

# Achieving and maintaining Lean and Six Sigma with Simulation.

**Presented by**  
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# Introduction

- About CreateASoft, Inc.
  - In business for 11 Years.
  - Provides software, and simulation consulting services.
- SimCAD Pro
  - Process Modeling and Simulation tool that's been successfully applied to multiple industries.

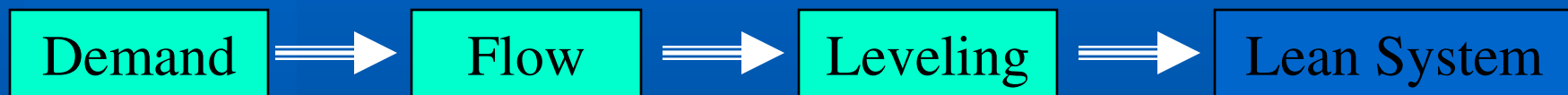
# Overview

- Refresher on lean and Six Sigma.
- Using simulation to achieve a lean environment.
- Using simulation to achieve Six Sigma.
- The role of simulation in maintaining and fine tuning the attained goals.

# What Is Lean?

- Set of methods and concepts used to
  - Reduce waste.
  - Decrease WIP.
  - Provide a streamline flow.
- Lean concepts are not industry specific.
  - Can benefit both the service and manufacturing environment.

# Key Stages of Lean application



- Demand identified by
  - Takt time, buffer inventory, safety inventory, ...
- The Flow
  - Continuous flow, work cells, Kanban system, FIFO lanes, ...
- Leveling
  - Paced withdrawal, Heijunka (load leveling)...

# Goals of Lean systems

- Stabilize your processes.
  - Review capabilities, labor, and material flow.
- Standardize processes and flow.
- Simplify, through Kaizan principals.

# Key Lean concepts

- Takt time

- Available production time/total quantity desired.

- Cycle time

- Time that elapses from the beginning of the operation until completion, also known as processing time.

- Value Added time.

- Non Value added time.

- Process efficiency.

- Value Added Time / Total time.

# Kanban System

- One of the most widely used terms in lean implementation.
- Implements a pull system.
  - Only produce what's needed downstream.
  - Create production orders to upstream processes through signals or bins.

# What is Six Sigma?

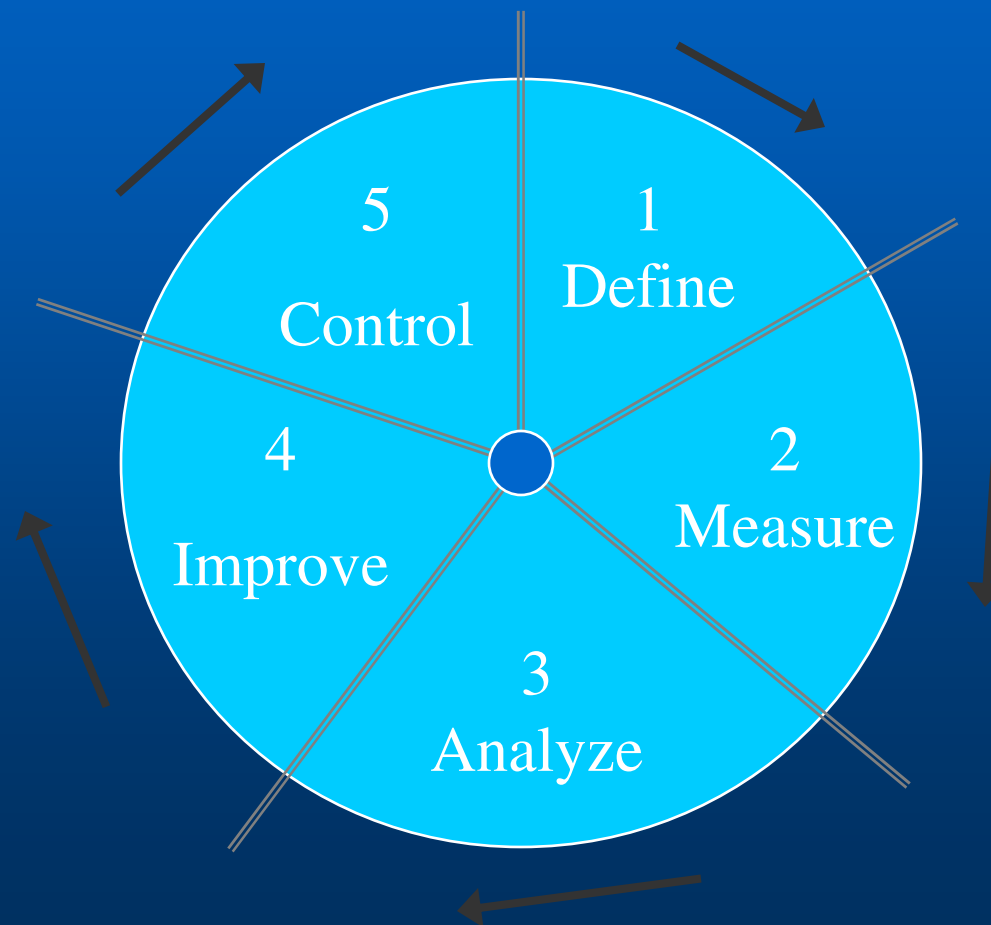
- System of **management** to achieve lasting business leadership and performance to benefit the business, its customers, shareholders, ...
- A **measure** to define the capability of any process.
- A **goal** for improvement that reaches near perfection.

# Six Sigma and Quality

- Six Sigma represents the capability of a core business process as measured in defects per million opportunities.

Sigma Level	Defects per Million	Yield
6	3.4	99.9997%
5	233	99.977%
4	6,210	99.379%
3	66,807	93.32%
2	308,537	69.2%
1	690,000	31%

# DMAIC Overview



# Benefits of Lean and Six Sigma.

- Projects that are lean pay off in inventory and manufacturing cost reduction.
- Six Sigma projects working on improving quality (reduce defects) provide improved production rate and customer satisfaction.

# The role of simulation

- Simulation provides a tool to analyze, visualize, and experiment.
- Improvement ideas are tested and analyzed before implementation.
- Migration scenarios can be tested.
- Forecasting and scheduling.

# Where to start?

- Identify the Goal.
  - Simulating without a defined goal does not generate results.
- Identify the processes involved in the environment.
- Define and collect metrics from existing line.

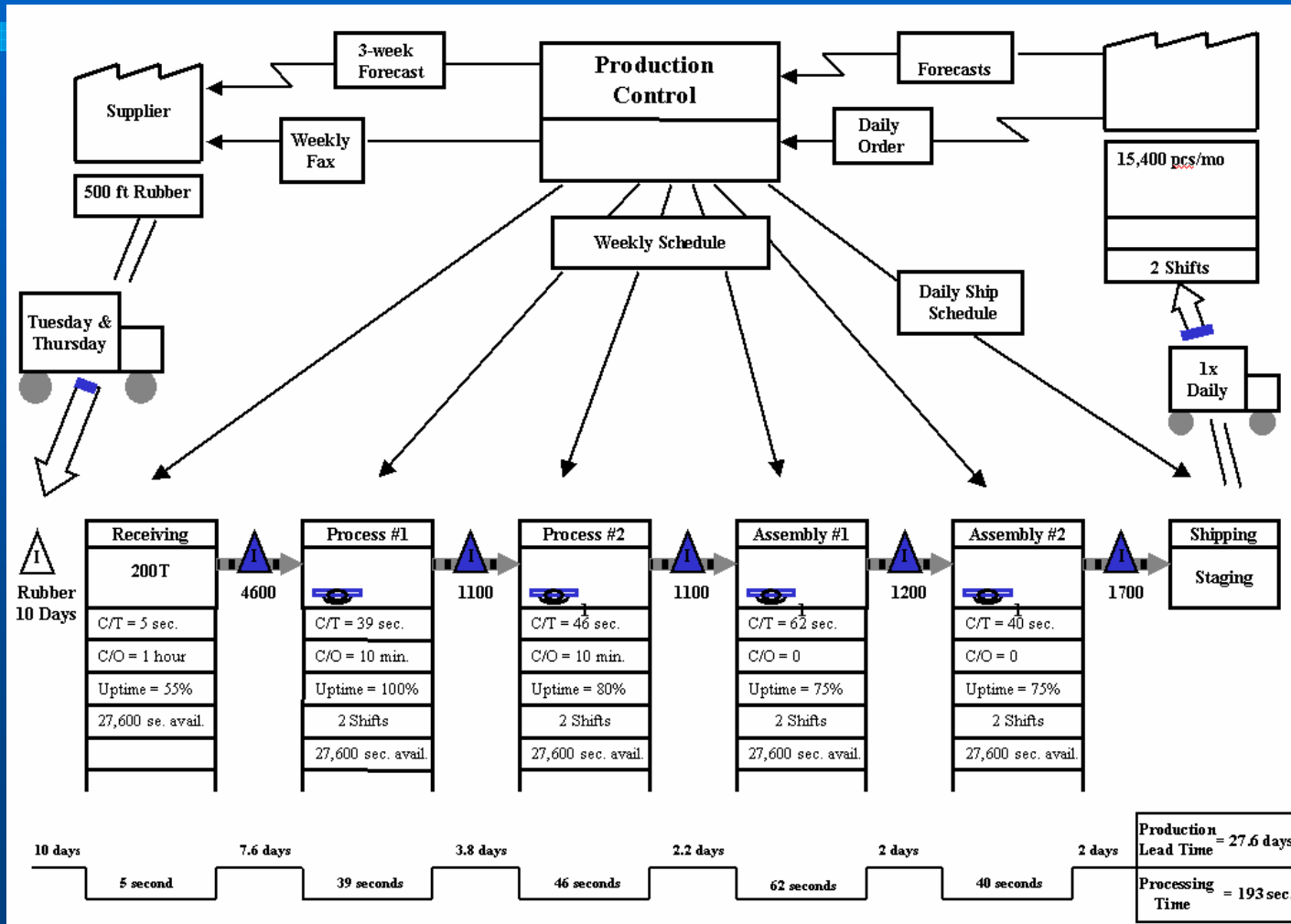
# Simulation - First Step

- Start with a process map.
- Define the process flow.
- Assign scrap rates, product specific flows, resources, ...
- Simulate and validate of the model.

# Simulation – Step 2

- Convert flow to a value stream map.
- Identify the processes contributing to value added time.
  - The remaining processes contribute waste to the overall flow.
- Identify the process efficiency rating.
  - Process efficiency = VAT / total time.
  - Identify the “worst performers” in the current flow.

# A Value Stream Map



# Things to watch for:

- Queue wait time can be misleading.
  - A set of parts waiting to be assembled at a process (Large WIP Values) may indicate a problem at the assembly process, while the actual problem is at the feeding process.
- Large production batches lead to large WIP values and a deviation from Lean principals.

# Achieving Lean – Step 1

- From the VSM determine the processes contributing to 80% of the waste.
- Determine the non-value added time in the flow.
- Simplify – determine processes that can be split to avoid long processing times.

# Achieving Lean – Step 2

- Can the Kanban system be used?
  - Main objective: Reduce WIP.
- Determine the Kanban size:
  - There should be enough work on every process to allow it to operate while the next bin is being produced.
  - How? Kanban size can be determined based on the cycle time of the upstream processes.

# Achieving Lean – Step 3

- Use simulation to implement changes.
  - Document the differences between runs (save the logs).
  - Compare results to determine which scenario produces the best outcome.
- Based on the goal, determine how close you are to the projected takt time.
- Simulate multiple product mixes.

# Achieving Lean – Step 4

- Define the worst case scenario.
  - If more than one is possible, then run all possibilities.
- Define the best case scenario.
  - A lean flow should operate flawlessly.
- Goal
  - A combination of the process changes that provide a lean environment in 80% of the cases.
  - Provide a solution for high demand scenarios.

# Applying Six Sigma Changes

- Six Sigma changes may include
  - Changes in the process flow.
  - Changes in resource allocation.
  - Changes in product mixes.
  - Changes in the number of items in the flow.
- Use the simulation model to apply the changes.
  - Is our lean solution still intact?

# Quality effect on the line.

- By reducing scrap, there is more demand on upstream processes to produce items.
  - Potential problem: down stream processes may starve, or utilization may drop.
- Is a reduced utilization a problem?
  - The goal is to produce products based on a preset customer demand (takt time).
  - If takt time is achieved with a lower utilization, the process can be expanded in the future without impacting the operation.

# Maintaining progress

- Current business models require constant monitoring of the operation.
- After desired improvements are achieved, the flow will lose efficiency through time if proper monitoring is not performed.
  - A large percentage of companies that achieve lean and Six Sigma fail to maintain improvement through time.

# Maintaining improvement with simulation

- Simulation models can play a major role in maintaining progress and help in constant improvement.
  - Time was invested in building a model that resembles the production line.
  - Constantly apply changes on the line to model and perform analysis before implementation.
- Always maintain an updated model.

# The role of forecasting

- By preloading the model with existing WIP, and forecasted orders, ....
- Schedules generated...
- Help the production line while maintaining model state.
- Proactive role ... predict problems before they affect your line.

# SimCAD Pro approach

- Support Value Stream Map and process map.
  - Computation of VAT, Process Efficiency, takt time deviation, and many others.
- Forecasting and scheduling.
  - Load existing WIP, forecasted orders, and generate the best production schedule.
- Ease of model creation.
  - Quick solution turnaround.

# Achieving and maintaining Lean and Six Sigma with simulation.

## Questions

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