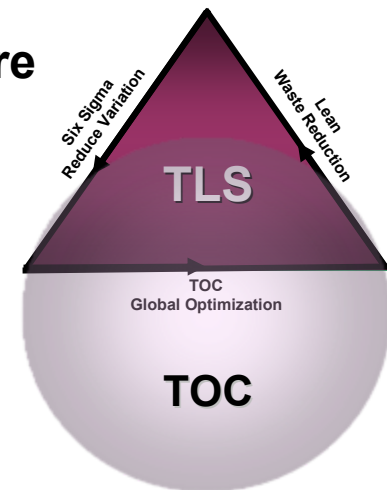


# TLS - CPI TRIO TOC Application

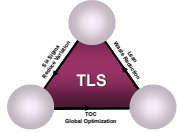


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- Purpose used:
  - Constraint Management and Global Optimization
    - Focusing on what is the constraint
    - Identifying the true constraint and its nature
    - Ensuring global optimization
    - Safeguard against local optimization
    - Realizing constraint shifts
    - Systems approach

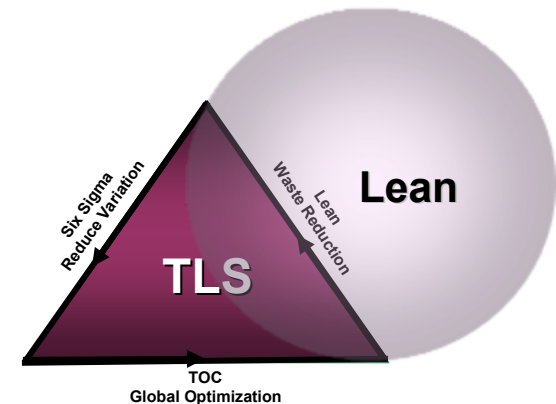


# TLS - CPI TRIO Lean Application

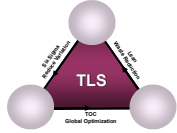


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- Purpose used:
  - Eliminate Waste
    - Identify what is important to the customer
      - Value
    - Clearly understand processes
    - Identify the sources of waste
    - Remove waste from processes
    - Create smooth flow of processes
    - Eliminate unnecessary inventories and WIP
    - Improve work cycle efficiencies by removing unnecessary steps and activities

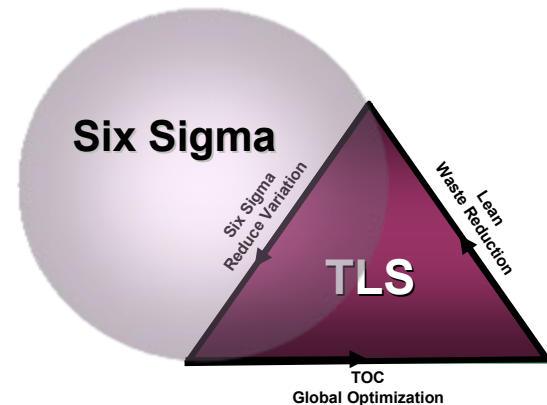


# TLS – CPI TRIO Six Sigma Application



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- Purpose used:
  - Perfecting process and optimizing variability
    - Apply Six Sigma's DMAIC to identify and isolate the source(s) of process variation and systematically remove or minimize those variations.
    - Apply DMADV for new designs
    - Strategically match voice of customer to the voice of process
    - Identify sources of variation in process
    - Design processes that are robust against natural variations



# TLS Engagement Model

## Start with TOC 5 – Focusing Steps



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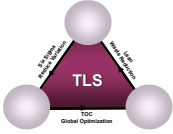
### 3 Methodologies

<b>TOC</b>	<ol style="list-style-type: none"><li>1. Identify the constraint</li><li>2. Exploit the constraint</li><li>3. Subordinate</li><li>4. Elevate the constraint</li><li>5. Go back to step 1 and repeat</li></ol>
<b>Lean</b>	<ol style="list-style-type: none"><li>1. Value</li><li>2. value-stream (eliminate waste)</li><li>3. Flow</li><li>4. Pull</li><li>5. Perfection</li></ol>
<b>Six-Sigma</b>	<ol style="list-style-type: none"><li>1. Define</li><li>2. Measure</li><li>3. Analyze</li><li>4. Improve</li><li>5. Control</li></ol>

### TLS Model



# Project Selection...



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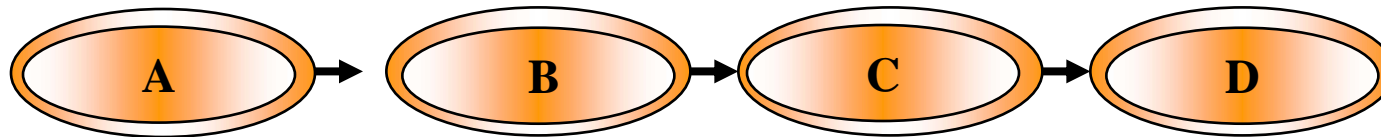
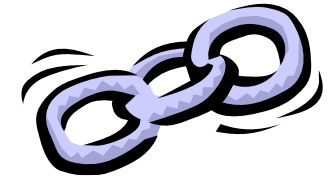
- **“.. Clelerant suggests ... assuming 60% of organizations are currently not selecting the projects that would benefit their businesses most.”**
- **“..48% of respondents to a survey sponsored by Leap Technologies listed improper project scope at outset as one of the three key factors causing Six Sigma projects to fail short of expectations.”**
- **Quality Progress, September 2007**



# Project Selection...

A: 120/D  
B: 100/D  
C: 85/D  
D: 110/D

Takt: 85/D



A: 200/D  
50% improvement

# TLS Engagement Model

## Next – Remove 7 Waste with Lean

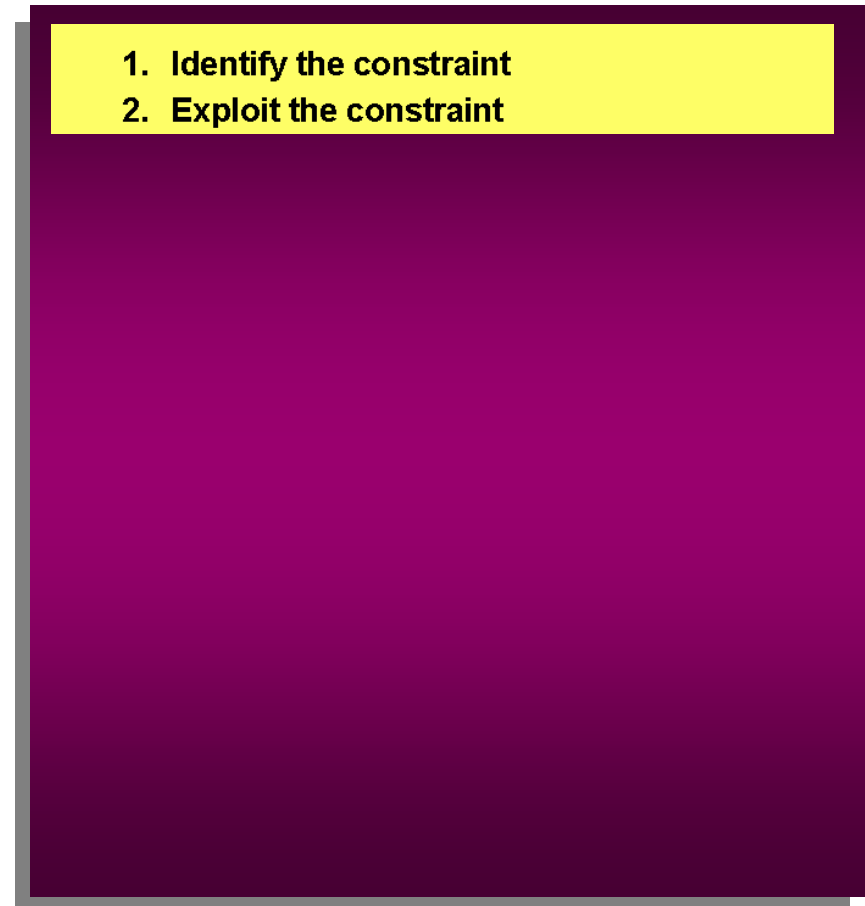


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### 3 Methodologies

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### TLS Model



# TLS Engagement Model

## Reduce Variability with Six Sigma



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### 3 Methodologies

<b>TOC</b>	<ol style="list-style-type: none"> <li>1. Identify the constraint</li> <li>2. Exploit the constraint</li> <li>3. Subordinate</li> <li>4. Elevate the constraint</li> <li>5. Go back to step 1 and repeat</li> </ol>
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### TLS Model

<ol style="list-style-type: none"> <li>1. Identify the constraint</li> <li>2. Exploit the constraint</li> </ol>
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# TLS Engagement Model

## Global Optimization with TOC



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### 3 Methodologies

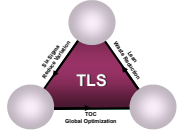
<b>TOC</b>	<ol style="list-style-type: none"> <li>1. Identify the constraint</li> <li>2. Exploit the constraint</li> <li>3. Subordinate</li> <li>4. Elevate the constraint</li> <li>5. Go back to step 1 and repeat</li> </ol>
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### TLS Model

<ol style="list-style-type: none"> <li>1. Identify the constraint</li> <li>2. Exploit the constraint</li> </ol>
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<ol style="list-style-type: none"> <li>1. Define</li> <li>2. Measure</li> <li>3. Analyze</li> <li>4. Improve</li> <li>5. Control</li> </ol>



# TLS Engagement Model Systematic Improvement



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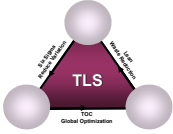
## 3 Methodologies

## TLS Model

<b>TOC</b>	<ol style="list-style-type: none"> <li>1. Identify the constraint</li> <li>2. Exploit the constraint</li> <li>3. Subordinate</li> <li>4. Elevate the constraint</li> <li>5. Go back to step 1 and repeat</li> </ol>
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<ol style="list-style-type: none"> <li>3. Subordinate</li> <li>4. Elevate the constraint</li> <li>5. Go back to step 1 and repeat</li> </ol>





# Lessons Learned

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- **TLS is a synergetic approach**
- **Right mixture of TOC, Lean and Six Sigma fills the gaps**
- **Evolves to a significant approach – Interaction effect**
- **Lean and Six Sigma are viable CPI approaches**
- **By applying TLS we can deliver higher values to our customers**

# Requirements to implement TLS

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## Executive leadership and buy-in

- **Adolfo Anzaldúa: Head of LRS division in Sanmina-SCI has sponsored and adopted TLS as standard CPI model**

## Champions – responsible for global implementation in integrated manner

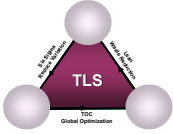
## Local trainers need to be proficient (MBB/BB), in application of:

- TOC
- Lean
- Six Sigma

## Understand TLS engagement model

## Solid project management



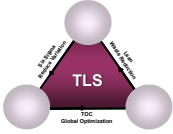


# The Good News...

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- **We have the needed tools**
  - **TOC for where to focus**
  - **Lean for waste reduction**
  - **Six Sigma to reduce variation**



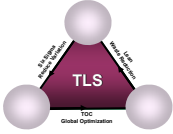


# The Bad News...

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- **Ownership is the constraint**
- **Group think**
- **The devil I know is always better than the devil I do not know**
- **Pain of change that is difficult, even for me**





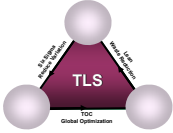
# The Change Is Up To You

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- **First adopters risk their necks in the hope of big rewards**
- **Later adoption is safer but also less rewarding**
- **Would you like your organization to be safe and not lead the change?**



# IT'S YOUR CHOICE



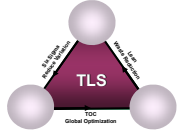
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Good Luck  
&  
Thank You!

- Russ Pirasteh, PhD, CMBB, CLM
- Global Director – Operations Excellence
  - Sanmina-SCI – LRS Division
  - [russ.pirasteh@sanmina-sci.com](mailto:russ.pirasteh@sanmina-sci.com)



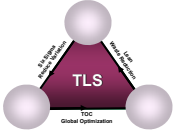
# About Dr. Russ Pirasteh



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***Dr. Russ Pirasteh is Global Director of Operations Excellence for Sanmina-SCI Corporation - LRS Division. In his current capacity he is responsible for CPI, engineering, supply chain management and quality. He has held executive, staff and line positions with 25 years of solid experience in implementation of continuous improvement systems in manufacturing and transactional environments. He has earned Ph.D. in Engineering, MBA in Industrial Management, BS in Industrial Engineering, Certified Lean Six Sigma Master Black Belt, and Certified Lean Master. He has formulated TLS CPI methodology to fill the gaps among CPI methodologies he has experienced. Russ has published numerous publications and provided lectures for Webber University, UTA, APICS, and IE organizations. He is a member of APICS, IE, and ASQ.***





# Credits and Recognition

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- **Adolfo Anzaldúa**
  - **Head of LRS division in Sanmina-SCI**
  
- **All Participating Sanmina-SCI plants**
  - **GMs, Team Leaders and staff**
  
- **Mentors & Inspirations:**
  - **Dr. Eli Goldratt, Robert Fox, John Ballis, Dr. K. Farah**

