



# Using Lean 6 Sigma in Academia

Office of Human Resources

January 2018

Competency: Functional-Technical Skills

# Objectives

**Identify**

Foundational concepts of Lean 6 Sigma

**Establish**

A common language for transformation

**Recognize**

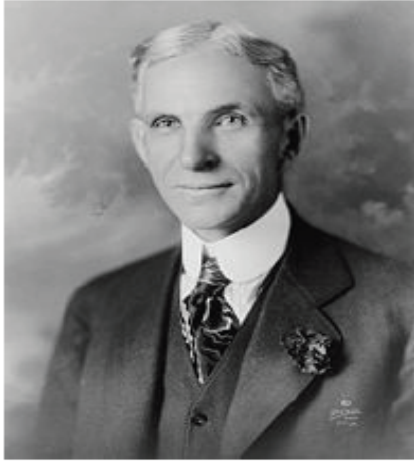
Where and how Lean 6 Sigma can be used

# I've heard of Six Sigma but what does it mean?

- Six Sigma is a quality improvement process that strives to reduce defects or errors. The "sigma" is a notation for one standard deviation. Six Sigma would mean 3.4 defects per million customer opportunities.
- Six Sigma was created at Motorola, but was popularized by Jack Welch, who made it his central business strategy at General Electric.

<b>Sigma Level</b>	<b><u>DPMO</u> Defects per Million Opportunities</b>
2 $\sigma$	308'537.0
3 $\sigma$	66'807.0
4 $\sigma$	6'210.0
5 $\sigma$	233.0
6 $\sigma$	3.4

# The Fathers of Lean Quality



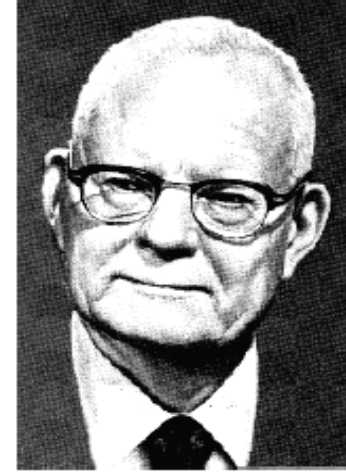
**Henry Ford**  
1863-1947

- Founder, Ford Motor Company
- Sponsor of the assembly line technique of mass production
- Introduced the Model T automobile



**Taiichi Ohno**  
1912-1990

- Production Engineer at Toyota
- The father of TPS – Toyota Production System
- Published the “Toyota Production System”



**W. Edwards Deming**  
1900-1993

- American statistician
- Helped the Japanese transform after WWII
- Deming Prize



**Shigeo Shingo**  
1909-1990

Author of several books about Lean concepts including single-piece flow, mistake-proofing and the Shingo system for continuous improvement

# What is Lean 6 Sigma?

- “Lean” described Toyota’s business during late 1980s
- Researcher James Womack, PhD from MIT
- Quality driven thinking
- 5 Step Process that focuses on Purpose, Process, People





# Core Lean 6 Sigma

**Customer Value:** Determine what matters most to customers

**Process Focus:** Enable the workforce to identify and remove waste from the system in order to satisfy customers

**Lean Culture:** Foster a respectful, interactive culture of process ownership

# Lean Six Sigma Project Types



## Quick Win

Implementation of a simple solution to a known issue

The problem is contained in one department, the root cause is known and the fix is painless

Also called "Just-Do-It" or Fast Track



## Process Improvement

Incremental reduction of defects, cycle time or cost

The presenting issue has an unknown cause and solutions are not predetermined

Also called DMAIC, Lean or PDCA



## Process Design

Creation of a brand-new, non-existent process

There is no existing process to analyze which requires benchmarking and collection of VOC

Also called DFSS or DMADV



## Process Redesign

Overhaul of non-capable, existing process

The process exists, but incremental improvements will not be able to satisfy requirements

Also called Reengineering



## Infrastructure Implementation

Establishment of key measurement systems

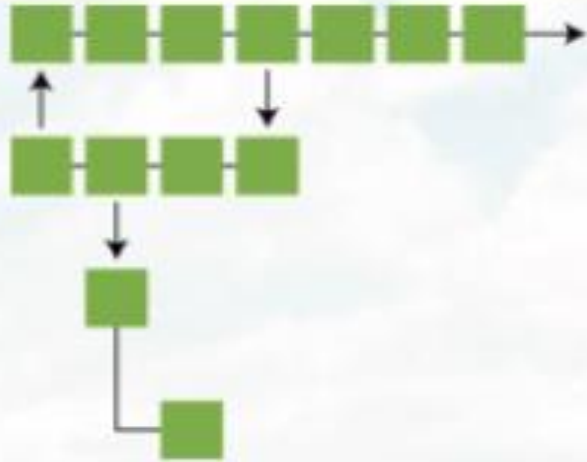
Monitoring of process capability and VOC are established to better focus improvement efforts

Also called Process Management

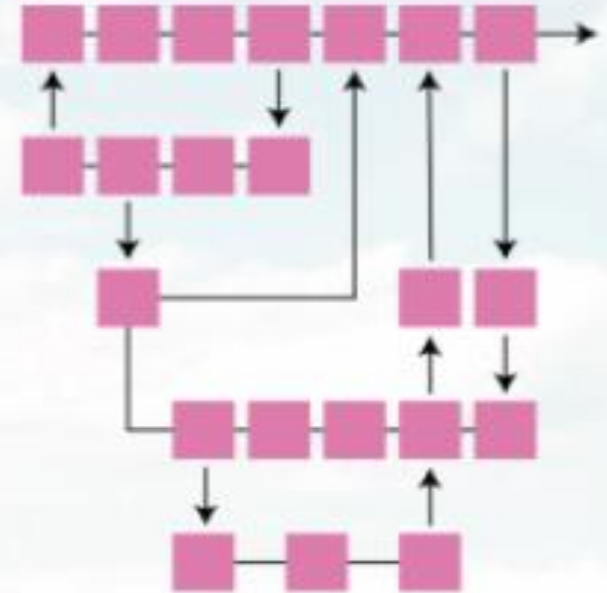


# PROCESS

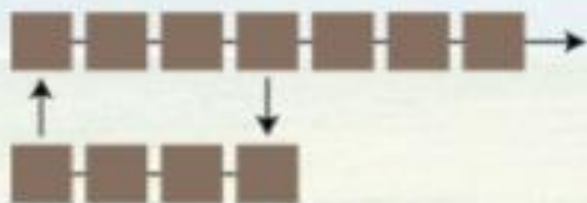
What you think it is...



What it really is...



What it should be...



What it could be...





# Lean 6 Sigma (L6S)

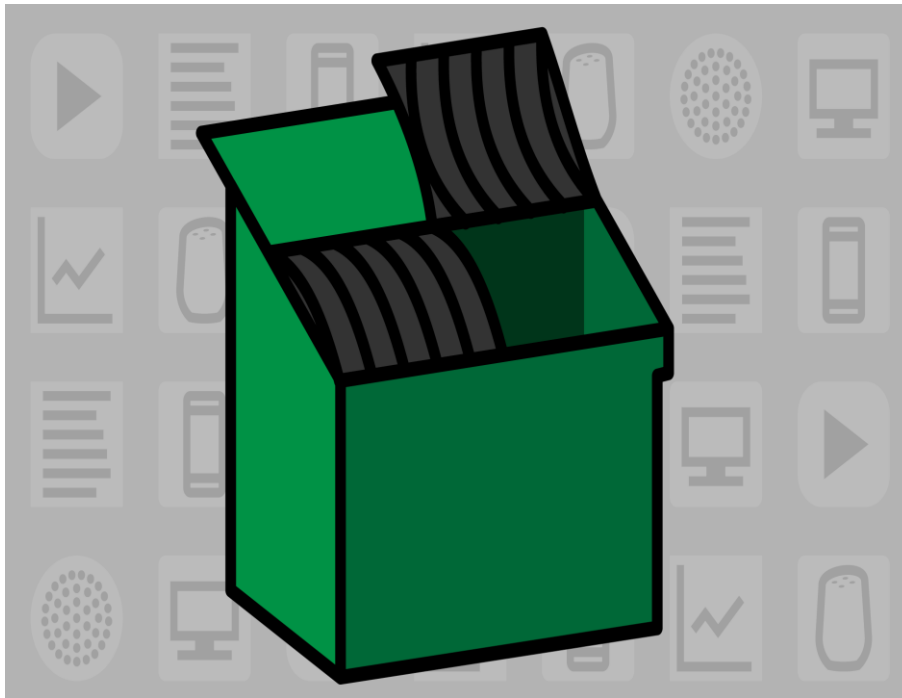
- Method of problem solving
- Not just a philosophy but goal too
- Increases revenue
- Increases customer satisfaction
- Increases efficiency/effectiveness
- Decreases cost
- Develops staff
- **MAXIMIZE** customer value
- Strips away **unnecessary** steps or time in the process -> **Waste!**

The M&M's logo is rendered in a stylized, brown, 3D font with a white outline and a drop shadow. The letters are slightly slanted and have a soft, rounded appearance.

- **Muda** - > WASTE, 8 types
- **Mura** - > strain, overburden, uneven
- **Muri** - > demand that exceeds capacity

# WASTE (aka MUDA)

**L6S has 8 kinds:**



- Errors/Defects
- Waiting
- Motion
- Over processing
- Non-utilized talent
- Over-estimation
- Inventory
- Transportation

# Examples @ a University

- **Errors/Defects**

- Data entry, missing or incorrect information, error gets passed downstream, billing errors

- **Waiting**

- Computer downtime, approvals, clarification or correction of work, additional information

- **Motion**

- Walking between offices, filing, searching for missing information, shuffling through papers

- **Over-processing**

- Re-entering data, double checking, extra copies, redundant filing, cc'ing too many on emails

- **Non-utilized talent**

- Restricting decision making, not trusting staff, confusing goals/metrics, ignoring strengths

- **Over Estimation**

- Extra anything

- **Inventory**

- Piles of anything, batch processing, unread email, things waiting in a box

- **Transportation**

- Paper moving, handoffs of data, excessive attachments (just in case)

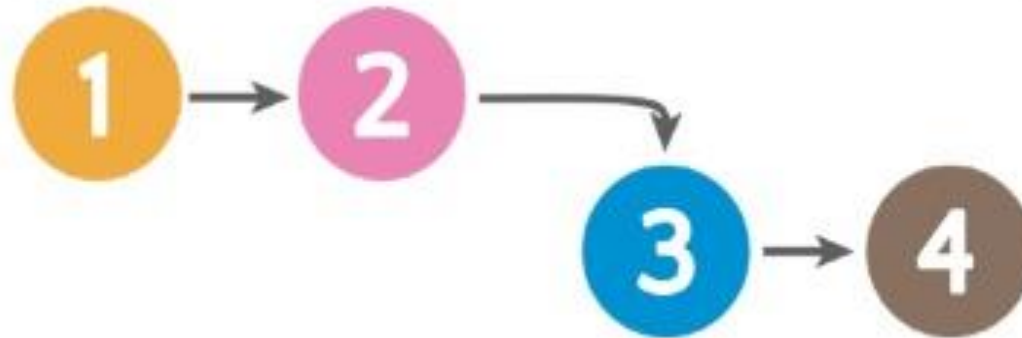
# Once Waste Is Identified

- What do you do?
- How can you:
  - Eliminate?
  - Simplify?
  - Streamline?
  - Minimize?

PROCESS BEFORE LEAN SIX SIGMA:



PROCESS AFTER LEAN SIX SIGMA:





**“That’s the way we’ve always done it.”**

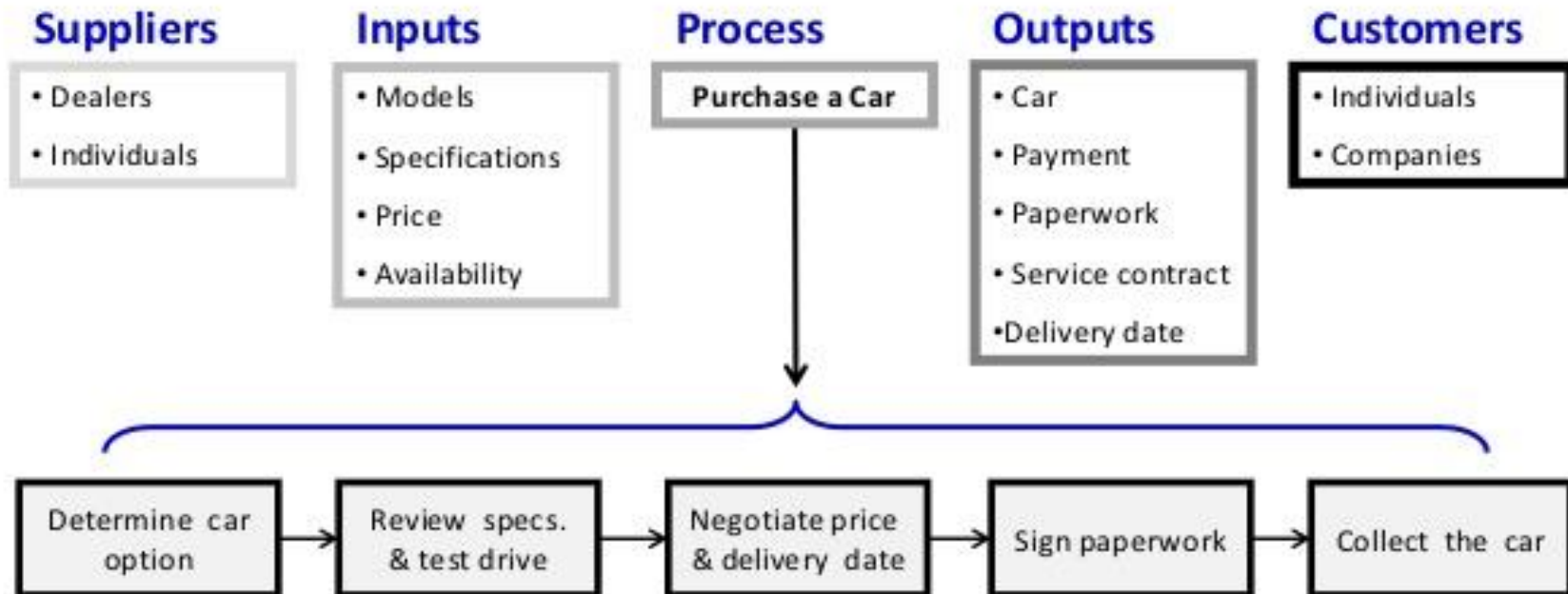
- Accountability, engagement
- Promotes action learning teams
- More trusting of organization and individuals
- **TRANSPARENCY & TRANSFORMATION**

# SIPOC You Say?

1

## - SIPOC Mapping

Example – A Car Purchasing Process:



# Problem Solving the Process

- **DEFINE** the problem and necessary outcome to satisfy the customer (internal or external)
- **MEASURE** and map the current and ideal process, gather data
- **ANALYZE** the map and data so cause can be found; generate solutions
- **IMPLEMENT** the selected solution; verify
- **CONTROL** solution with maintenance; “facts for fixes”

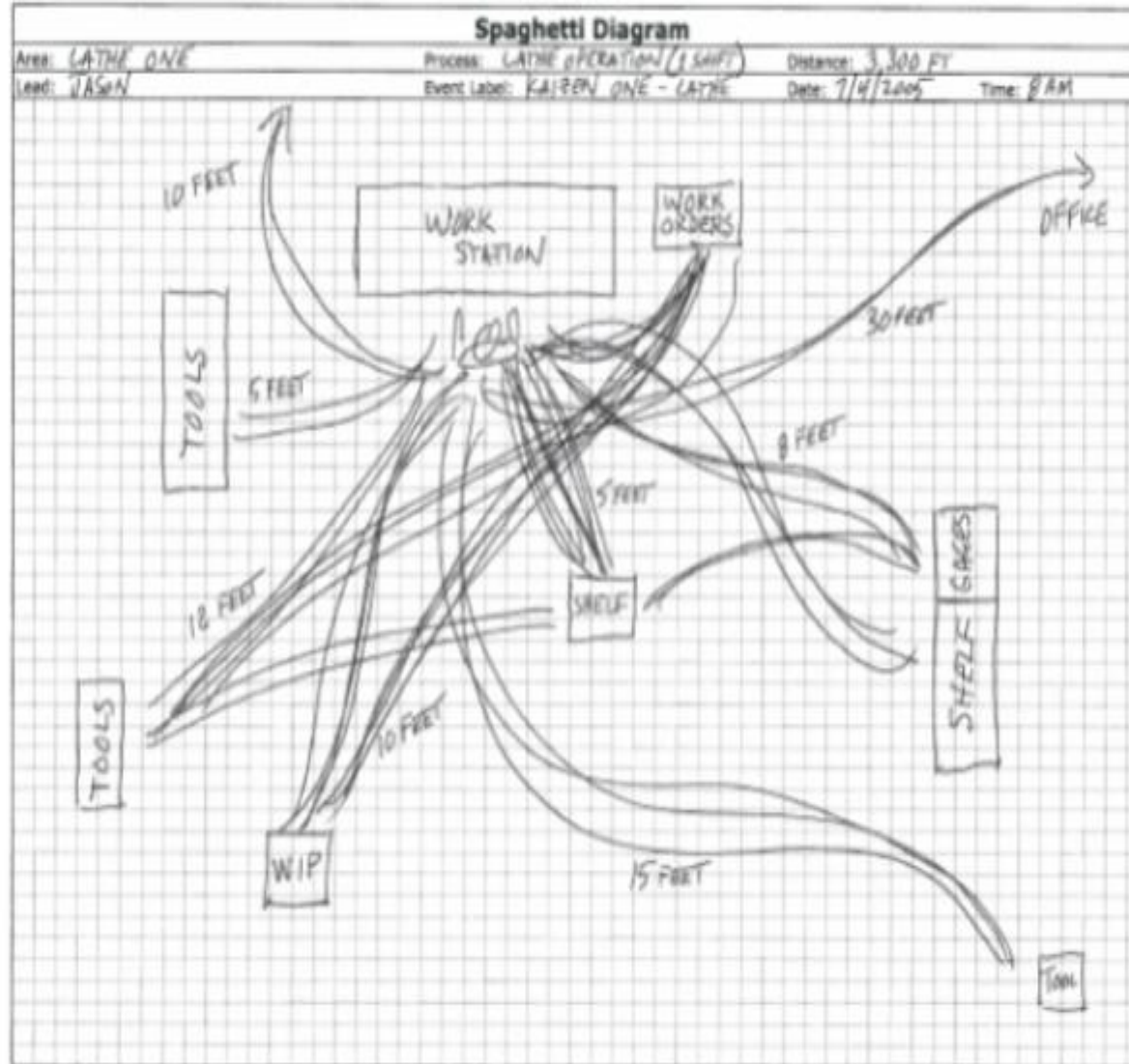
**DMAIC**



# DEFINE

- **Define what?**
- **4 items**
  - A statement of the problem
  - A goal statement
  - Current process, spaghetti map
  - Customer requirements (outcome)

# A Spaghetti Map?



# MEASURE

- Select data collection methods
- Create data collection plan
- Collect data-> RELIABILITY
- Compile data
  - Baseline data



# ANALYZE

- Closely examine process: Root Cause
  - USE 5Ys
- Visually present the data
- Brainstorm ideas for the cause: Verify
- Create an ideal map
- Identify solutions
  - Narrow brainstorm ideas



# IMPROVE

- Focus on designing and implementing changes for desired effect
- Design future state
  - Current + Ideal = Future (Hybrid)
  - Consider constraints
- Select and implement solution
- Measure solution implementation for improvement

# CONTROL

- Trust but verify
- Maintaining solution -> Feedback loop
- Monitor and make adjustments to solution
- Use the knowledge of this implementation for application to other processes



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# Assemble Your Team

- You are the **LEADER** if its **YOUR** problem
- Gain supervisor buy-in: **SUPPORT**
- Tap into unfamiliar talent
  - Fresh perspectives
  - Talent Profiles
  - 5 or less on the team



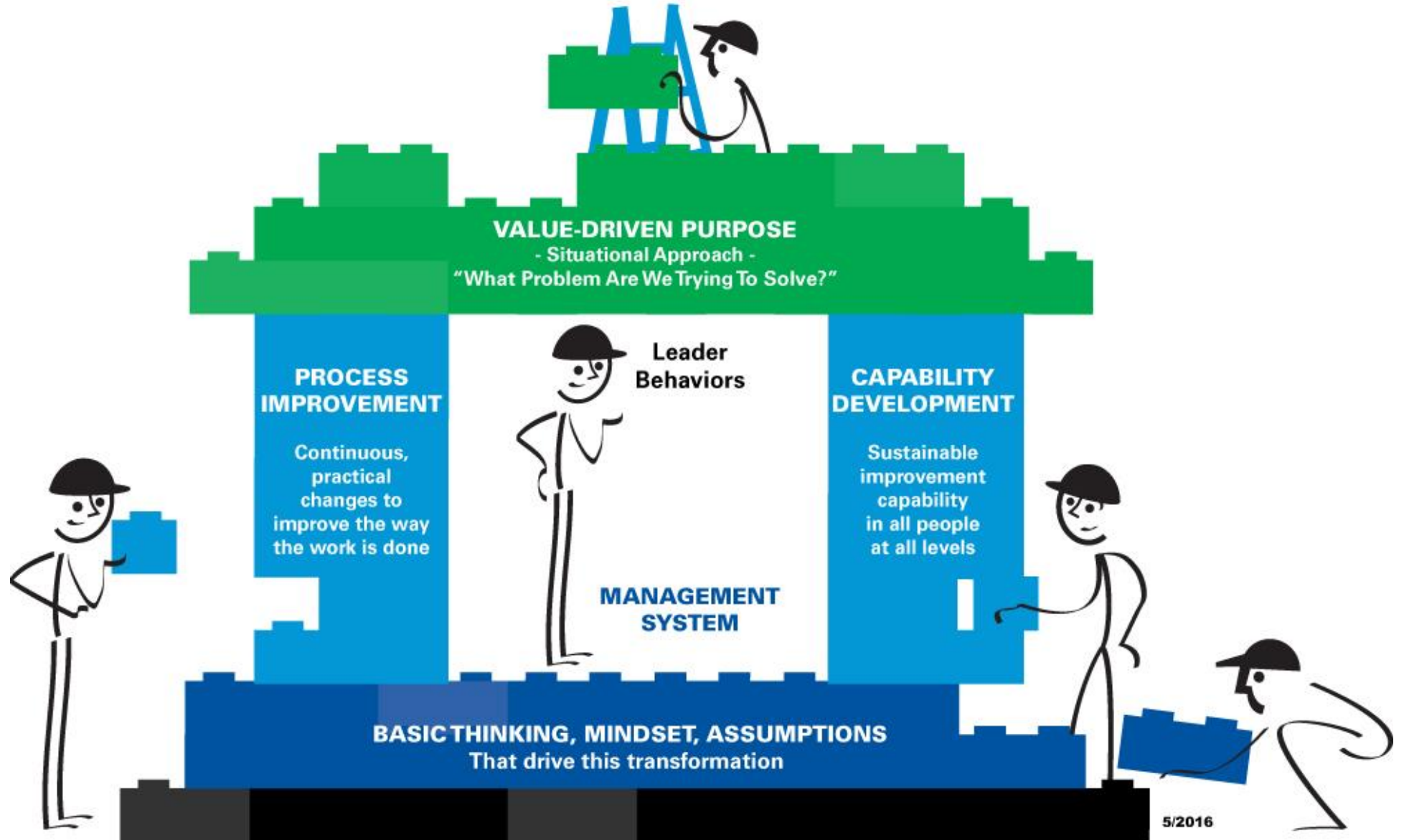


# Tips for Getting Started

- Assemble your team
- Forget grand strategy
- Seize a crisis as the impetus for change
- Map your processes including spaghetti charts
- Demand immediate results
- Once you have momentum, look to the adjacent processes



# The Lean Transformation Framework

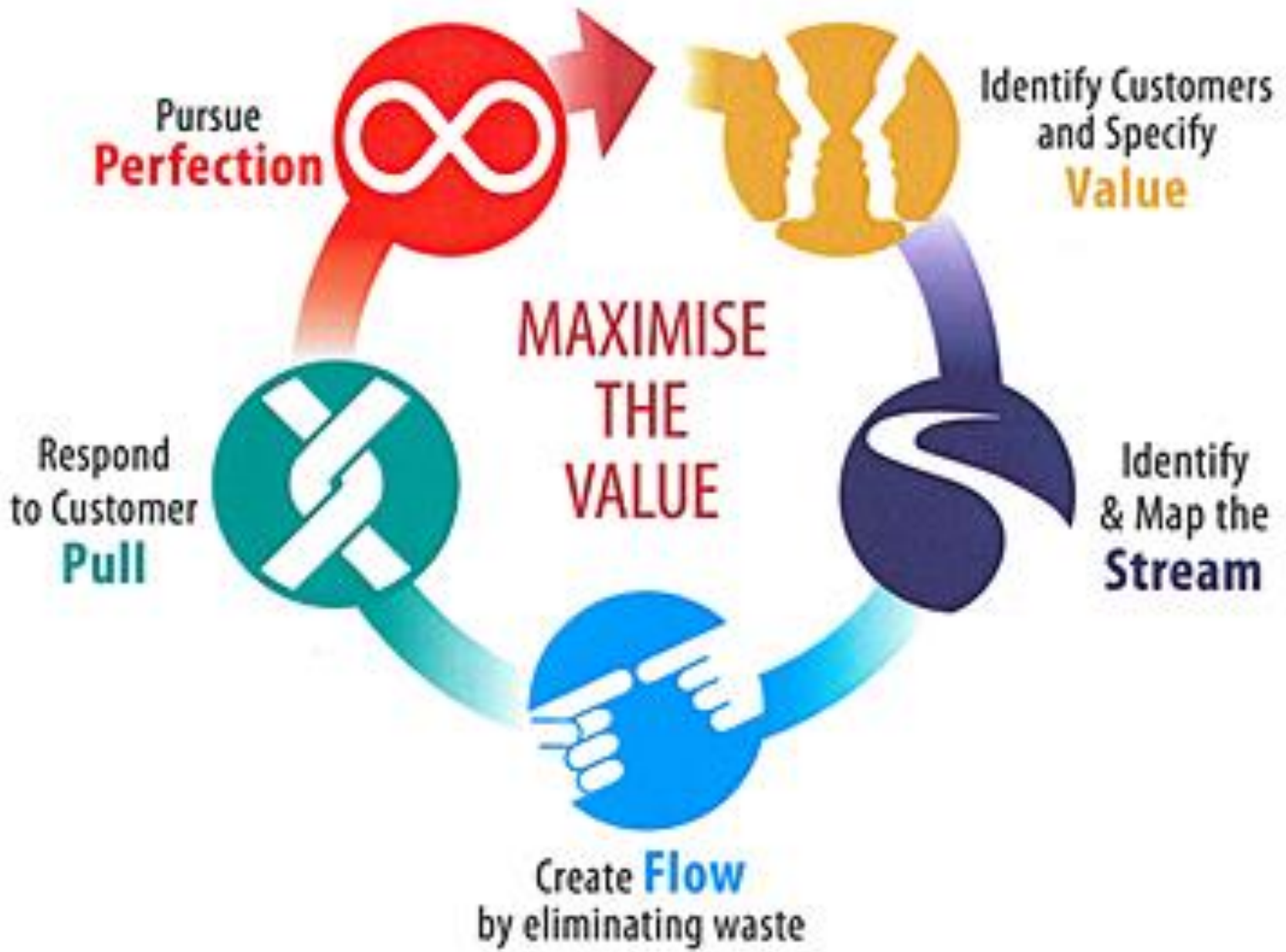




# Encourage Lean Thinking

*“Two steps forward and one step backward is O.K.;  
no steps forward is not O.K.”*

- Utilize policy deployment – work with HR
- Make all performance measures transparent, measurable
- Teach lean thinking and skills to all staff
- Build a business case to right size your tools instead of patching





# Key Takeaways 1

- Focus on the customer.
- Identify and understand how the work gets done
- Map processes and use spaghetti charts
- Manage, improve, and smooth process flow
- Remove waste!
- Manage by facts, reduce variations
- Use DMAIC across all processes for consistency

# Key Takeaways 2

- Start with a “bite” size project
- Keep in mind your resource constraints
- Ensure the project is tied to your Unit goals/results
- Select diverse team members, limit to 5 max
- Hold people accountable for their effort





# Lean Six Sigma DMAIC Tools and Activities

- ◆ Review Project Charter
- ◆ Validate High-Level Value Stream Map and Scope
- ◆ Validate Voice of the Customer & Voice of the Business
- ◆ Validate Problem Statement and Goals
- ◆ Validate Financial Benefits
- ◆ Create Communication Plan
- ◆ Select and Launch Team
- ◆ Develop Project Schedule
- ◆ Complete Define Tollgate

## Define

- ◆ Project Charter
- ◆ Voice of the Customer and Kano Analysis
- ◆ SIPOC Map
- ◆ Project Valuation/ROIC Analysis Tools
- ◆ RACI and Quad Charts
- ◆ Stakeholder Analysis
- ◆ Communication Plan
- ◆ Effective Meeting Tools
- ◆ Inquiry and Advocacy Skills
- ◆ Time Lines, Milestones, and Gantt Charting
- ◆ Pareto Analysis

- ◆ Value Stream Map Flow
- ◆ Identify Key Input, Process and Output Metrics
- ◆ Develop Operational Definitions
- ◆ Develop Data Collection Plan
- ◆ Validate Measurement System
- ◆ Collect Baseline Data
- ◆ Determine Process Capability
- ◆ Complete Measure Tollgate

## Measure

- ◆ Value Stream Mapping
- ◆ Process Cycle Efficiency/Little's Law
- ◆ Operational Definitions
- ◆ Data Collection Plan
- ◆ Statistical Sampling
- ◆ Measurement System Analysis (MSA)
- ◆ Gage R&R
- ◆ Kappa Studies
- ◆ Control Charts
- ◆ Spaghetti Diagrams
- ◆ Histograms
- ◆ Normality Test
- ◆ Process Capability Analysis

- ◆ Identify Root Causes
- ◆ Reduce List of Potential Root Causes
- ◆ Confirm Root Cause to Output Relationship
- ◆ Estimate Impact of Root Causes on Key Outputs
- ◆ Prioritize Root Causes
- ◆ Value-Add Analysis
- ◆ Takt Rate Analysis
- ◆ Quick Wins
- ◆ Statistical Analysis
- ◆ Complete Analyze Tollgate

## Analyze

- ◆ Process Constraint ID and Takt Time Analysis
- ◆ Cause & Effect Analysis
- ◆ FMEA
- ◆ Hypothesis Tests/Conf. Intervals
- ◆ Simple & Multiple Regression
- ◆ ANOVA
- ◆ Components of Variation
- ◆ Conquering Product and Process Complexity
- ◆ Queuing Theory

- ◆ Develop Potential Solutions
- ◆ Evaluate, Select, and Optimize Best Solutions
- ◆ Develop 'To-Be' Value Stream Map(s)
- ◆ Develop and Implement Pilot Solution
- ◆ Implement 5s Program
- ◆ Develop Full Scale Implementation Plan
- ◆ Cost/Benefit Analysis
- ◆ Benchmarking
- ◆ Complete Improve Tollgate

## Improve

- ◆ Replenishment Pull/Kanban
- ◆ Stocking Strategy
- ◆ Process Flow Improvement
- ◆ Process Balancing
- ◆ Analytical Batch Sizing
- ◆ Total Productive Maintenance
- ◆ Design of Experiments (DOE)
- ◆ Solution Selection Matrix
- ◆ Piloting and Simulation
- ◆ Work Control System
- ◆ Setup reduction
- ◆ Pugh Matrix
- ◆ Pull System

- ◆ Develop SOP's, Training Plan & Process Controls
- ◆ Implement Solution and Ongoing Process Measurements
- ◆ Confirm Attainment of Project Goals
- ◆ Identify Project Replication Opportunities
- ◆ Training
- ◆ Complete Control Tollgate
- ◆ Transition Project to Process Owner

## Control

- ◆ Mistake-Proofing/ Zero Defects
- ◆ Standard Operating Procedures (SOP's)
- ◆ Process Control Plans
- ◆ Visual Process Control Tools
- ◆ MGPP
- ◆ Statistical Process Controls (SPC)
- ◆ Solution Replication
- ◆ Visual Workplace
- ◆ Metrics
- ◆ Project Transition Model
- ◆ Team Feedback Session

## Kaizen Events Targeted in Measure to Accelerate Results