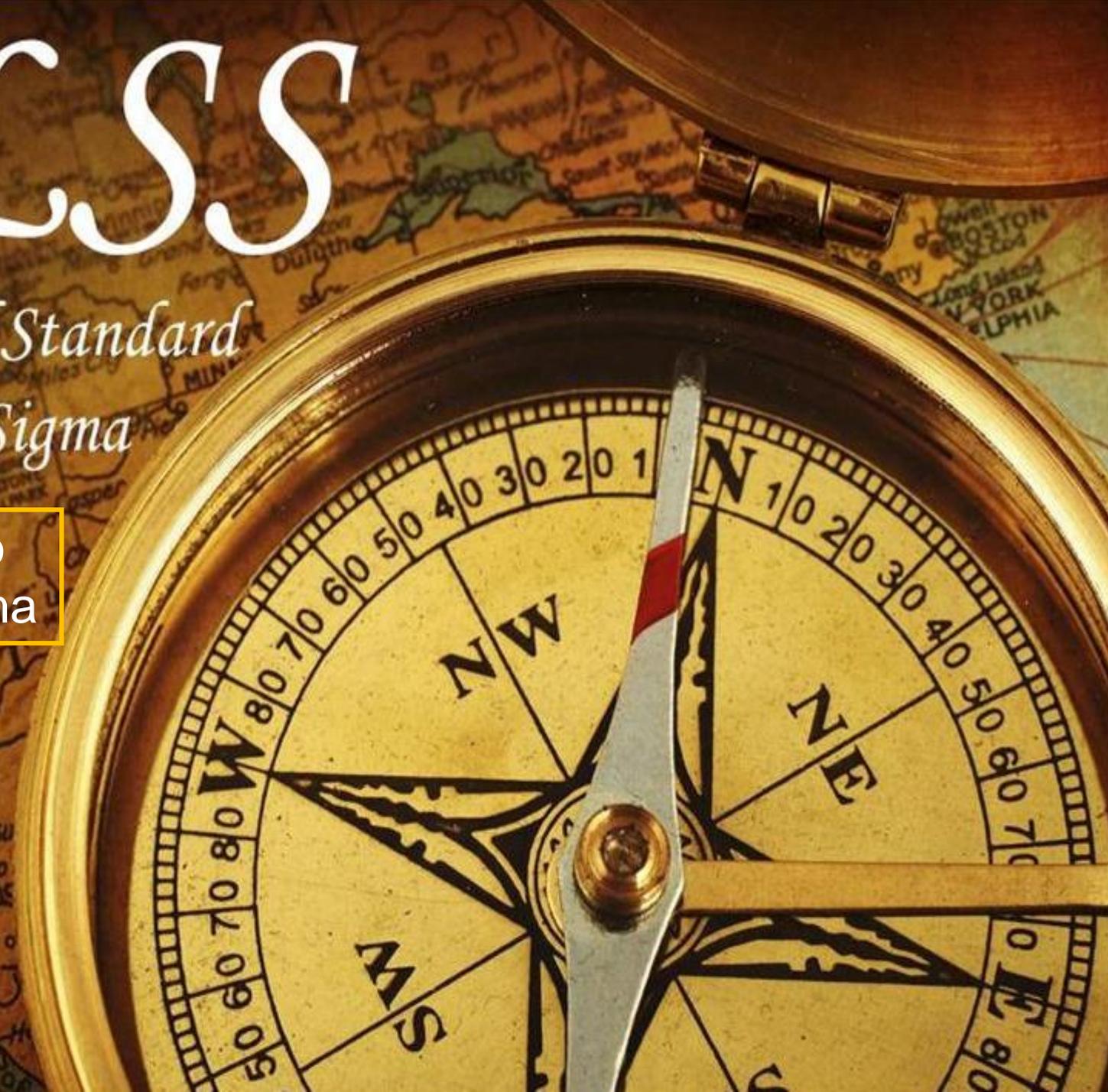
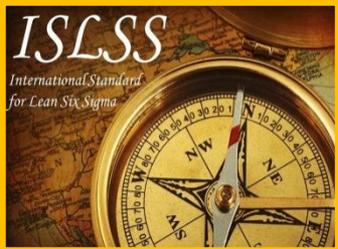


# ISLSS

*International Standard  
for Lean Six Sigma*

◆ Introduction to  
Lean Six Sigma



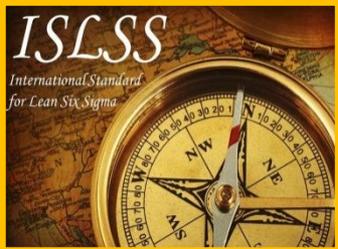


# Table of Contents

- ◆ Lean Overview
- ◆ Six Sigma Overview
- ◆ Lean Six Sigma Integration
- ◆ Lean Six Sigma Deployment Planning
- ◆ Wrap-Up



**“A bad system will defeat a good person every time.” – Deming**



# Learning Objectives

By the end of this course, you will:

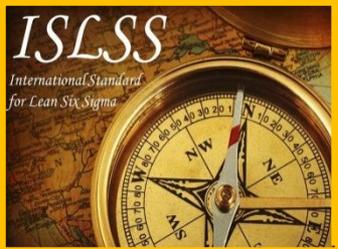
- ◆ Know the origin and aims of Lean, Six Sigma, and Lean Six Sigma
- ◆ Understand the roles and responsibilities within a Lean Six Sigma Team
- ◆ Understand the project identification, selection, and prioritization process
- ◆ Understand how Lean and Six Sigma synergistically come together, building a transformation methodology more powerful than the sum of the parts
- ◆ Understand the value proposition of Lean Six Sigma
- ◆ Learn the Lean Six Sigma terms, tools, and DMAIC methods/definitions



**Tell me & I will forget, show me & I may remember, involve me & I'll understand**

# Lean





# Origins of Lean

## ◆ Lean has been around a long time:

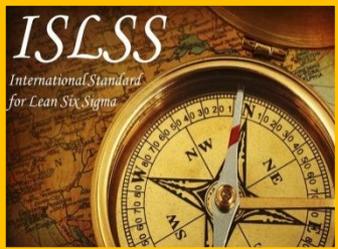
- Pioneered by Ford in the early 1900's (33 hrs from iron ore to finished Model T, almost zero inventory but also zero flexibility!)
- Perfected by Toyota post WWII (multiple models/colors/options, rapid setups, Kanban, mistake-proofing, almost zero inventory with maximum flexibility!)

## ◆ Known by many names:

- Toyota Production System
- Just-In-Time (JIT)
- Continuous Flow



While Lean was born in Manufacturing, It later matured into Transactions & Services



# Management, Core & Support Processes Defined

- ◆ **Management Processes:** the activities associated with governing the organization.

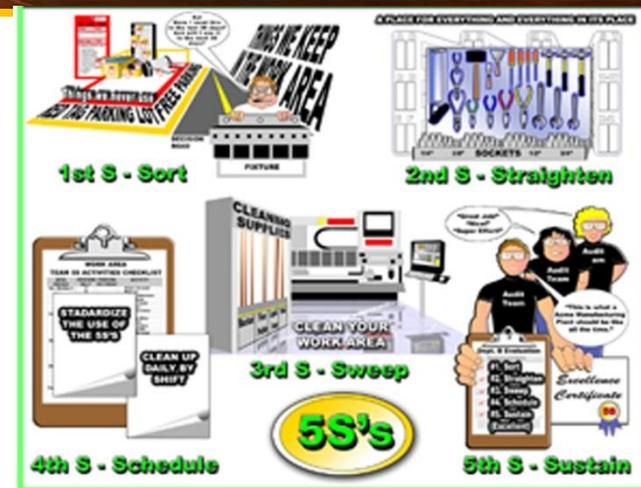
Examples: strategic planning; corporate governance, budgeting

- ◆ **Core Processes:** the activities that create the primary value stream (important to the customer) in an organization.

Examples: contract negotiation, customer acquisition, assembly, testing

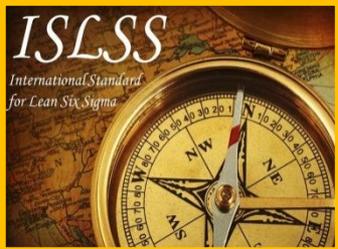
- ◆ **Support Processes:** these activities enable the core processes

Examples: recruiting, production control, accounts receivable



- ◆ 5s can be applied on all processes.
- ◆ Sort, Straighten, Sweep, Schedule, Sustain
- ◆ Organize what is needed, where it is needed, in the needed quantities.

**Lean Six Sigma can be applied to any Process**



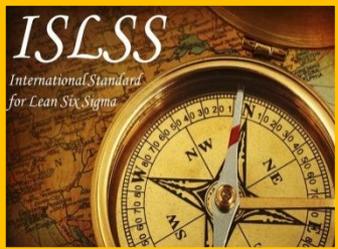
# Lean Basics

## ◆ The Basics

- What is Lean?
  - Value Analysis
  - Little's Law: Lead Time (Calculation)
  - Process Cycle Efficiency (Calculation)
  - Takt Time (Calculation)
- ◆ Outwardly focused on being flexible to meet customer demand, inwardly focused on reducing/eliminating the waste and cost in all processes
- ◆ Highly applicable to transactional businesses!
- Whenever flexibility and speed are key: banks, technology firms and customer service organizations the most recent to adopt Lean practices

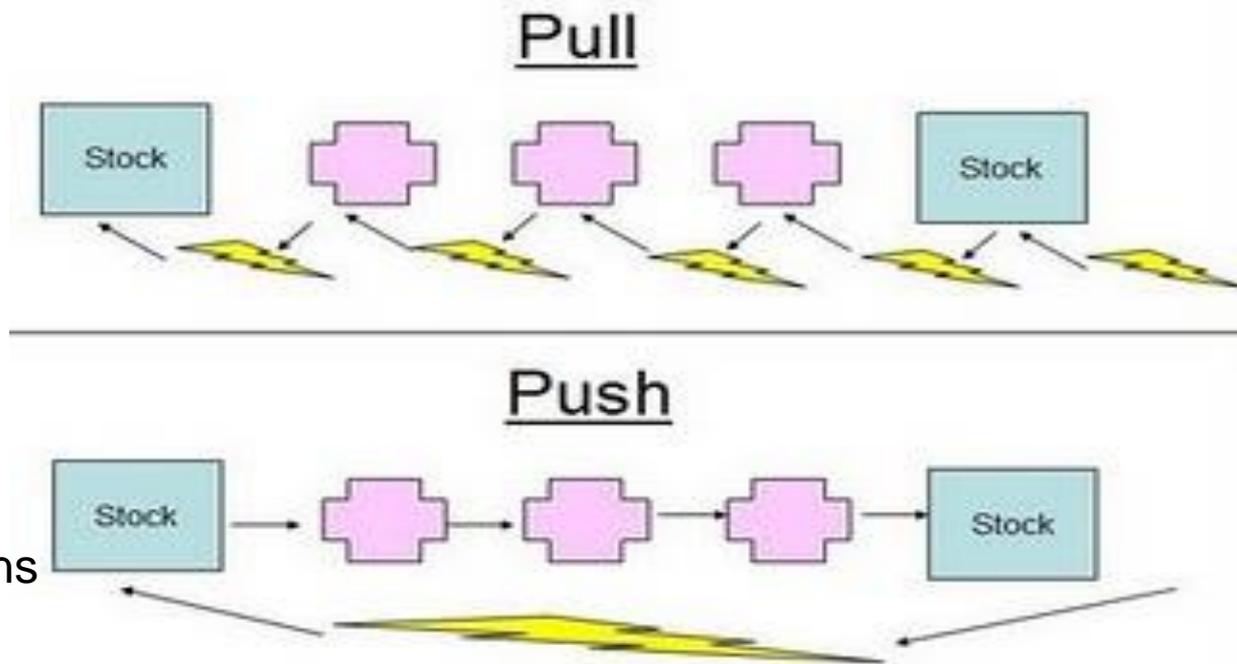


**Lean Flows Value from Customer Demand**

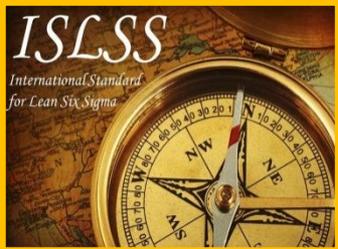


# Lean - What is Lean?

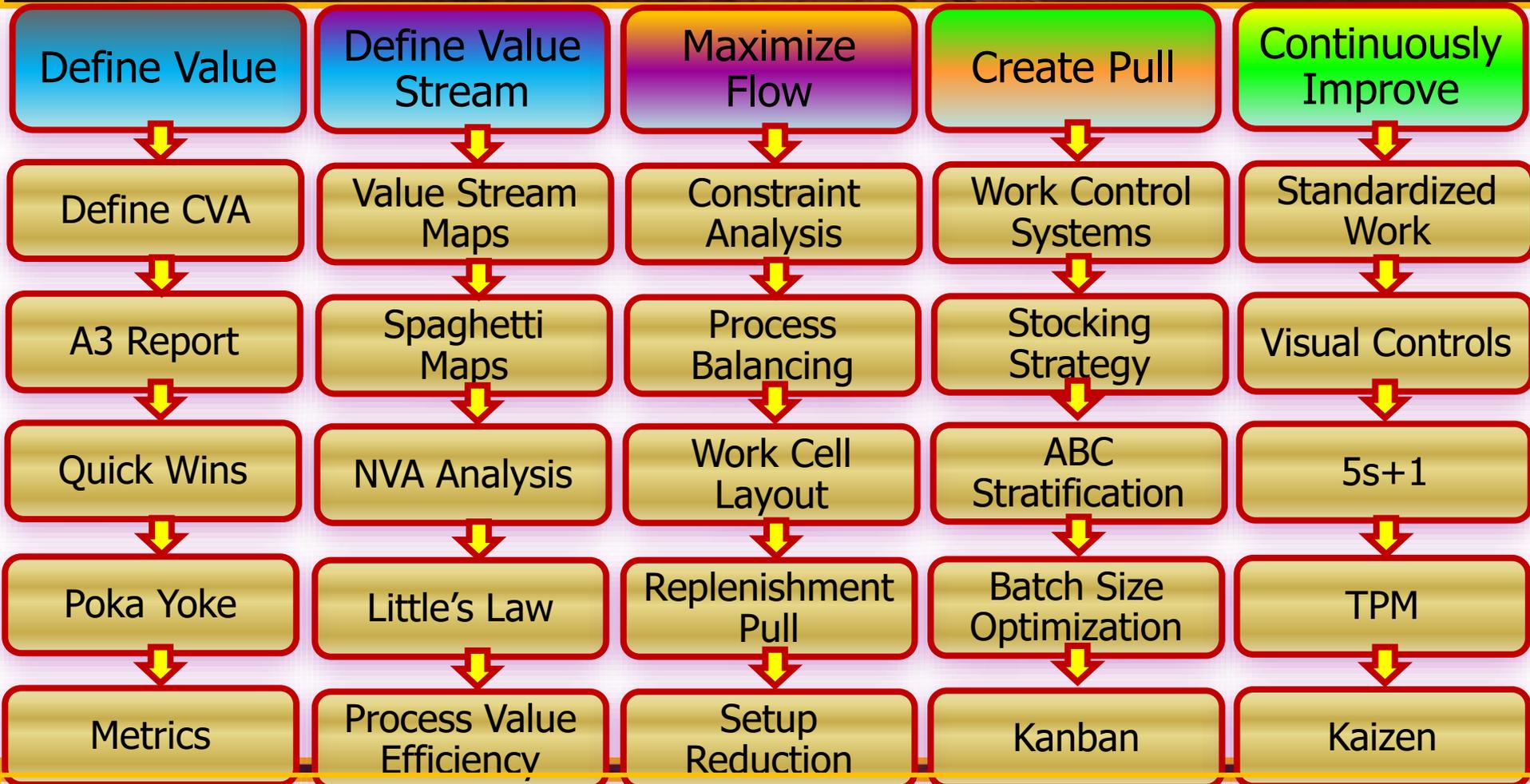
- ◆ Lean is a methodology for increasing process speed (reduced cycle time), improving efficiency (minimize time, capital invested, and cost) in any process, and increased agility and process flow.
- ◆ Lean is a methodology for increasing process speed and improving efficiency through waste reduction.
- ◆ What Lean Is Not:
  - A business strategy
  - Only for manufacturing companies
  - About headcount reductions
  - Only about the tools



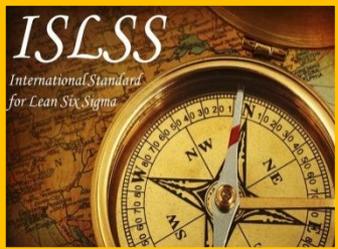
**Products and Services are Process Pulled vs. Pushed**



# The Path to Lean



**Lean (Speed) + Six Sigma (Quality) = ROI (Lower Costs)**

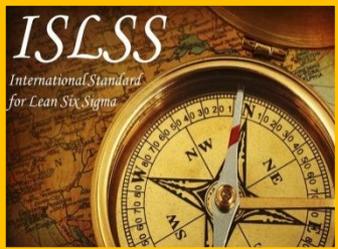


# Value Analysis



- ◆ With regard to Value Analysis there are three things to look for in every process:
- ◆ **Value-Add (VA) or Customer Value-Add (CVA)**
  - This is the activity or process steps that are essential to delivering a product or service to a customer. These are the activities the customers are willing to pay .
- ◆ **Business Non-Value Add (BNVA) or Required Waste (RW)**
  - These are the process steps and activities that the company needs to execute the value-added work; the customer may not see a direct correlation to the delivery of the product or service. These also include regulatory requirements.
- ◆ **Non-Value Add (NVA)**
  - These are the activities that add no value and are not required for financial, legal or other business reasons.

**Value Analysis is thru the Customer's Perspective**



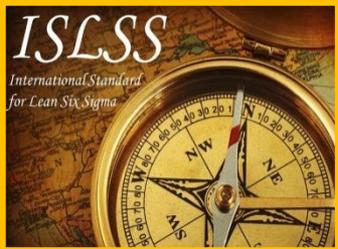
# The Seven (7) Wastes of Lean

1. **T**ransport – movement of parts and/or documentation further than necessary.
2. **I**nventory – stock of virtually anything is waste.
3. **M**otion – non-value added movement of people, or machinery.
4. **W**aiting – wait time is idle time; waiting for people, machines, information or material.
5. **O**verproduction – producing more than customers demand or producing at a faster pace than is needed.
6. **O**verprocessing – putting in more work than is necessary to meet the customer's requirements.
7. **D**efects – rework and defects which take time, materials, energy, capacity and labor.

T  
I  
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\* Another waste is: People (untapped and/or misused resources)

**TIMWOOD = Process Waste to Target & Eliminate**



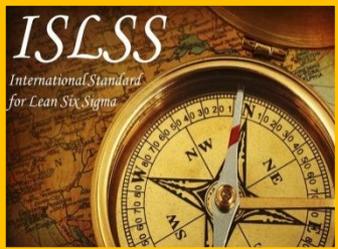
# The Lessons of Lean

## ◆ “Un-lean” processes

- Most processes are not lean
- In most service process 90% or more of the work is non-value add or Business non-value add, while world class service processes still contain 50% waste.
- Work done to correct mistakes, correct earlier delays, contact someone when pre-negotiation could have been done, etc. contributes to non-value added work.
- Lean is about increasing process speed, flow, and agility where produces and services are pulled thru the process by customer demand.



**Lean is a Bottoms-Up Management Approach**

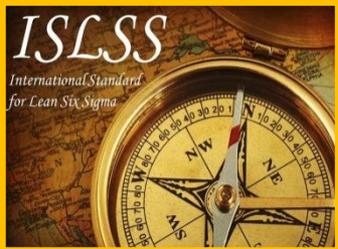


# Little's Law

$$\text{Avg Lead Time} = \frac{\text{No. of "Things In Process"}}{\text{Avg Completion Rate}}$$

- ◆ **To reduce Lead time, you have 2 choices:**
  - Invest dollars of capital in people and equipment to increase Avg. Completion Rate
  - Invest Intellectual capital to reduce number of “Things In Process” using Lean Tools (Pull Systems, Setup Reduction, etc) and Six Sigma tools (Variation Reduction)
- ◆ **Little's Law:** Mathematics of Theory of Constraints (TOC) and Toyota Production System (TPS)
  - Pull rather than Push work into a process which may already be overloaded. Why is it called Pull? Because the WIP is not increased until it has been reduced by a shipment or a service completion.
  - This requires an input queue prior to WIP, and a ranking system for release of work into WIP.
  - Lead Time (process) starts when an item is released into WIP.

**WIP = Work In Process; TIP = Things In Process**



# Process Cycle Efficiency

- ◆ Process Cycle Efficiency helps quantify opportunity

$$PCE\% = \frac{\text{Value-Added Time (VA)}}{\text{Process Lead Time (PLT)}} \times 100\%$$

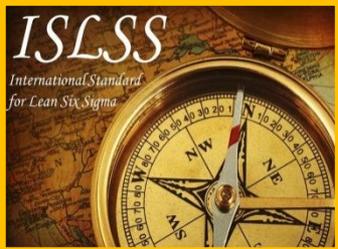
$$PLT = \frac{\text{Amount of WIP}}{\text{Avg. completion rate}} = \text{Little's Law}$$

\* Chart from Lean Six Sigma for Service, Michael L. George, copyright 2003, The McGraw Hill Companies

- ◆ PCE% is a universal process metric that can be used to compare different processes.
- ◆ It estimates how efficient a process is from the customers perspective.
- ◆ The higher the PCE%, the faster the customer value is delivered.

Application	Typical PCE	World-Class PCE
Manufacturing	5%	30%
Services	10%	50%

**How Much Value Add Does Your Processes Generate?**



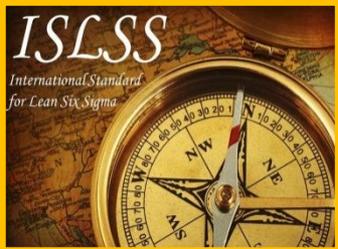
# Analysis Tool: “Value-Add” Assessment

## Assessing Types of Tasks

- ◆ **Value Adding (VA):** Steps essential to deliver product or service according to customer requirements. Three criteria:
  1. Transforms the product or service toward completion
  2. Customer cares (would be willing to pay for it)
  3. Done right the first time
- ◆ **Required Waste (RW):** Steps that are not essential to the customer but the business has to perform
- ◆ **Non-Value Adding (NVA):** Steps that do not qualify as Value Add or Business Non-Value Adding



**Each Process Step Can Have Varying % of VA, RW, NVA**



# Takt Rate Analysis

- ◆ **Time Trap Identification:** the process (or process step) that injects the most amount of delay into the process is the time trap.
- ◆ Takt Rate Analysis compares the task time of each process or step to:
  - Each other to determine the time trap
  - Customer demand to determine if the time trap is the constraint

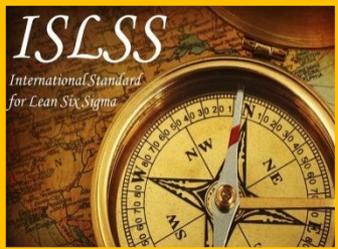
Takt Rate = Customer Demand Rate =  $\frac{\text{Number of Units to Process}}{\text{Net Process Time Available}}$

Takt Time =  $\frac{\text{Net Process Time Available}}{\text{Number of Units to Process}}$



- ◆ How Do We Find the Time Traps (Wasted Time)?
  - Map the process; known as a value stream map
  - Time each activity (if timing is not available)
  - Time the wait states (waiting on material, other people, rework, overloaded WIP)

**Takt = German Word for Rhythm, The Beat of a Drum**

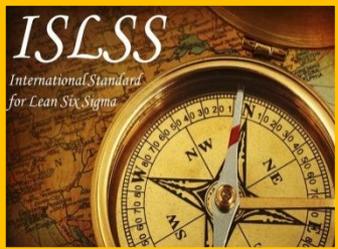


# Visible Workplace

Work that is not seen (invisible) cannot be improved

- In manufacturing you can see large parts of the work flow; in service work you cannot. Perhaps that's why lean started in manufacturing.
- WIP (TIP = Things In Process) is difficult to see in services
- How Do We Make Work Visible?
  - Establish and display WIP = Work in Process (TIP)
  - Establish and display metrics for the process (the dashboard for the hour, day, week, month)
  - Display a list of proposed Quality, Speed, and Financial metrics.
    - i.e. Quality = Defect Rate, Rolled Throughput Yield
    - i.e. Speed = Process Lead Time (PLT), PCE%
    - i.e. Financial = Per Unit Cost, Scrap Rate

**How Visible are your Business Processes?**



# Toyota Production System

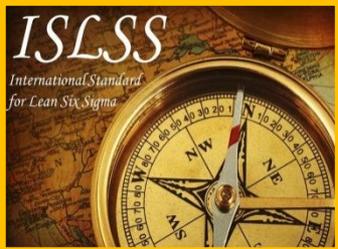
## Waste Elimination (Applies to Every Process)

*“The ability to eliminate waste is developed by giving up the belief that there is ‘no other way’ to perform a given task. It is useless to say, ‘It has to be done that way,’ or ‘This can’t be helped!’*

*At Toyota, we have found that there is always another way.”*

*– Study of the Toyota Production System*

**“Quick and Crude is better than Slow and Elegant” – John R. Black**



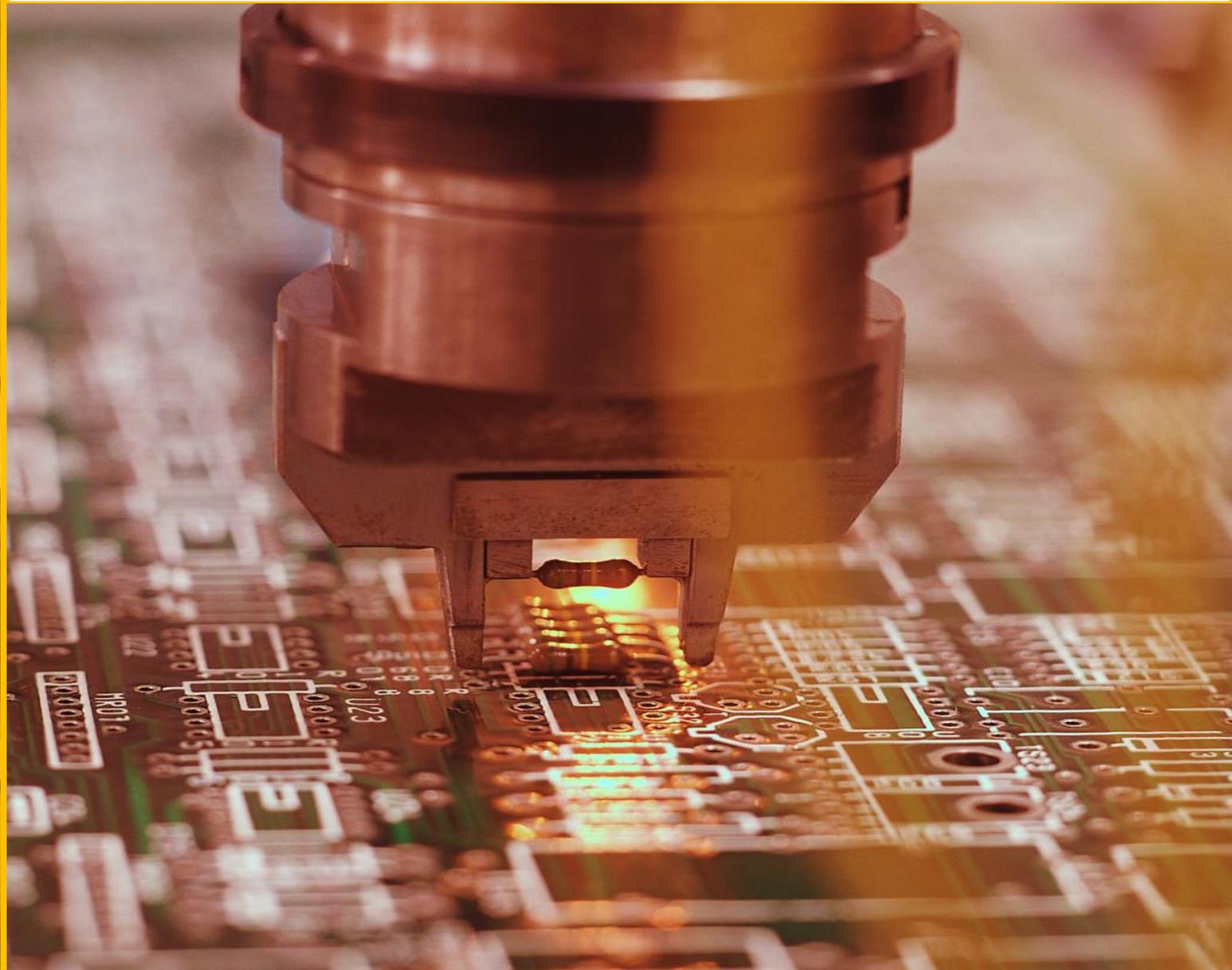
# But Lean Alone Has Holes

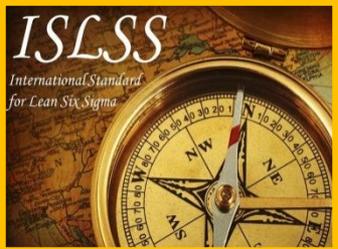
- ◆ Lacks defined cultural infrastructure
  - Top leadership engagement
  - Deployment organization (Champions, Black Belts, etc.)
  - Sometimes lacks focus on customer
- ◆ Lacks a consistent methodology
- ◆ Most lean efforts lack focus on variation elimination and simply “account for” the variability by carrying excess inventory and resources
- ◆ Lean tools do not intrinsically focus on bringing a process under statistical control and maintaining that control allowing for unpleasant surprises



**When using Lean alone, you risk delivering the wrong things, faster!**

# Six Sigma

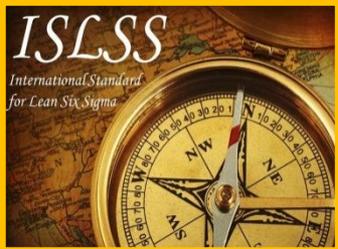




# Six Sigma History

- ◆ Motorola was the first advocate in the 80's
- ◆ Six Sigma Black Belt methodology began in late 80's/early 90's
- ◆ More recently, other companies have embraced Six Sigma:
  - GE                      ■ Bombardier            ■ US NAVY            ■ Eli Lilly            ■ Best Buy
  - Allied Signal        ■ Sony                    ■ US ARMY            ■ Xerox            ■ Caterpillar
- ◆ Project implementers names includes “Black Belts”, “Top Guns”, “Change Agents”, “Trailblazers”, etc.
- ◆ Implementers are expected to deliver annual benefits between \$500,000 and \$1,000,000 through 3-5 projects per year
- ◆ Top-down program with Executive and Champion support
- ◆ Outwardly focused on Voice of the Customer, inwardly focused on using statistical tools on projects that yield high return on investment

**Six Sigma Improves Quality by Reducing Defects & Variation**

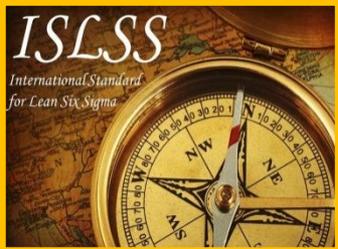


# What is Six Sigma?

- ◆ Six Sigma is a quality improvement methodology designed to reduce product or service failure rates to near perfection.
- ◆ Incorporated into the methodology is the use of a data-driven approach to work toward the elimination of defects in every process area of a business, emphasizing the production of products and services better, faster and at a lower cost than the competition.
- ◆ Simply: Six Sigma is a methodology for determining and reducing/eliminating variation in a process, thereby improving quality.



**Six Sigma is a Data & Customer Driven Approach**



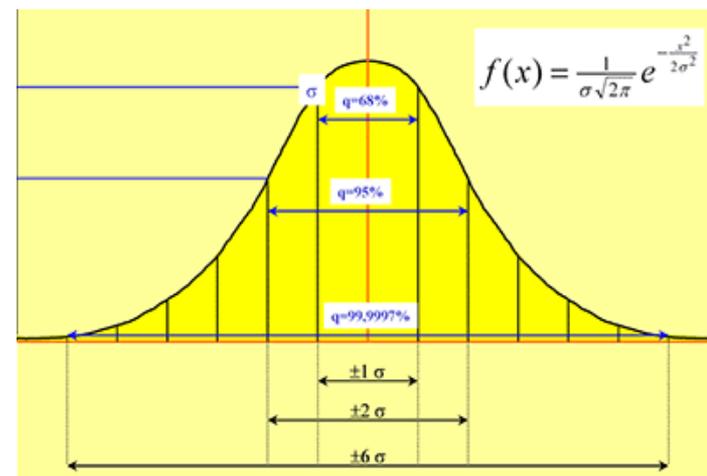
# Six Sigma Defined

## ◆ What Six Sigma Is:

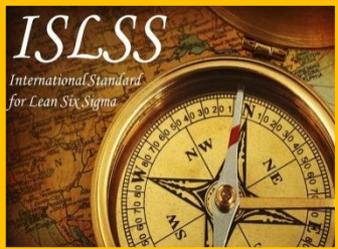
- An enabler to business strategy
- Places customers at the center of performance improvements
- Fact-based approach for improving business processes & solving problems
- A proven methodology and toolset supported by deep training and mentoring
- Focused on reducing variability of processes
- A way to develop highly skilled business leaders
- A means for creating capacity in organizations

## ◆ What Six Sigma Is Not:

- A business strategy
- A way to develop statisticians and engineers
- Only for manufacturing companies
- Only about “cost reductions”
- A “flavor of the month” approach
- An approach that slows decision making and business outcomes



**Six Sigma Practitioners Believe Quality is Everyone's Responsibility**

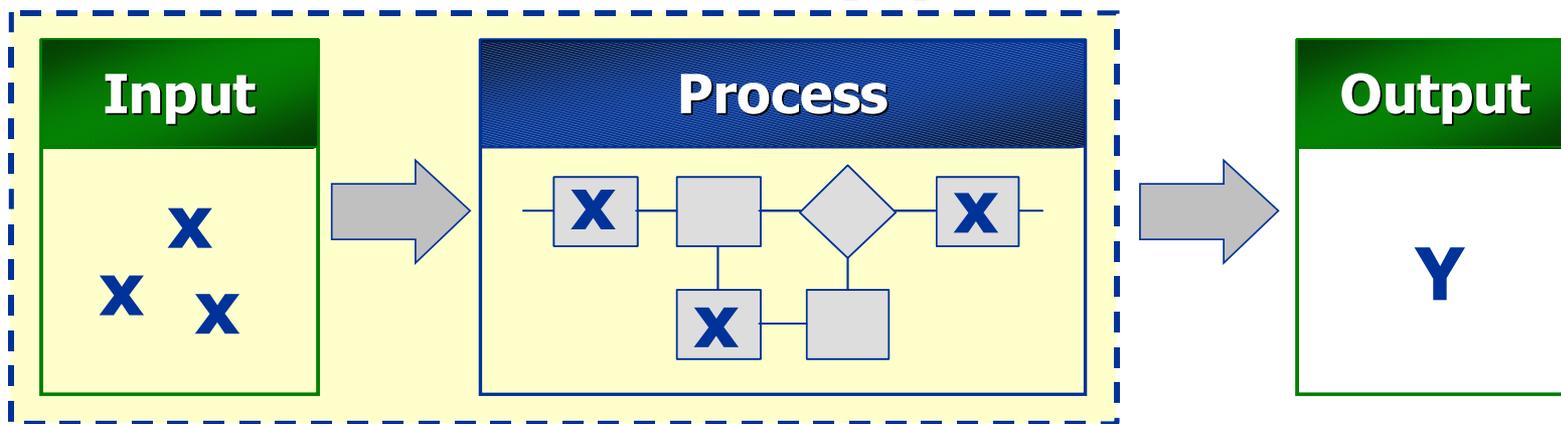


# What is a Process?

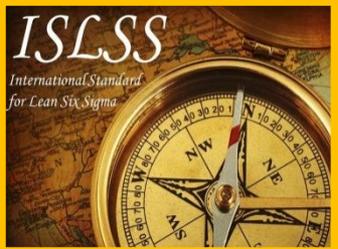
Process: Any activity that takes inputs, adds value and provides an output(s).

Process Approach: The identification, interaction, application and management of systematic activities in an organization.

$$Y = f(X)$$



**Each Process Step is and Opportunity for Value Creation or Defects and Waste**

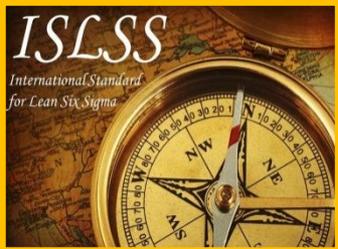


# What Do Our Clients Want?

**All the Client Really Wants Is Everything**

**Faster**      **Better**  
**Cheaper**

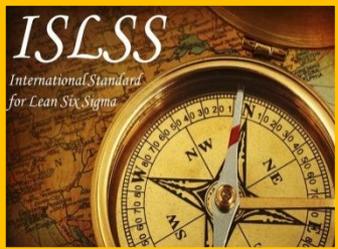
**Lean (Speed); Six Sigma (Quality); Both (Cost)**



# Six Sigma Tools

- ◆ Quality Functional Deployment
- ◆ SIPOC
- ◆ CCR or CTQ Tree
- ◆ Process Map
- ◆ Voice of the Customer Analysis
- ◆ Quality Function Deployment
- ◆ Kano Analysis
- ◆ Data Collection Plan
- ◆ Statistical Sampling
- ◆ Measurement System Analysis
- ◆ Statistical Process Control
- ◆ Financial Analysis
- ◆ Pareto Analysis
- ◆ Brainstorming
- ◆ Frequency Plots & Histograms
- ◆ Control Charts
- ◆ Process Capability Analysis
- ◆ C & E Matrix
- ◆ Failure Modes and Effects Analysis
- ◆ Cause and Effect Diagrams
- ◆ Mood's Median
- ◆ ANOVA
- ◆ Components of Variation Analysis
- ◆ Simple and Multiple Regression
- ◆ Chi-Square Analysis
- ◆ Logistical Regression
- ◆ Benchmarking
- ◆ Pugh Selection Matrix
- ◆ Design of Experiments
- ◆ Piloting
- ◆ Gage R&R or AR&R
- ◆ Cost/Benefit Analysis
- ◆ Standard Operational Procedures
- ◆ Control Response Plans
- ◆ Control Charting

**Kaizen Events Targeted in Measure to Accelerate Results**



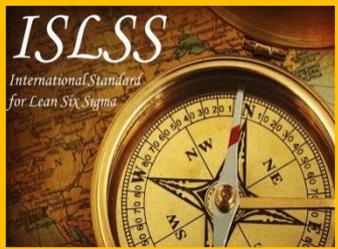
# How Capable Are Your Products & Services? (% Shippable without Rework)

The amount of process variation and defects increase as the # of SKU's or Process Steps increase, while the yield decreases

# of Parts or Steps	$\pm 3\sigma$ (Cp=1.00)*	$\pm 4\sigma$ (Cp=1.33)*	$\pm 5\sigma$ (Cp=1.67)*	$\pm 6\sigma$ (Cp=2.00)*
1	93.32%	99.38%	99.98%	99.9997%
2	87.08%	98.76%	99.95%	99.9993%
3	81.27%	98.15%	99.93%	99.9990%
4	75.84%	97.54%	99.91%	99.9986%
5	70.77%	96.93%	99.88%	99.9983%
10	50.09%	93.96%	99.77%	99.9966%
30	12.56%	82.96%	99.30%	99.9898%
50	3.15%	73.24%	98.84%	99.9830%
100	0.10%	53.64%	97.70%	99.9660%
300		15.43%	93.26%	99.8980%
500		4.44%	89.02%	99.8301%
1,000		0.20%	79.24%	99.6605%
3,000			49.75%	98.9849%
5,000			31.24%	98.3140%
10,000			9.76%	96.6564%

\* Distribution shifted by  $1.5\sigma$

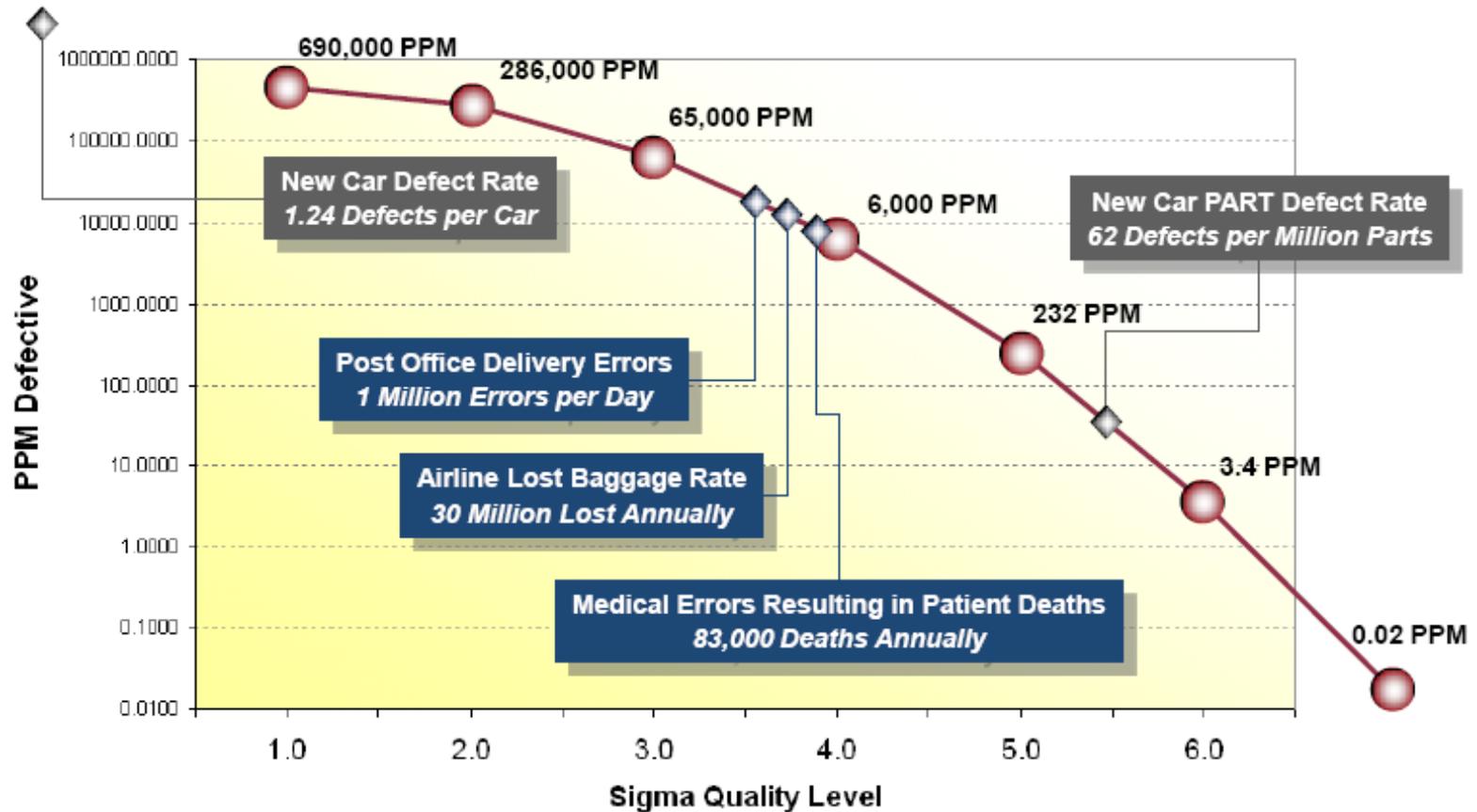
**Cp = Capability of your Process**



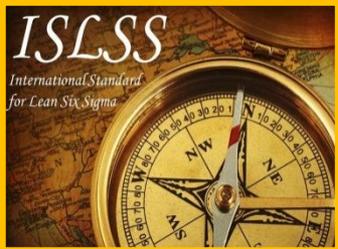
# Six Sigma DPMO

## Defects Per Million Opportunities

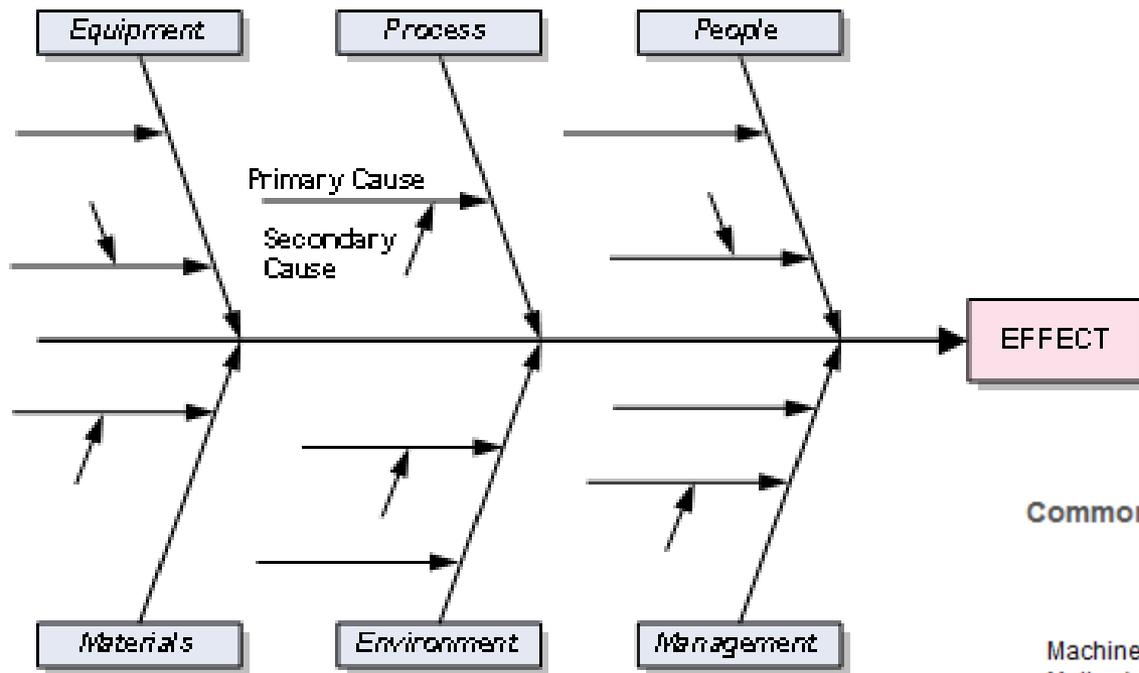
Parts per Million (PPM) Defective by Sigma Quality Level



**Six Sigma is a Quality Measure and a Goal**



# Six (6) Causes of Variation?



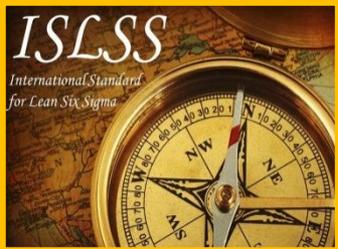
- ◆ A Fishbone Diagram is also called the Ishikawa Diagram or Cause and Effect Diagram.
- ◆ It gets its name from the fact that the shape looks a bit like a fish skeleton.
- ◆ The 5 Why's technique help us drill down to the root cause

### Common Categories in a Fishbone Diagram

The M's	The P's (Service Industry)	The S's (Service Industry)
Machine (Equipment)	Plant/Place	Surroundings
Method (Process)	Process	Supplies
Man Power (People / physical labor)	People	Systems
Material	Policies	Skills
Mother Nature (Environment)	Procedures	
Management (Policies)	Price	
Measurement (Inspection)	Promotion	
Maintenance	Product	
Marketing (Promotion)		

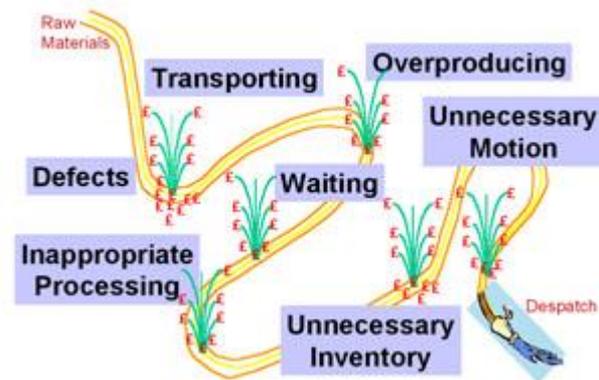
◆ A fish bone diagram is a common tool used for a cause and effect analysis, where you try to identify possible causes for a certain problem or event.

**What are the causes of variation in your processes?**



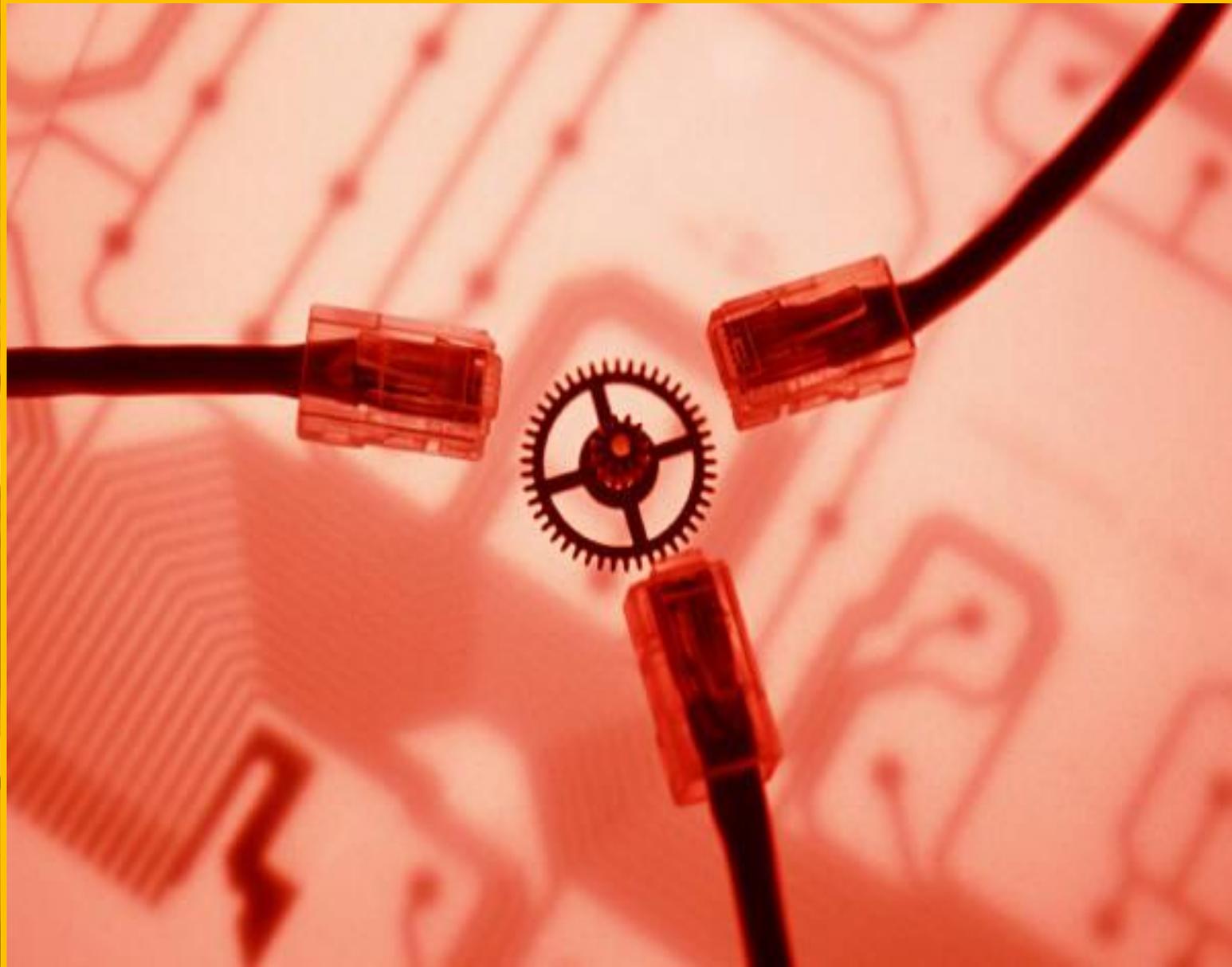
# But Six Sigma Alone Has Holes

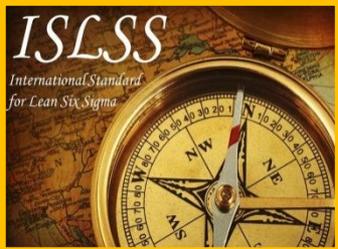
- ◆ Six Sigma lacks many concepts and tools lean is strong in
  - Set-up reduction
  - Waste elimination
  - Mistake Proofing (Error Proofing or Poke Yoke)
  - Cycle-time improvement
  - Process simplification
  - Work in process control and reduction
- ◆ Six Sigma has long time-lines for projects (4-18 months) compared to Lean (1-4 months) or even less with Kaizen
- ◆ Six Sigma specialists (Black Belts) are often less productive than Lean specialists (Lean Sensei)
  - Six Sigma Black Belts do 3-5 projects a year
  - Dedicated Lean project leaders do 10-20 projects a year
- ◆ Six Sigma is often seen as being “too slow”



**When using Six Sigma alone, you risk delivering the right things, slower!**

# Lean Six Sigma Integration





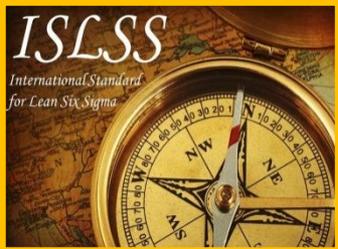
# What is Lean Six Sigma?

- ◆ Lean Six Sigma is a methodology for achieving the goals of the enterprise; lean six sigma is utilized to improve Customer Satisfaction and gain greater Return on Investment.
- ◆ Simply Stated: Lean Six Sigma is the combined methodology of lean and six sigma utilized to increase process velocity, improve efficiency, and reduce or eliminate process variation.
- ◆ Six Sigma is the “Unifying Framework”
  - Six Sigma provides the improvement infrastructure
    - » CEO Engagement
    - » Deployment Champions
    - » Green Belts, Black Belts, Master Black Belts
  - Over-riding methodology: DMAIC, DFSS



- ◆ Lean provides additional tools and approaches to “turbo-charge” improvement efforts
  - Tools: Set-up reduction, 5S, Kanban, Waste Reduction, Value Stream Map
  - Approaches: Kaizen, Poke-Yoke

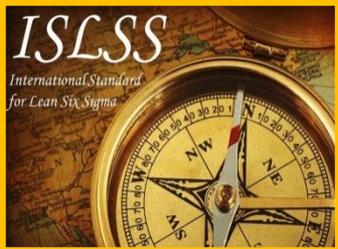
Lean & Six Sigma can co-exist independently, but the benefits of integration are huge



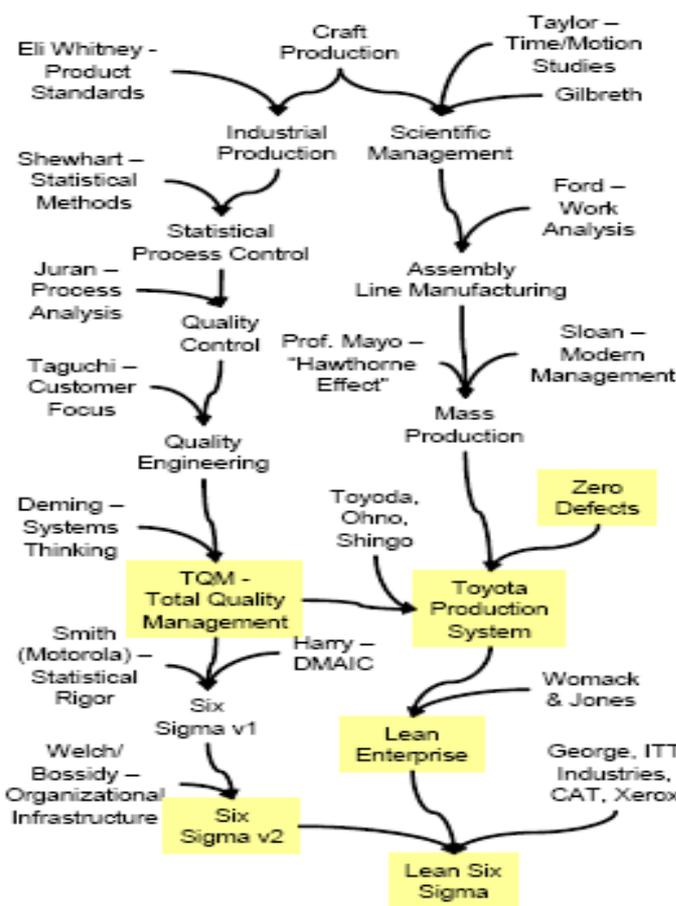
# Why Combine Lean & Six Sigma?

- ◆ Lean and Six Sigma are often viewed as competing practices which misses the central issues:
  - You can't reliably maximize velocity (through waste reduction) without improving quality (through elimination of process variation)
  - You can't maximize quality without improving process velocity (take out non-value add)
  - You can't maximize ROI unless you do both.
- ◆ ...while the pitfalls of not integrating them are formidable
  - Divided focus of the organization
  - Separate and unequal messages for improvement
  - Destructive competition for resources and projects

**Lean (Speed) + Six Sigma (Quality) = ROI (Lower Costs)**

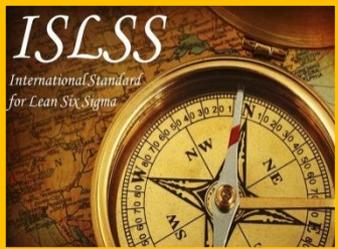


# The Evolution of Lean Six Sigma



- ◆ Continuous Improvement can be traced to Taylor's time studies
- ◆ Toyota created Lean to achieve Henry Ford's low cost GM's variety of product
- ◆ Motorola initiated "Six Sigma" to meet the challenge of Japanese chip quality and cost
- ◆ Deming, Baldrige, and Shingo Prize's are Descriptive of success
- ◆ GE Prescribed the Six Sigma infrastructure of success connected to business strategy
- ◆ Lean Six Sigma integrates Lean lead time and cost reduction with Six Sigma quality and sustaining infrastructure of success

**We are moving into Lean Six Sigma Industry Integration**

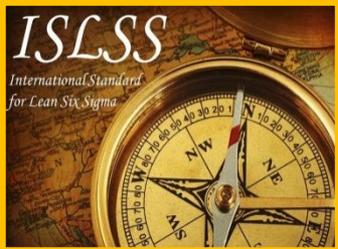


# The DMAIC Methodology

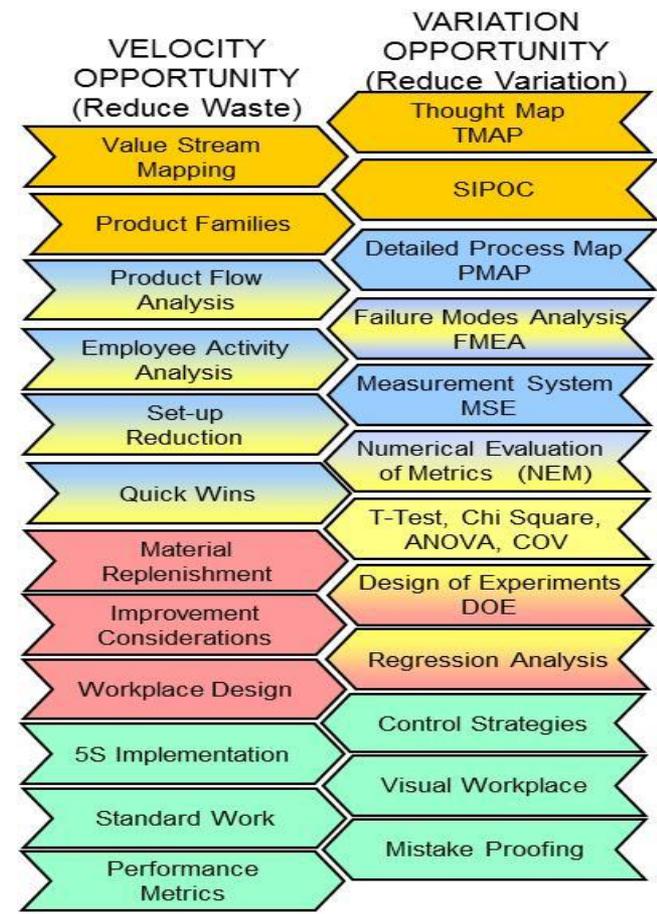
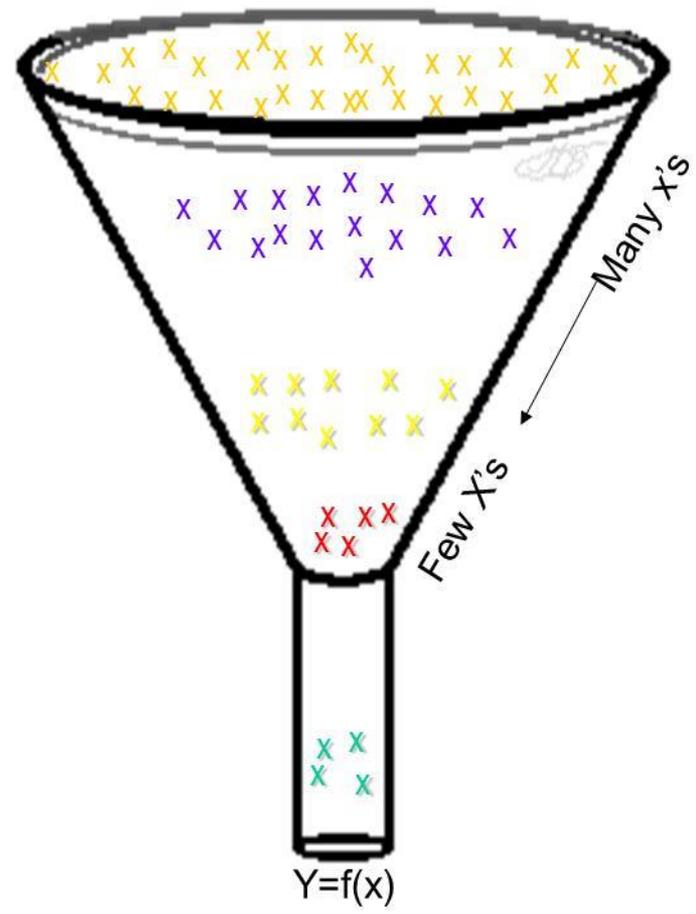
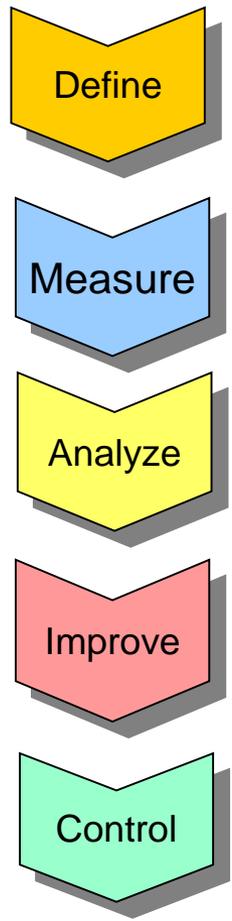
- ◆ Used by improvement teams to improve the current capabilities of an existing process.
- ◆ Used to:
  - Define a problem,
  - gather data and Measure the problem,
  - Analyze the captured data for root causes,
  - Improve the process by developing and implementing solutions, and
  - Control (standardize the solution) the process.



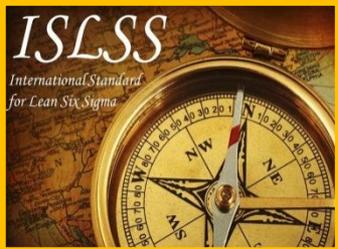
**DMAIC is used to Improve Existing Processes**



# Funnel-Down Many Variables to the Critical Few!



**"It is not necessary to change ! Survival is not mandatory."... Demming**



# High Level DMAIC Approach

## Define

- When did it happen?
- Where did it happen?
- What is the success criteria?

## Measure

- How often does this happen?
- What trends have we observed relative to the target?

## Analyze

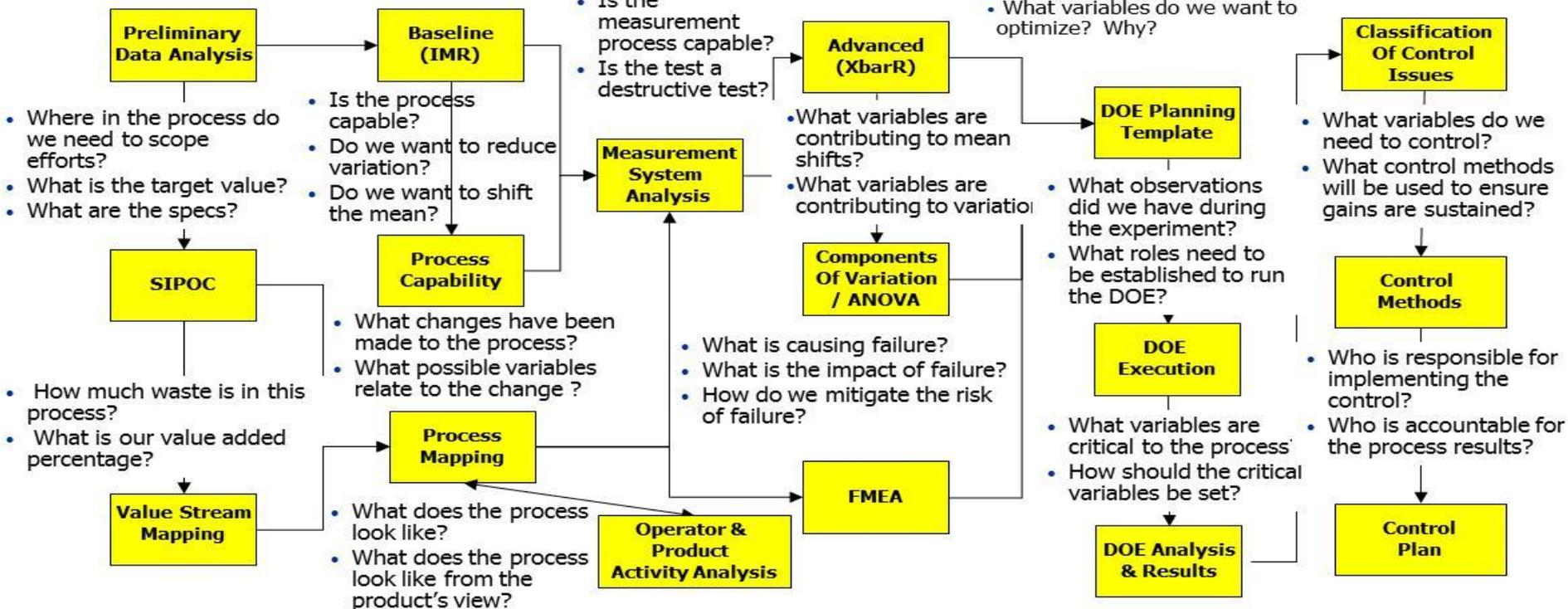
- What is the sub-grouping strategy?

## Improve

- What does the DOE process plan look like?
- What responses are we interested in (Average, Range)?
- What variables do we want to optimize? Why?

## Control

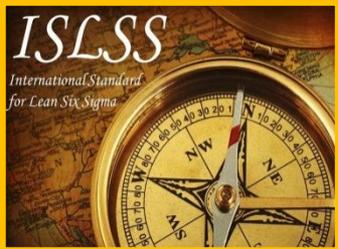
- How will we address Org. issues?
- How will we address Behavioral issues?



**We Learn as we Move Through the DMAIC Phases**

# Deployment Planning





# Lean Six Sigma DMAIC Roadmap

**Deliverables**

Validated Project Charter  
Stakeholder Analysis  
Communication Plan  
Initial Project Plan  
Risk Mitigation Plan  
Updated Project in Tracking System  
Completed Tollgate

Value Stream Map  
Data Collection Plan  
Validated Measurement System  
Baseline metrics  
Quick Wins  
Validated Financial Benefits  
Completed Tollgate

List of Potential Root Causes  
Validated Root Causes  
Prioritized List of Root Causes  
Quick Wins  
Completed Tollgate

List of Potential Solutions  
Prioritized List of Solutions  
'To-Be' Value Stream Map  
Pilot Plan  
Pilot Results  
Detailed Implementation Plan  
Completed Tollgate

Process Control System  
Implemented Solution  
Validation of Benefit Attainment  
Replication Plan  
Project Transitioned to Process Owner  
Completed Tollgate (Project Closed-Out)

**Define**

**Measure**

**Analyze**

**Improve**

**Control**

**Activities**

Review and Validate Project Charter  
VOC/VOB  
Problem Statement  
Goals  
Financial Benefits  
Project Timeline  
Launch Team  
Create Risk Mitigation Plan  
Create Communication Plan  
Create Initial Workplan  
Complete DEFINE Tollgate

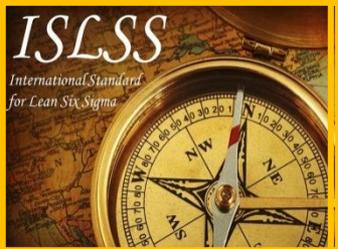
Complete Value Stream Map  
Identify Key Input, Process and Output Metrics  
Develop Data Collection Plan  
Validate Measurement System  
Collect Baseline Data  
Determine Process Capability  
Conduct MEASURE Tollgate

Identify Potential Root Causes  
Reduce List of Potential Root Causes  
Validate Root Causes  
Prioritize Validated Root Causes  
Complete ANALYZE Tollgate

Develop Potential Solutions  
Evaluate, Select & Optimize Best Solutions  
Develop 'To-Be' Value Stream Map(s)  
Develop and Implement Pilot Solution  
Confirm Attainment of Project Goals  
Develop Full-Scale Implementation Plan  
Conduct IMPROVE Tollgate

Develop SOP's & Training Plan  
Develop Process Control System  
Implement Solution  
Confirm Attainment of Project Goals  
Develop Replication Plan  
Transition Project to Process Owner  
Complete CONTROL Tollgate

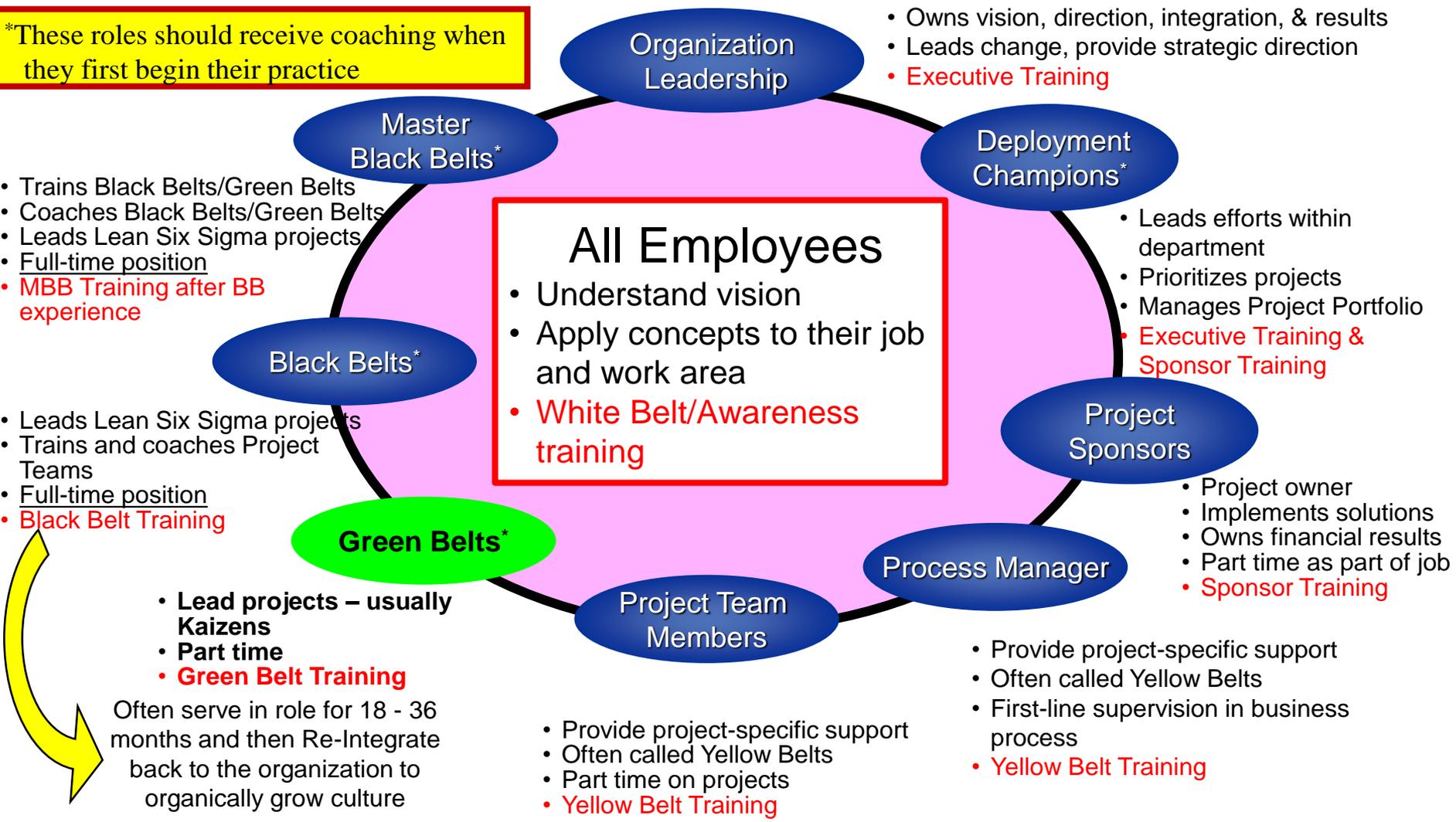
**Kaizen Events Targeted in Measure to Accelerate Results**

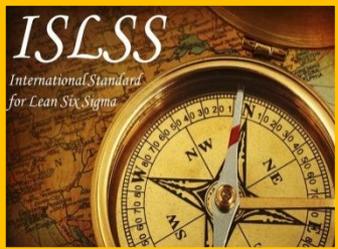


# Deployment Infrastructure

## Typical Roles for Lean Six Sigma Deployment

\*These roles should receive coaching when they first begin their practice





# Green Belt Candidates Factors for Project Success

## Drive

- ◆ Willing to APPLY what was covered in class
- ◆ Drive the solution
- ◆ Candidate able to stay schedule focused and keep project on time
- ◆ Candidate resolves barriers or gets help resolving barriers quickly
- ◆ Does not let 'artificial' organizational boundaries get in the way

## Mindset

- ◆ Open and flexible mindset
- ◆ For both class and project work want to stay focused on the process and not on blaming people!  
“Blame the process not the people”

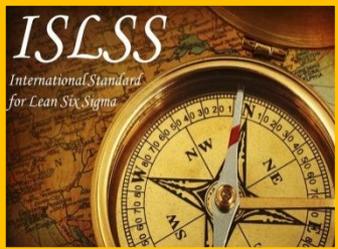
## Communication

- ◆ High team involvement, collaborative
- ◆ Able to communicate progress frequently
- ◆ Able to lead a group effort (flip charts & post-its)
- ◆ Mentoring time taken seriously

## Readiness

- ◆ Open to constructive criticism
- ◆ Able to ask the fundamental or tough questions
- ◆ Candidate prepared for class and completes tools per schedule
- ◆ Basic MS Office Computer Skills
- ◆ Basic statistics knowledge

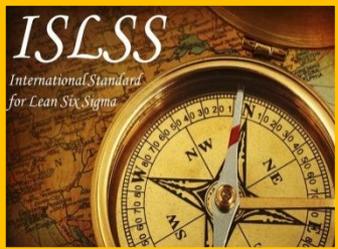
**Leadership and Team Facilitation Skills are Critical**



# Belt Expectations and Involvement

Role	Commitment	Objectives/Activities
<b>Black Belt</b>	<ul style="list-style-type: none"> <li>• Full-time</li> <li>• 5-week training</li> <li>• Lead multiple projects</li> <li>• 18-24 months until redeployed</li> </ul>	<ul style="list-style-type: none"> <li>• Learn how to build and lead cross-functional teams</li> <li>• Learn/Apply the DMAIC problem solving - solve high priority opportunities</li> <li>• Learn and practice using Lean Six Sigma toolset to deliver 6 to 8 projects over 18-24 months</li> <li>• Re-deploy into the business with an enhanced set of leadership and technical skills</li> </ul>
<b>Green Belt</b>	<ul style="list-style-type: none"> <li>• Part-time</li> <li>• 2-week training</li> <li>• Lead smaller projects</li> <li>• On-going</li> </ul>	<ul style="list-style-type: none"> <li>• Learn how to build and lead cross-functional teams</li> <li>• Learn the DMAIC problem solving and process improvement approach</li> <li>• Learn how to utilize core tools in the Lean Six Sigma toolset</li> </ul>
<b>Yellow Belt</b>	<ul style="list-style-type: none"> <li>• Part-time</li> <li>• 1-week training</li> <li>• On-going</li> </ul>	<ul style="list-style-type: none"> <li>• Learn how to utilize the most basic Lean Six Sigma tools</li> <li>• “Power team member” on small/large projects</li> </ul>
<b>White Belt</b>	<ul style="list-style-type: none"> <li>• Part-time</li> <li>• 1-8 hr training</li> <li>• On-going</li> </ul>	<ul style="list-style-type: none"> <li>• Engage the organization</li> <li>• Develop basic awareness of DMAIC methodology and Lean Six Sigma tools and rationale</li> </ul>

**Leadership and Team Facilitation Skills are Critical**



# The “Burning Platform” Is Essential to Create the Compelling Need for Change

◆ Persuading people to pay the price of commitment requires a compelling need that drives towards a new vision of the future. When this message is owned and driven by an organization’s leadership, the likelihood of success is increased exponentially.

...lighting a “burning platform” at both the organizational and personal level

## Compelling Need



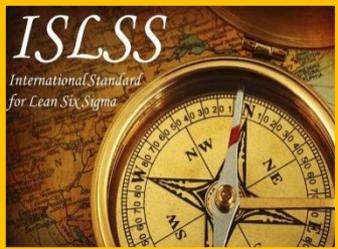
to our organization

To me through my frame of reference

- ◆ Business opportunities
- ◆ Business threats
- ◆ Personal opportunity
- ◆ Personal threat

- ◆ Human and financial resources
- ◆ Other opportunities
- ◆ Personal energy and time
- ◆ Loss of control
- ◆ Personal risk

**Benefits of change is greater than cost & risk of change**



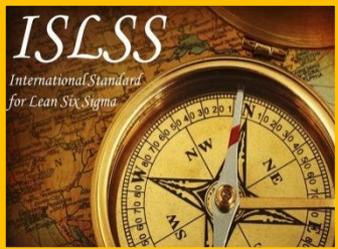
# Change Management Tools

- ◆ Project Charter
- ◆ Stakeholder Analysis
- ◆ Influence Strategy Plan
- ◆ Risk Analysis
- ◆ Communication Plan
- ◆ Issue Logs
- ◆ Effective Meeting Skills
- ◆ RACI Chart
- ◆ Conflict Management Skills
- ◆ Toll Gate Reviews (DMAIC)
- ◆ Project Status Reports
- ◆ Financial Progress Reports
- ◆ A3 Report
- ◆ Storyboards
- ◆ Data & Metrics

Change Management Success Factors



**Black Belts Selection from Future Leadership Pool**

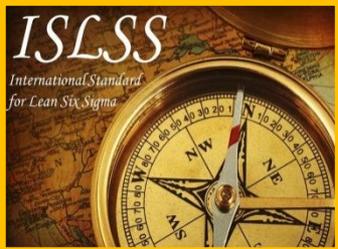


# Successful Project Factors

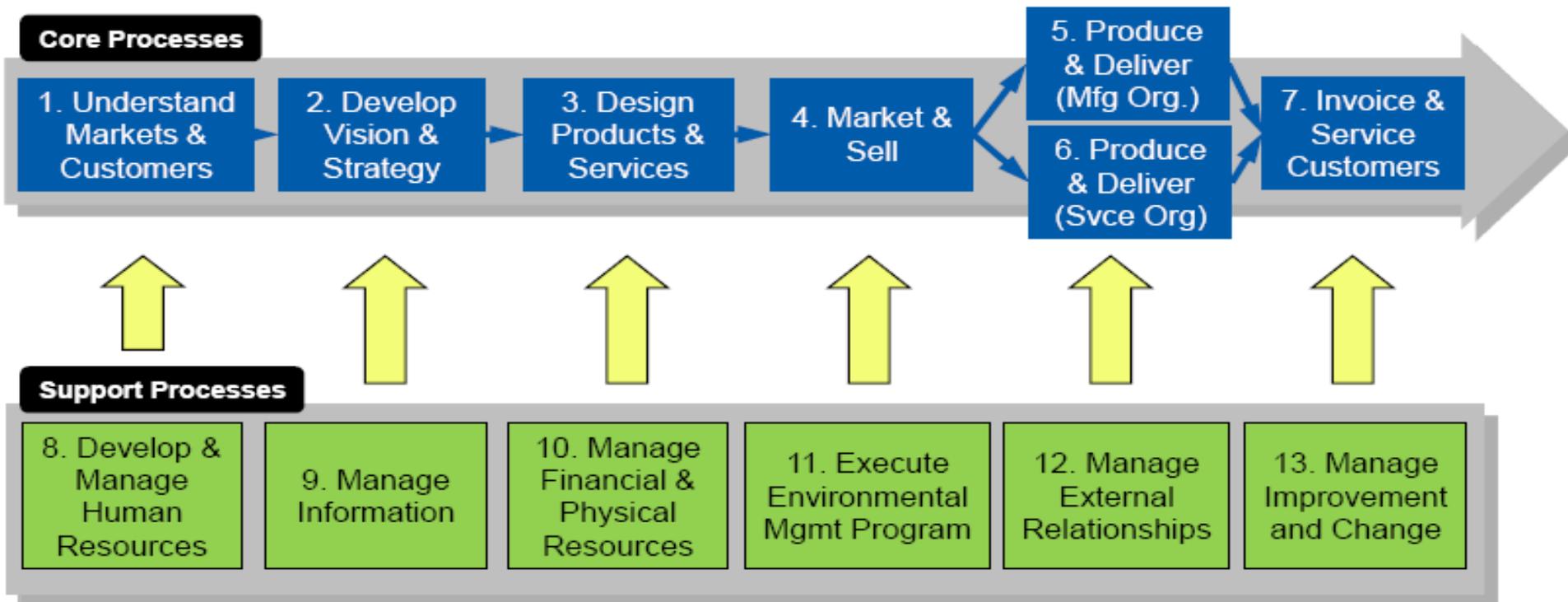
- ◆ Project selected is clearly aligned with strategic company objectives
- ◆ Problem, Goal and Metrics are well defined and agreed upon
- ◆ Management and/or Champion involvement
- ◆ Project is one you need to work anyway
- ◆ Scope is well defined and reasonable
- ◆ Data is available
- ◆ Management resource commitment
- ◆ Defects and Waste issues; tools are applicable
- ◆ FREQUENT Communication about the project – candidate to team and management
- ◆ Ability to implement potential solutions, not just to come up with recommendations



**Projects Scoped Small for Faster Execution of Results**



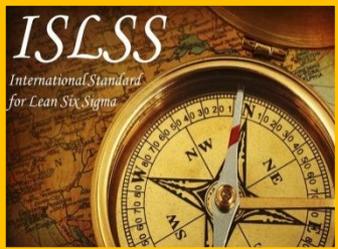
# Identifying The Opportunities



Core Processes: Exist to create enterprise value to customers

Support Processes: Exist to Help Core Processes Create Value

Everything is vague to a degree you do not realize until you have tried to make it precise

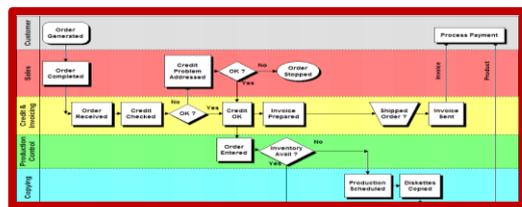


# Lean Six Sigma Project Identification



Financial Value Drivers

**Voice of Customer**



Process Analysis

Reduce Inventory costs 20% to achieve industry benchmark levels

Reduce cycle time of incoming quality inspections

Improve efficiency of shipping and receiving

Green energy efficiency & optimizations

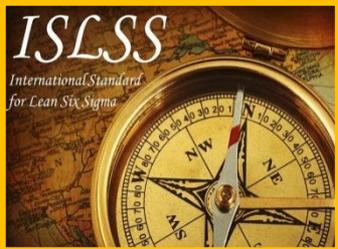
Packaging rationalizations

Reduction of slow inventory turn items

Strategy & Goals

Assess Levers

Opportunity Areas



# Lean Six Sigma Project Selection



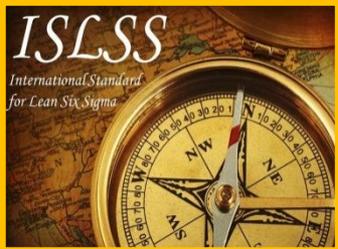
## Project Prioritization Matrix

Projects	Link to Strategy	Business Impact - Savings	Business Impact - Revenue Growth	Environmental Impact	Level of Effort to Implement	Ratio of Weighted benefit to effort
Criteria WT.	(10 = High; 1 = Low)	10	8	6	(1=L; 5=M; 10=H)	
Project 1	Top 10 Supplier for New Product Rollout in USA	H			L	2.5
Project 2	Asset MGMT Optimization	H		H	M	1.45
Project 3	Asset MGMT Optimization	M			M	2.1
Project 4	Top 10 Supplier for New Product Rollout in USA		H		H	1.25
Project 5	Asset MGMT Optimization	H			L	1.5
Project 6	Competitor Sales		M	M	M	1.6

<p><b>Black Belt Charter #1</b></p>	<p><b>Black Belt Charter #2</b></p>	<p><b>Kaizen Charter #2</b></p>	<p><b>Green Belt Charter #1</b></p>	<p><b>Kaizen Charter #1</b></p>	<p><b>Green Belt Charter #2</b></p>
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**Act as though it were impossible to fail - Winston Churchill**

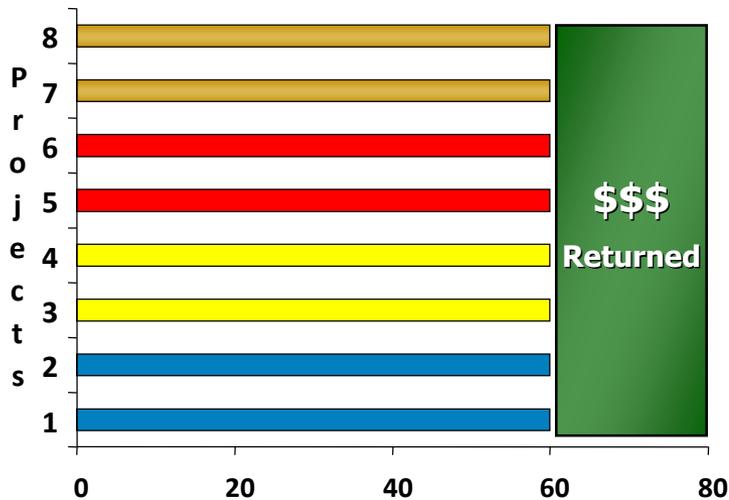


# Projects in Process (PIP)

## Traditional Approach:

Start all projects at once. Have each of 4 resources resource split their time evenly between 2 projects of 30 man- days of work each:

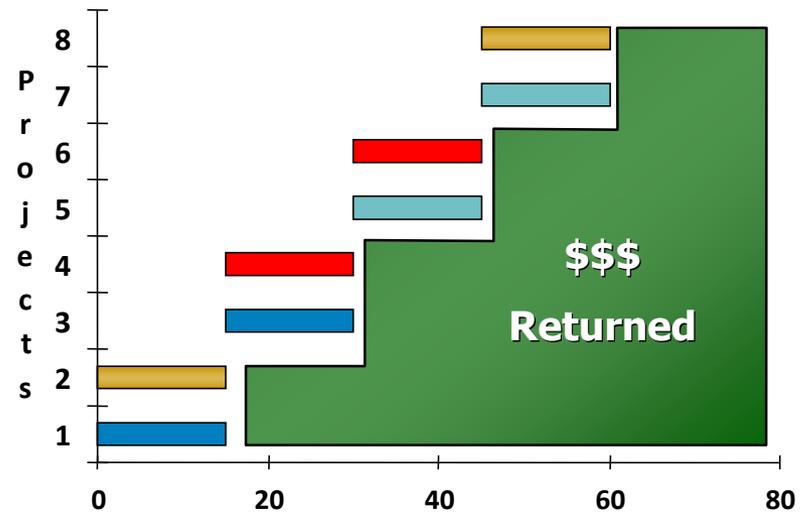
**Resources Spread:**  
Results Accrue at the End



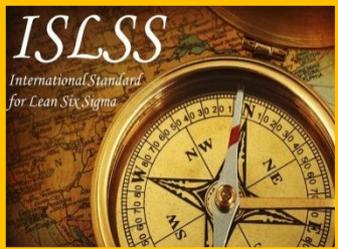
## Work Control Approach:

Minimize those same projects in process: this time use the 4 resources by teaming 2 people on the two highest priority projects until they are complete:

**Resources Focused:**  
Results Accrue As Projects Complete



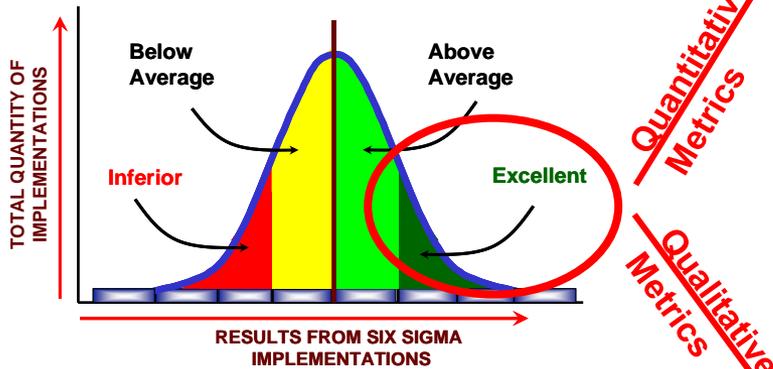
The real bang here is the cycles of learning, realized by completing projects sooner



# Measure Program Success

Set Stretch Goals and Metrics to Focus Effort on Six Sigma Quality

## Variation in Deployment Results

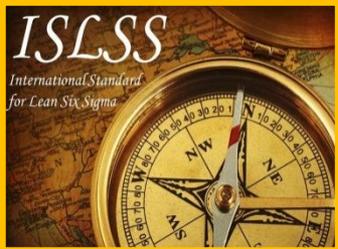


A combination of Quantitative & Qualitative program metrics trigger early identification of issues for proactive resolution to ensure deployment results are maximized

FACTOR	POOR	BELOW AVERAGE	ABOVE AVERAGE	EXCELLENT
Average Level of Improvement per Project	Unknown or less than 30%	May be known and 30% to 40%	Known and 40% to 60%	Known and greater than 60%
Average Financial Results per Project	Generally not quantifiable	Not well defined and less than an average of \$40K per project	Defined, tracked and average around \$100K per project	Defined, Tracked and average greater than \$150K per project
Average Quantity of Projects per Black Belt/Year	1 to 2	2 to 3	3 to 4	4 or more
Organizational Approach/Culture Change	Little or no impact on the behavior of the organization	More frequent use of data, but in isolated cases	Trend or movement towards the use of analytical methods and data oriented decisions	Six Sigma becomes the "Way we think and work"

FACTOR	POOR	BELOW AVERAGE	ABOVE AVERAGE	EXCELLENT
Management Understanding	Heard of Six Sigma	Know of Six Sigma, do not understand tools or system aspects	Know of Six Sigma and some of the tools	Know the system aspect of Six Sigma and can relate to the usage of the tools
Management Commitment Up Front Planning	none, purely a "Grass Roots" Initiative Quality Manager selects a couple of Quality Engineers for training	Some Support but weak and variable Middle to upper Management pilot a small launch to see if it works	Good support but variable One to two year plan, deployment is given good consideration, planning has some holes which create frustration points	Involved and reviewing results periodically Two to three year plan developed considering best roll out sequence, financials, goals, employee awareness
Black Belt Participation	Task force level, time unknown	Part time only, less than 50%	Suppose to be full time but management pulls them off projects, less than 75%	Full time, greater than 90%
Infrastructure Development	None	Generally None	Most support functions have been alerted of support requirements with some documentation	Fully intergrated and documented Six Sigma System operating guidelines
Project Selection	Done by the Black Belt, no management ownership	Done by the Black Belt, low level management concurrence	Black Belts usually finds projects and Champion agrees	Champions and Black Belts work together to find best projects
Project Tracking	None	Manual or poorly defined	System in place but not very disciplined usage	System and placed and used to manage the Six Sigma effort
Green Belts	May only be Green Belts or just a few Black Belts	Sprinkling of Green Belts, but training is only for awareness, no strategy	Strategy in place, difficult time getting projects assigned to Green Belts, training is to low a level	Strategy in place, Green Belts play a key role in overall effort, perform process management functions

## Weekly Status Reporting of all Projects in Process



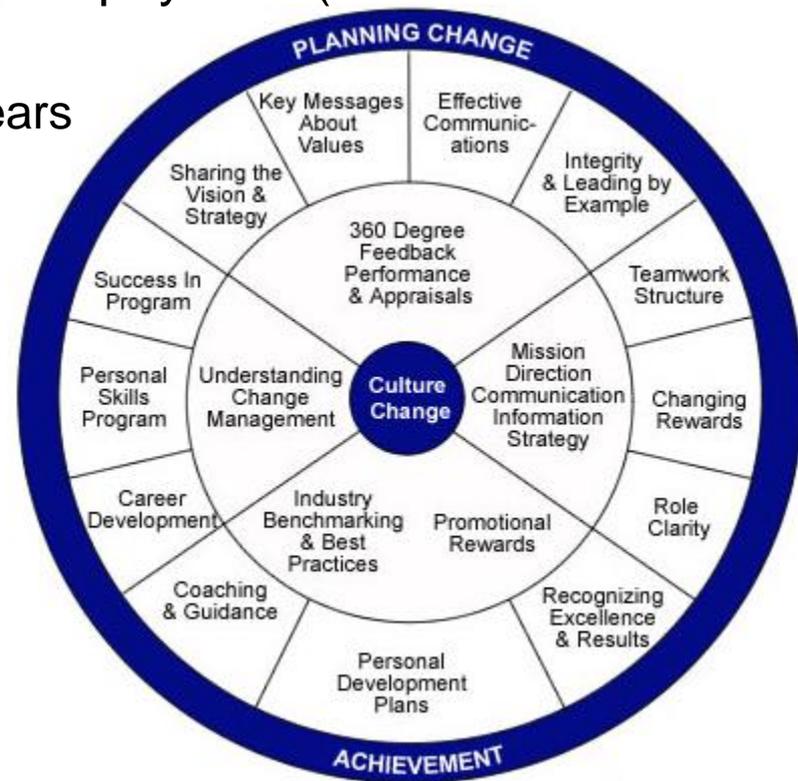
# Benefits and Culture

## Financial:

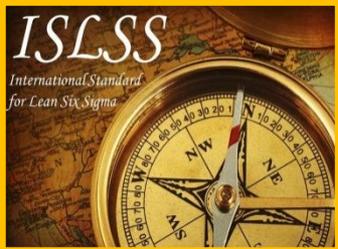
- ◆ Companies embracing Lean Six Sigma report payback (inclusive of all costs) within 12 months
  - Ultimate ROI in range of 25-50x over 2-4 years

## Cultural:

- ◆ Deliberate and proven-approach to work
- ◆ Returns dependent on:
  - Selecting and engaging the right people
  - Executing the right projects
  - Fully engaging company leadership

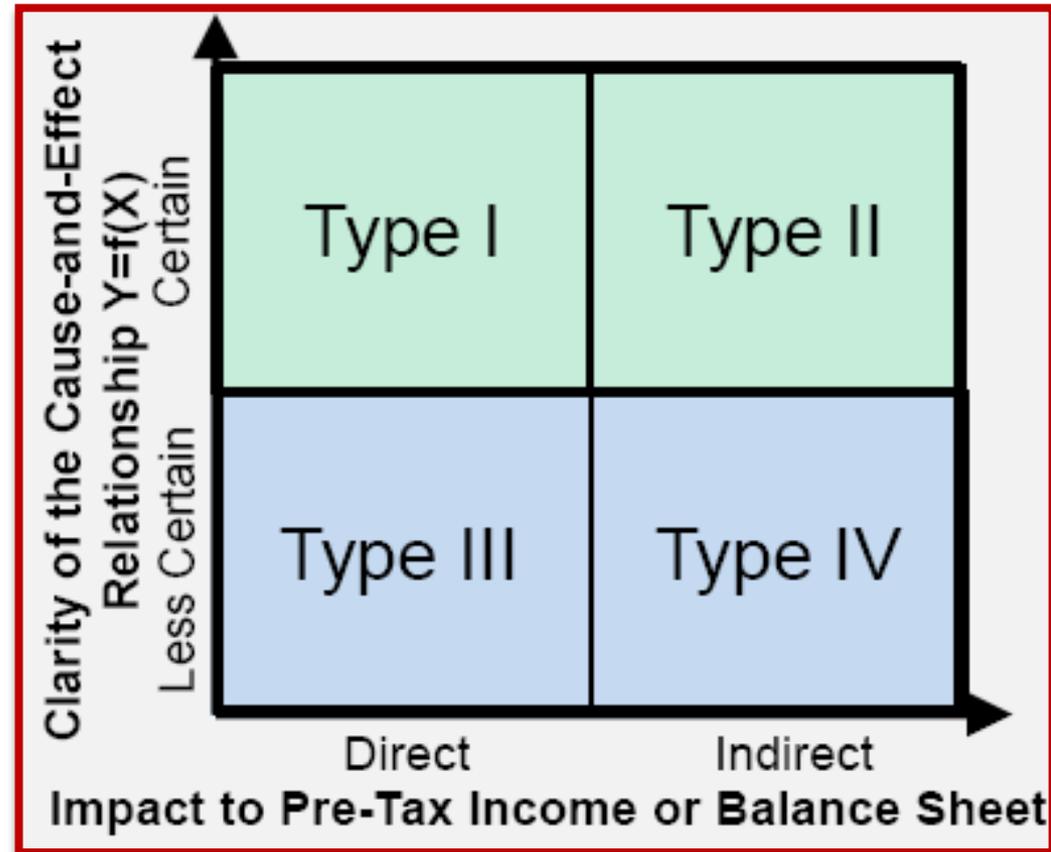


**Lean Six Sigma Cultural Change on Average is 3 Years**

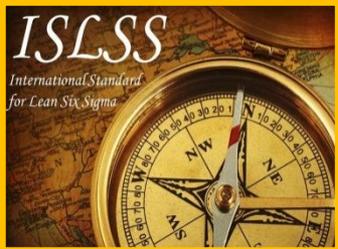


# Rigorous Benefits Measurement

- ◆ **Why rigorously classify benefits?**
  - Understand financial impact
  - External communications
  - Build momentum
  - Validate investment
- ◆ **Benefit Categorization**
  - Type I: Direct benefits
  - Type II: Redeployments and cost avoidance
  - Type III: Direct savings, but lack of certainty as to cause
  - Type IV: Other benefits



**Linking Strategy Results to Business Process Execution**



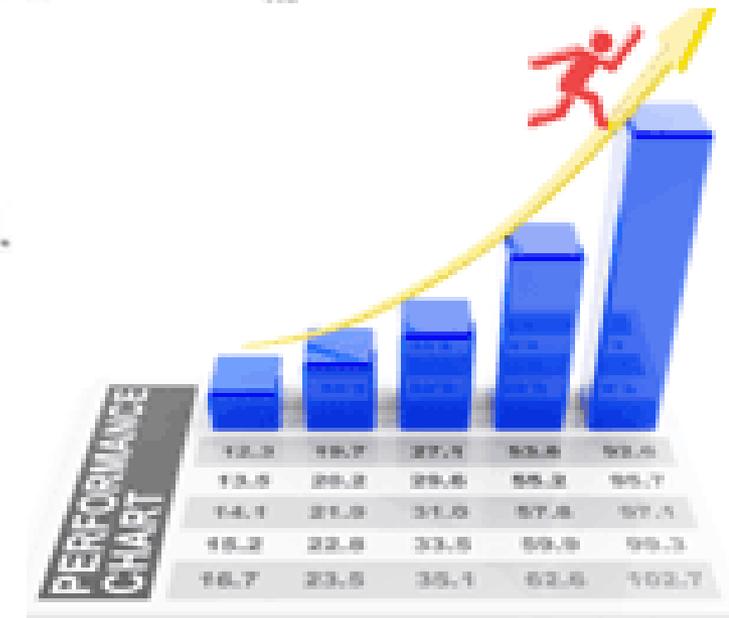
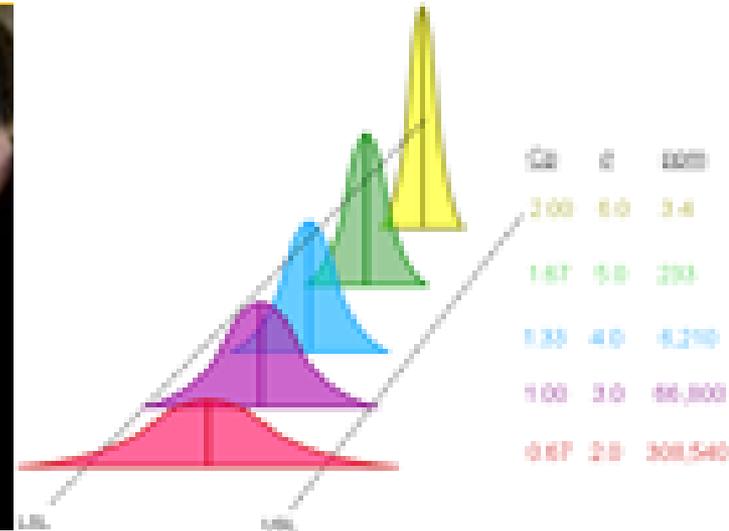
# Lean Six Sigma Deployment Key Success Factors

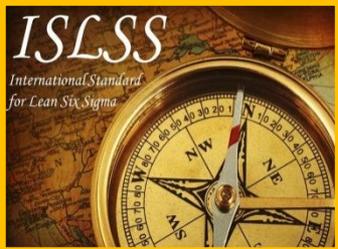
- ◆ Executive support and engagement
- ◆ Rigorous and appropriate project selection
- ◆ Selecting projects that support the business strategy
- ◆ Metrics that focus on results, not the number of people trained!
- ◆ Active project sponsorship at the project level
- ◆ Selection of high-talent Black Belts and Champions
- ◆ Full-time, dedicated resources in key roles
- ◆ Mentoring by guides that understand Lean Six Sigma and understand your business



**Black Belt at 0.5 – 1% DNA; Green Belts at 2-6% DNA**

# Wrap Up



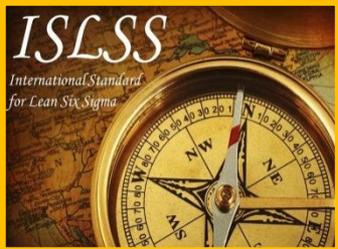


# Takeaways

## Now you should be able to

- ◆ Know the origin and aims of Lean, Six Sigma, and Lean Six Sigma
- ◆ Understand the roles and responsibilities within a Lean Six Sigma Team
- ◆ Understand the project identification, selection, and prioritization process
- ◆ Understand how Lean and Six Sigma synergistically come together, building a transformation methodology more powerful than the sum of the parts
- ◆ Understand the value proposition of Lean Six Sigma
- ◆ Understand the Lean Six Sigma terms, tools, and DMAIC methods and definitions

**Thank You for Sharing Your Experiences**



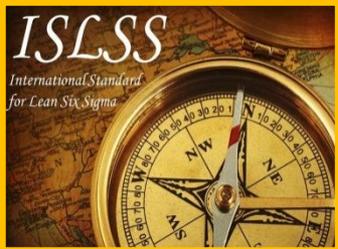
# Questions or Feedback?



**We Hope You Enjoy The Lean Six Sigma Overview Training**

# Backup



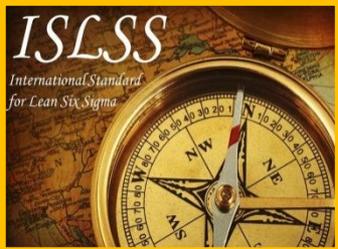


# How will Lean Six Sigma Help Me?

- ◆ It is a problem solving methodology to put **recurring problems to bed!**
- ◆ It will facilitates **communication** between people with different backgrounds and from different functions
- ◆ Can be applied in all areas of your life and career
- ◆ Helps drive focus and prevents gaps in logic
- ◆ It is visible to higher levels of the company
- ◆ **Uses data** for sound conclusions
- ◆ Allows you to **leverage** and build on what you already know!
- ◆ Requires team involvement and emphasizes sound communication
- ◆ **Minimizes emotion and conflict** and moves to data-driven process-based solutions
- ◆ Focuses on fundamentally solving a problem NOT on adding band-aids and additional complexity
- ◆ Built on standard tools & **standard methodology**, helps simplify your discussions!
- ◆ It has been proven successful across many industries, solved countless problems and saved billions of dollars



**Focus on creating opportunities vs. resource constraints**

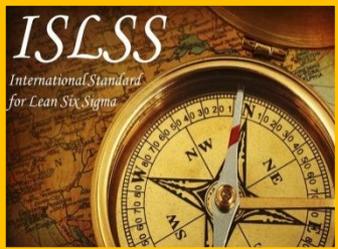


# How does Lean Six Sigma Differ from other 'Initiatives'?

- ◆ Builds on what you already know!!
- ◆ Puts the customer and their requirements first
- ◆ Fact-based, data-driven, scientific approach
- ◆ Combines proven tools into an integrated approach
- ◆ Project selection based on top and bottom-line impact
- ◆ Focus on eliminating defects and reducing variation
- ◆ Cross-functional, process-driven
- ◆ Exponential improvement targets
- ◆ Builds upon past improvement techniques



Lean Six Sigma identifies and eliminates the root causes of waste and variation



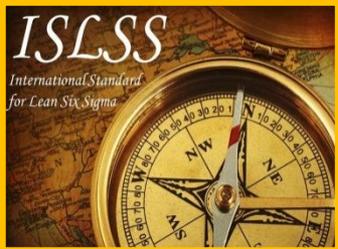
# Leading Lean Six Sigma Companies

- ◆ 52 publicly traded organizations
- ◆ Company-wide, highly active deployments

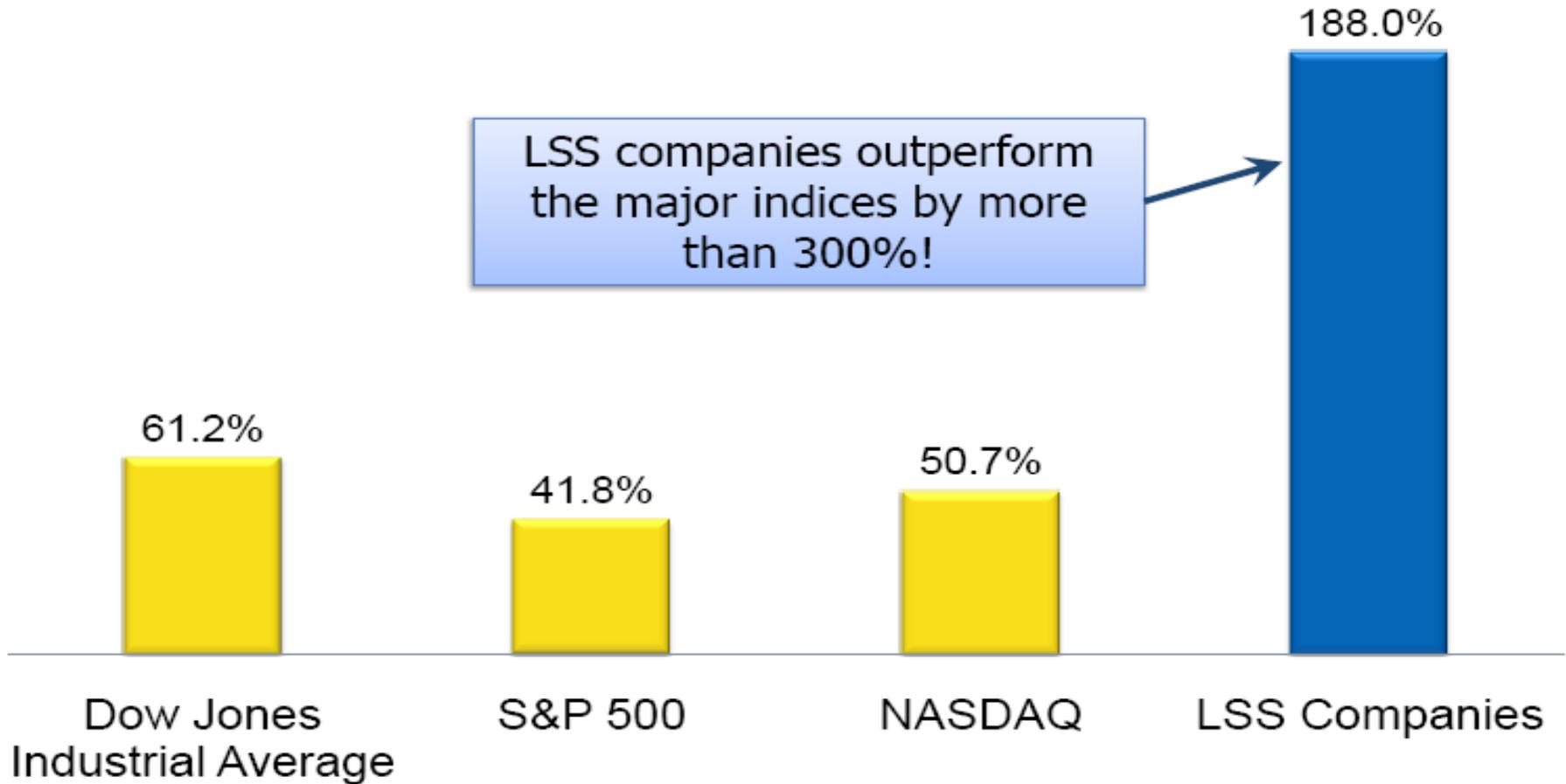


Source: Proficiency Systems Research

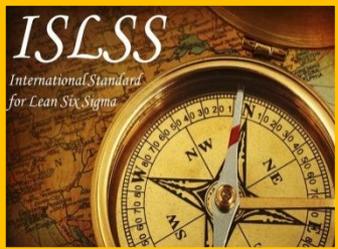
## Lean Six Sigma Company Stock Performance Research



# Lean Six Sigma Stock Price Increase



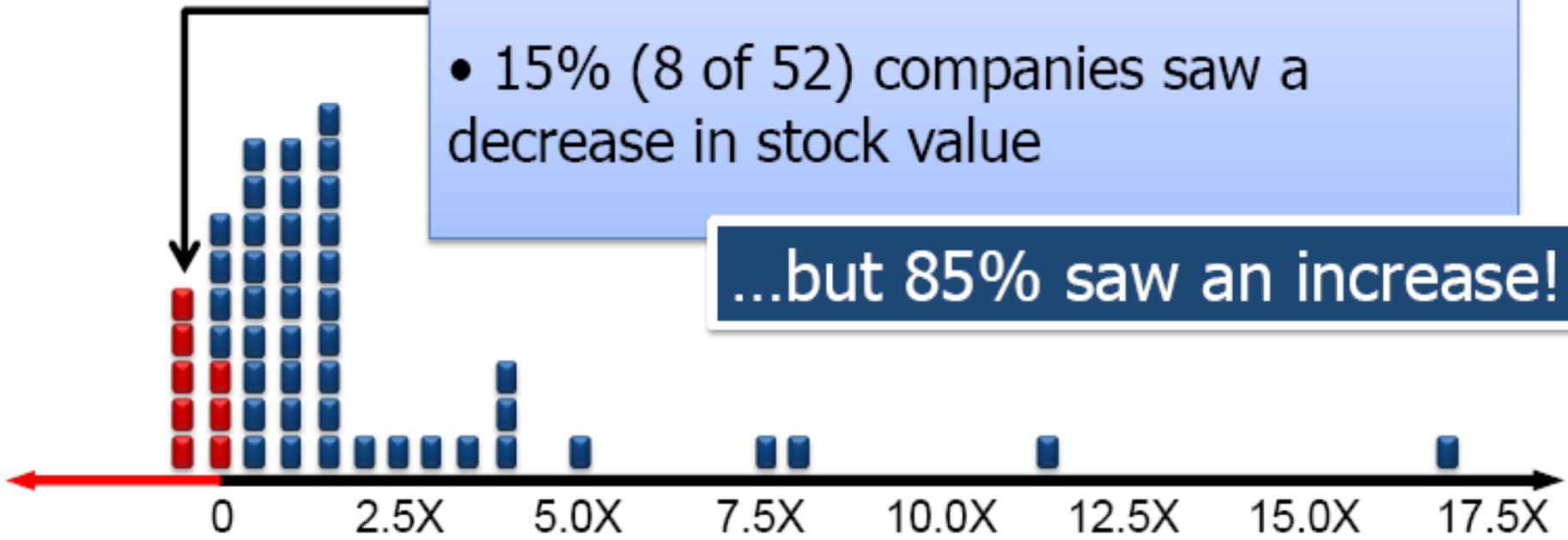
**\* January, 1998 – January, 2008**



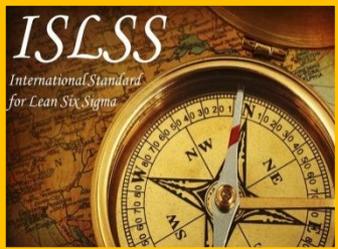
# 10 Year Stock Price Increase\* Lean Six Sigma Companies

- Lean Six Sigma is not a panacea
- It is not a substitute for poor strategy
- 15% (8 of 52) companies saw a decrease in stock value

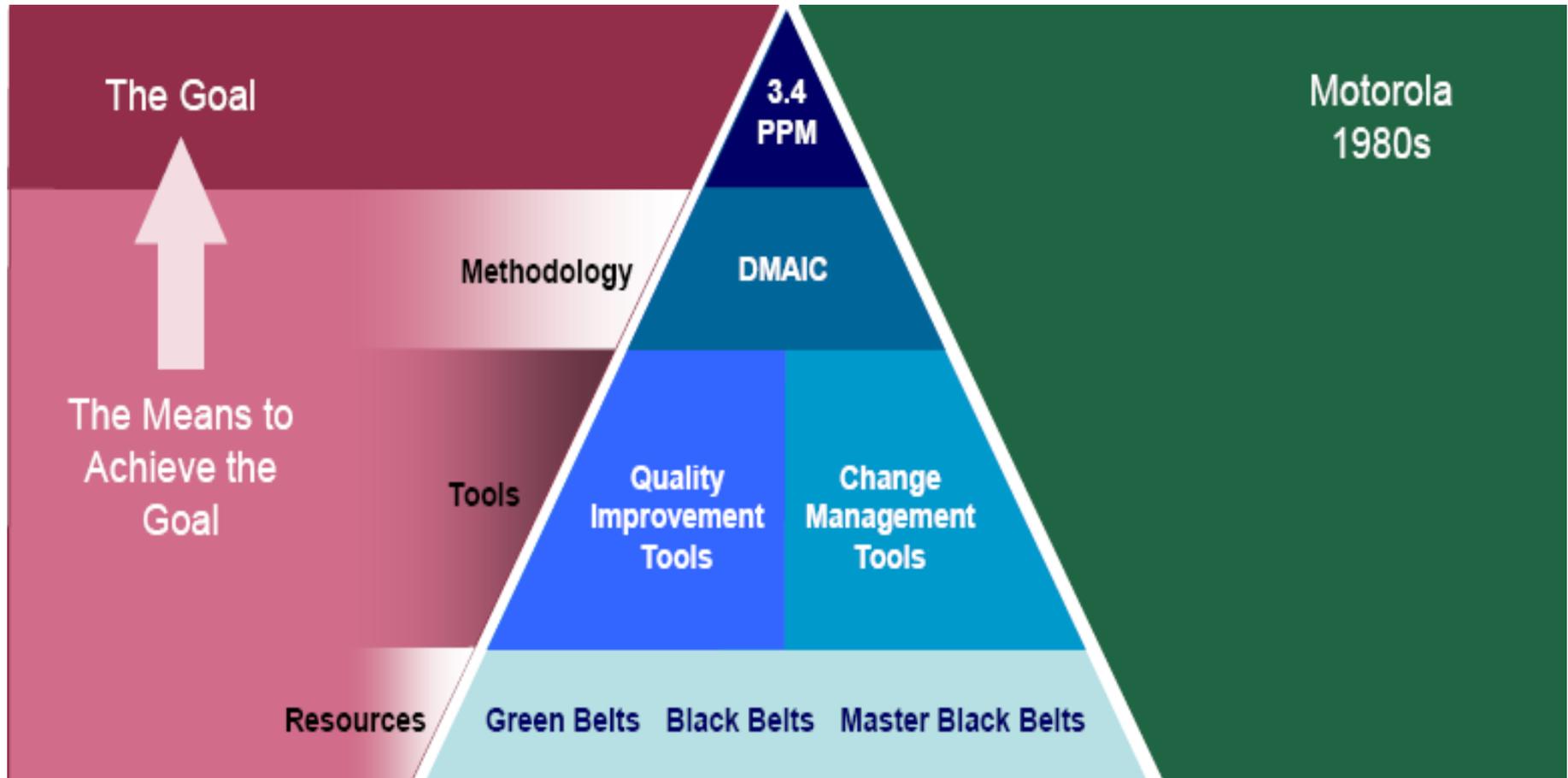
...but 85% saw an increase!



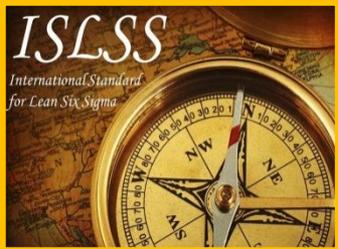
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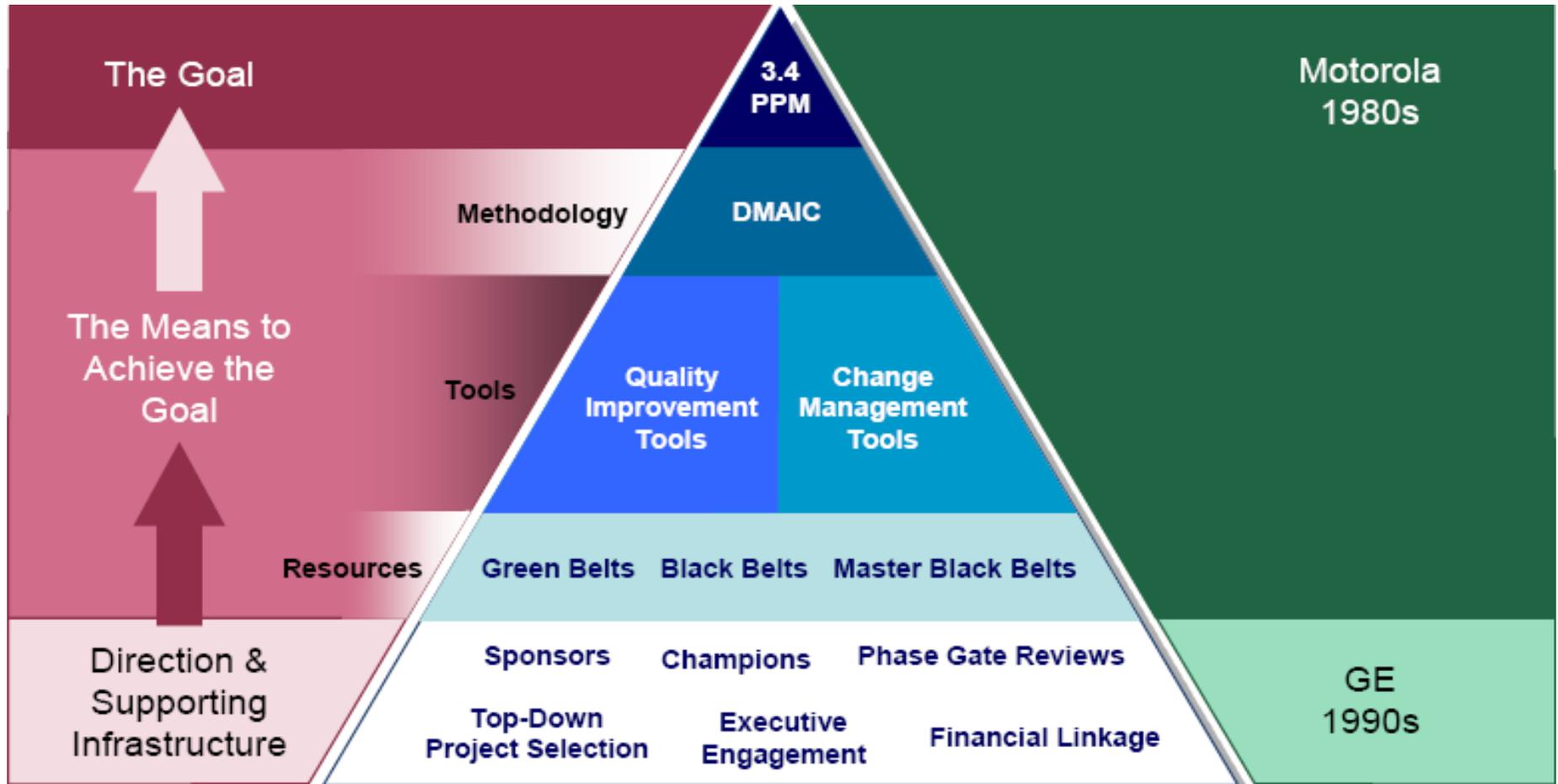
# Six Sigma in 1980's



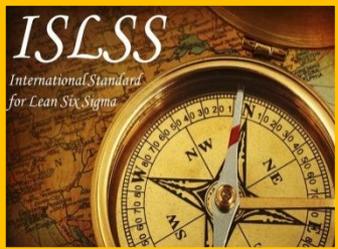
**Motorola has documented +\$16B in savings as a result of Six Sigma efforts**



# Six Sigma in 1990's



General Electric added the Support and Sustain Infrastructure, Tollgates & Define Phase



# Six Sigma in 1990's Advances

## Development of Sponsor Role

- ◆ The project charter author
- ◆ The individual responsible for sustaining the gains
- ◆ The Process Owner
- ◆ Part of existing role

## Creation of a Financial Representative Role

- ◆ Independent of the project
- ◆ Validates the project savings

## Creation of Champion Role

- ◆ Facilitates project selection process
- ◆ Aligns resources with projects
- ◆ Audits project progress
- ◆ Full-Time role if >15 Black Belts

## Executive Commitment

- ◆ Top executives trained and active
- ◆ Mandated participation

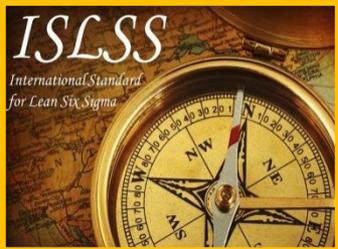
## Implementation of a Formal Project Selection Process

- ◆ Ensures strategic and financial linkage
- ◆ Ensures properly scoped projects
- ◆ Ensures alignment between projects

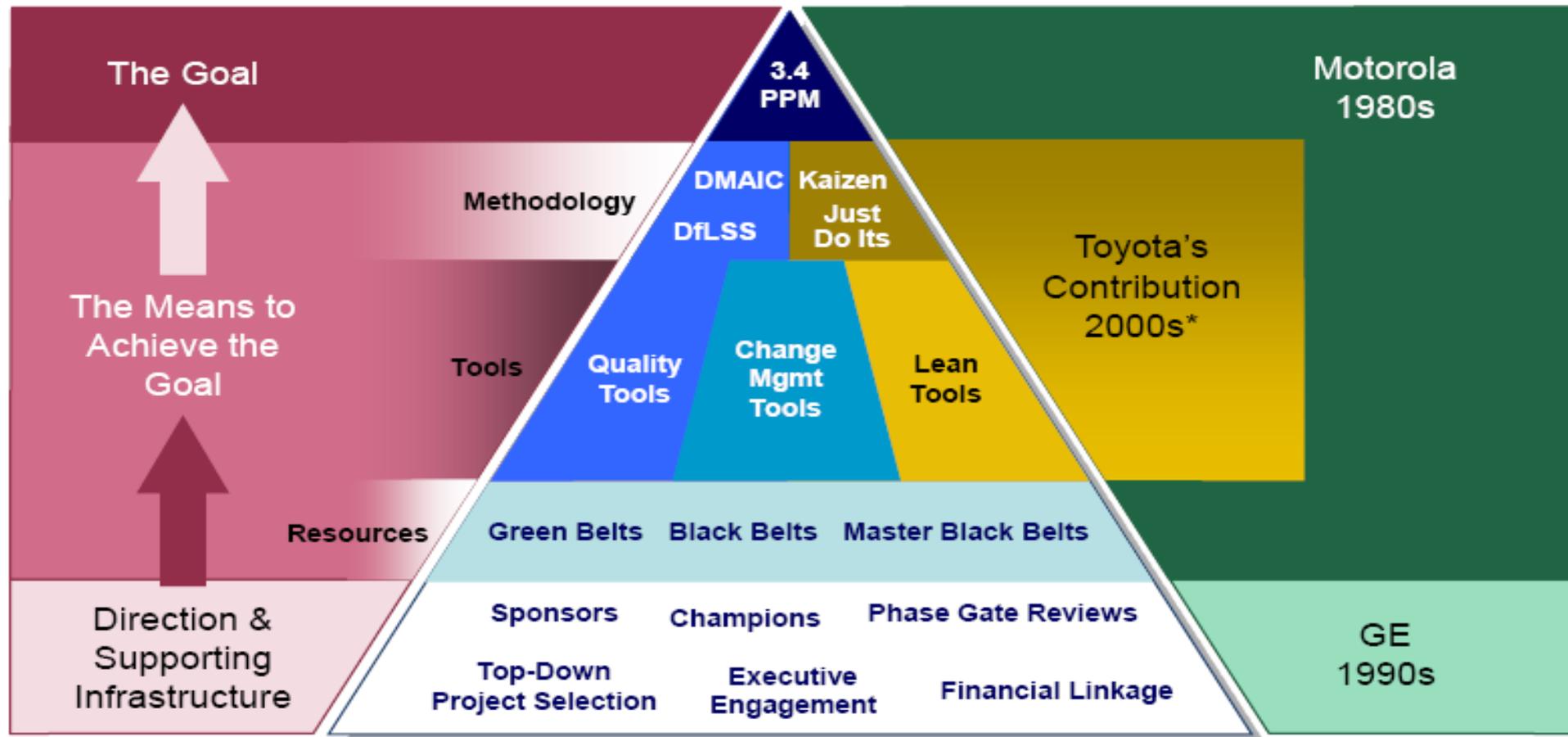
## Implementation of Formal Phase Gate Review Process

- ◆ Ensures Stakeholders, Together, Regularly Review Project Progress and Gain alignment around future direction
- ◆ Each review ends with formal Go/No-Go decision

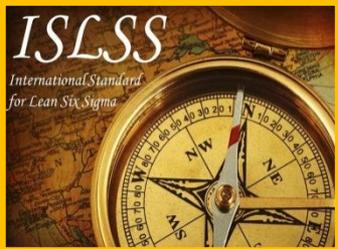
**1% Black Belt; 2-6% Green Belt DNA**



# Lean Six Sigma in 2000's



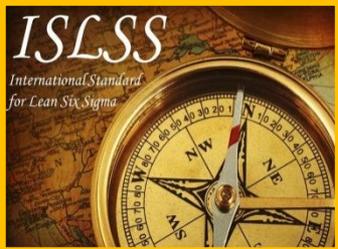
Toyota has continued to evolve its Toyota Production System (TPS) since the 1950s, but the integration with Six Sigma has just recently occurred



# References

- ◆ Pyzdek, Thomas, *The Six Sigma Handbook*, McGraw-Hill, 2003
- ◆ Hildebrand, David H. & Ott, R. Lyman, *Statistical Thinking for Managers*, Duxbury Press, Pacific Grove, CA, 1998
- ◆ Kiemele, Mark J. & Schmidt, Stephen R. & Berdine, Ronald J., *Basic Statistics Tools for Continuous Improvement*, Air Academy Press, Colorado Springs, CO, 2000
- ◆ Schmidt, Stephen R. & Launsby, Robert G., *Understanding Industrial Designed Experiments*, Air Academy Press, Colorado Springs, CO, 2000
- ◆ Minitab, Inc. 3081 Enterprise Dr., State College, PA 16801, 800-448-3555

**I've learned that mistakes can often be as good a teacher as success - Jack Welch**



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