Before we begin:
- Turn on the sound on your computer. There is audio to accompany this presentation.
- Audio will accompany most of the online presentation materials throughout the semester.

Week 12
Lean Six Sigma Basics: Improve

Lean Six Sigma Improve Phase
Introduction
LEARN SIX SIGMA PROCESS...

THE IMPROVE PHASE

Improve Phase Goals/Steps

1. Finalize the list of KPIVs
2. Develop comprehensive list of solutions or improvements.
3. Fully evaluate solutions and choose best solution(s)
4. Visualize the new processes using the Future State Process Map
5. Pilot Study Implementation Plan Developed

THE IMPROVE PHASE

Improve Phase Expected Outcomes

- Finalized List of KPIVs
- Fully developed/evaluated solutions
- Future State Process Map
- Completed Pilot Study Implementation Plan
Lean Six Sigma Improve Phase Tools

LEAN SIX SIGMA TOOLS...

IMPROVE TOOLS

Step | Tools
--- | ---
Finalize KPIVs | KPIV Analysis
Develop/ Evaluate Solutions | Solution Matrix
Future State Process Map | Impact/Effort Matrix
Pilot Study Implementation Plan | Future State Process Map

Pilot Implementation Checklist | Process Modeling and Simulation
Lean Six Sigma Improve Phase
Work Smarter

WORKING SMARTER, NOT HARDER...

- Efficiency describes the extent to which time, effort or cost is used to complete an intended task or purpose with a minimum amount or quantity of waste, expense, or unnecessary effort.
- A simple way of distinguishing between efficiency and effectiveness is the saying, “Efficiency is doing things right, while Effectiveness is doing the right things.”
- Planning Is The Key To Working Smarter Not Harder

WORKING SMARTER, NOT HARDER...

- Standardize all key processes with the “best known”
- Active participation and leadership from the staff closest to the process
- Staff commitment to identify potential failures, implement formal counter-measures, and redesign system
- Decreased need for staff workarounds
WORK SMARTER: REPENNING MODEL

FIGURE 1. The "Physics" of Improvement


WORK SMARTER: REPENNING MODEL

FIGURE 2. The Work Harder Balancing Loop


WORK SMARTER: REPENNING MODEL

FIGURE 3. The Work Smarter Balancing Loop

WORK SMATER: REPENNING MODEL


WORK SMARTER: REPENNING MODEL


WORK SMARTER: WORKPLACE ORGANIZATION

- Organizes job elements into a smooth sequence
- Creates a balance of human and machine utilization
- Improves physical layout to support employee efficiency
- Provides process control and reduces variation
WORK SMARTER: WORKPLACE ORGANIZATION

- Provides a training tool for new employees
- Offers information in an easily understood format
- Prompts level production
- Improves safety
- Improves communication and understanding
- Establishes a base for Continuous Improvement (Kaizen)

Lean Six Sigma Improve Phase
Positive Deviance

POSITIVE DEVIANCE

- Positive Deviance is a concept that in any community or group, there are people whose uncommon but successful behaviors or strategies enable them to find better solutions to a problem or work activity compared to their peers, despite facing similar challenges and having no extra resources or knowledge than their peers.
- These individuals are referred to as a positive deviant.
**Positive Deviants**

- Positive Deviants have the ability to function more effectively than their peers with the exact same resources and conditions (Workarounds).
- These individuals should be active members of any improvement initiative or interviewed.
- No other person knows the process better than the people who work with it every day and positive deviants do it better.

**Positive Deviants**

Positive Deviant Characteristics:
- Very open, curious and willing to explore ideas.
- Daring, courageous, motivated by adventure.
- Receptive to feedback/low ego.
- Intrinsically motivated to do extrinsic “value to society” activities.
- Passionate, energetic, vibrant, enthusiastic, dynamic.
- High cognitive development.
- High morals and ethics.
- A Sixth Sense.
- Walk to the beat of a different drum.
- Highly creative.

**Gathering the Knowledge from Positive Deviants:**

- **Purpose:** To engage those who are known to routinely overcome obstacles and barriers known to stop staff from completing the process in a quality fashion in conversations to discover existing solutions among them and create new ideas to improve the “process/system/task”.
- **Utilize an interview process known as Discovery and Action Dialogue.**
Gathering the Knowledge (continued):

- Use Prompting Questions:
  - What stops you from completing “task”?
  - What do you do to complete the “task”?
  - Who do you know that is able to consistently complete the “task” in a quality fashion?
  - What recommendations do you have for improving the “task” so everyone can complete in a quality fashion every time?

A Few Points:

- Discovery & Action Dialogues may not be linear
- Your job is to listen → silence is OK
- Sit among the participants → every voice is needed
- Invite others into the conversation → “What do others think?” “Are we missing anyone?”
- Useful to have a silent scribe to capture ideas

Lean Six Sigma Improve Phase
KPIV Analysis
GUIDELINES to the IMPROVE PHASE

Remember...

• Your solution(s) should:
  • Address the KPIVs identified during the Analyze Phase
  • Support with the goals and deliverables in the Charter.
  • Many solutions will be developed, however, only the BEST solutions should be fully developed.
  • Pilot, pilot, pilot...

STEP #1 – IMPROVE PHASE

Determine Process Failure Modes

• “Convicted” KPIVs from Analyze Phase
• Failure Mode and Effects Analysis (FMEA)
• Re-examine your current state process map.
• Re-examine the data analysis conducted during the Analyze phase.

STEP #1 – KPIV IDENTIFICATION

Current State Process Map Example

KPIVs from Analyze Phase

Note: For KPIVs that are high level processing steps, additional drill-down may be necessary.
Order Assignment Process

Additional data may need to be collected to ‘convict’ the lower level KPIVs.

EVALUATING PROCESS STEPS

- Identify the value adding (VA), non-value adding but necessary (NVAN), and non-value adding unnecessary (NVAU) process steps for the current state map
  - Place a green dot on the steps identified as VA
  - Place a yellow dot on the steps identified as NVAN
  - Place a red dot on the steps identified as NVAU
- Separately calculate the sum of the Value Adding (VA), Non-Value Adding Necessary (NVAN), and Non-Value Adding Unnecessary (NVAU) metrics.

EVALUATING PROCESS STEPS

Value adding and non-value adding determined using CTQ, VOC and group consensus
EVALUATING PROCESS STEPS

Current State Value Assessment

- **VA**: 2 Steps  Average Time = 345 seconds
- **NVAN**: 1 Step  Average Time = 75 seconds
- **NVAU**: 2 Steps  Average Time = 639 seconds

Total Average Time = 1059 seconds

Current state value assessment provides a baseline for comparison after improvements are made to the system.

STEP #2 – IMPROVE PHASE

Develop Solutions

- Develop solutions to reduce and/or eliminate the impact of KPIVs. Tools:
  - Affinity Diagram
  - Brainstorming
  - Multi-voting
  - Benchmarking

Benchmarking:

- Can be used during any part of the DMAIC process to compare against other processes and/or sites
- Used in the Improve Process to develop solutions.
  - “Borrowing” good ideas that have already been tested at other sites rather than developing in-house
  - Need to be aware of key differences between your process and benchmark
STEP #3 – IMPROVE PHASE

Choose the 'Best' Solution(s).

- Consider:
  - Effort to implement the solution, i.e. cost, resources
  - Impact to the KPOV

- Tools:
  - Solution Matrix
  - Impact / Effort Matrix

SOLUTION MATRIX

1. List KPIVs
2. RPN from FMEA
3. List Solutions
4. Quantify impact of each solution on KPIVs (0-10) scale
5. Calculate Total Impact Score
6. Identify success criteria
7. Rank solutions by success criteria (0-10) scale

SOLUTION MATRIX INSTRUCTIONS

Instructions:
1. List Failure Modes (KPIVs)
2. List RPNs calculated by FMEA (optional)
3. List Potential Solutions
4. Quantify impact of each solution on failure modes:
   - 0 no impact
   - 5 moderate or indirect positive impact
   - 10 direct positive impact
5. Calculate Total Impact by summing each KPIV impact
6. List success criteria, i.e. Risk to Patient Safety, Likelihood of Success, Cost
7. Rank each solution by success criteria, where:
   - 0 no impact
   - 5 moderate or indirect positive impact
   - 10 direct positive impact

NOTE: If cost is used, determine actual costs if possible, or use scale
Impact/Effort Matrix

- **LH**: Quick Wins (Primary Focus)
- **HH**: Major Projects (Complex/Time Consuming)
- **LL**: Fill-Ins (Quick Fix)
- **HL**: Thankless Tasks (Time Wasters)

Take each solution and place it in the quadrant that best reflects the impact expected and the effort it would require.

**Step #4 – Improve Phase**

Future State Process Mapping

- Create a process map of what the process will look like following implementation of process improvements.
- Validate Future State process to insure functionality
- Identify action items that must occur to transform process to future state.

**Future State Process Mapping**

- The future state is designed to the best known process – pursuit of perfection
- Necessary design characteristics for a reliable sustainable process
  - Consistently brings value (what the customer needs) to the customer when they need it (pull)
  - Requires elimination and/or reduction of as many non-value adding process steps as possible
FUTURE STATE PROCESS MAPPING

EXAMPLE ➤ Current State Process Map
Order Assignment Process

Order Placed ➔ Label Prints In Lab ➔ Phlebot Paged ➔ Phlebot Calls Back ➔ Label Tubed To Phlebot ➔ Wrong Location ➔ Tube Delays

Order Placed ➔ Label Prints In ED ➔ Phlebot Picks-up

FUTURE STATE PROCESS MAPPING

EXAMPLE ➤ Future State Process Map
Order Assignment Process

Future State Value Assessment

- **VA**: 2 Steps Average Time = 345 seconds
- **NVAN**: 1 Step Average Time = 60 seconds
- **NVAU**: 0 Steps Average Time = 0 seconds

Total Average Time = 405 seconds
Time Savings = 654 seconds

Time savings determined by comparing current state value assessment with future state.
STEP #5 – IMPROVE PHASE

What is stopping us from reaching the future state?

- Non-value added process steps
- The waste (muda)
- Bottlenecks/backups occurring in current process (muri and mura)
- Other obstacles and barriers
- Variations in process and practice

What do we reach the future state?

- Gap Analysis: Future State vs. Current State

GAP ANALYSIS

Current
Order Placed → Label Prints In Lab → Phlebot Page → Phlebot Calls Back → Label Tubed To Phlebot → Phlebot Picks Up

Future
Order Placed → Label Prints In ED → Phlebot Picks Up

Gaps:
- Staff Training
- Dedicated ED Phlebot
- Label printer in ED
- ED Manager Ownership

STEP #6 – IMPROVE PHASE

Develop a Pilot Implementation Plan

- Complete Pre-Pilot Planning Checklist
- Inform stakeholders of the Pilot
- Train Relevant Employees
- Conduct the Pilot Study
- Increase the scope to a full process change.
STEP #6 – IMPROVE PHASE

What is a Pilot?

- A small scale implementation conducted using:
  - A short time frame
  - Select customers or products
  - Limited scope
  - Partial solutions (staggered implementation)
  - A pilot is used to test solutions as well as the implementation strategy.

Why conduct a pilot instead of a full implementation?

PRE-PILOT CHECKLIST – PAGE 1

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PRE-PILOT CHECKLIST – PAGE 2

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STEP #6 – IMPROVE PHASE
Informing the Stakeholders:
• Stakeholders should be informed of the pilot schedule, pilot plan PRIOR to implementation.
• Stakeholders should be informed of the pilot progress on a regular basis.

STEP #6 – IMPROVE PHASE
Employee Training:
☑ Employee In-servicing should be scheduled and conducted prior to pilot.
    ☐ JIT Training – don’t train too soon prior to the pilot start date.
    ☐ Re-training will be necessary following adjustments to the process.

STEP #7 – IMPROVE PHASE
Pilot Control Plan
☑ Keep Score; Establish process measures that enable:
    ☐ Real Time, Immediate Feedback
    ☐ Incremental (daily) feedback on KPOV performance
    ☐ Establish daily meetings to review pilot process performance
1. The Improve phase of your class project includes using the tools discussed.
2. Select possible solutions for your project Charter based on the analysis using the improve tools.
3. Develop a Future State Map
4. Assess improvements from current to future state
5. Perform a gap analysis

Lean Six Sigma Improve Phase Modeling and Simulation
What is Modeling and Simulation?

- Simulation is the “imitation of a dynamic system using a computer model in order to evaluate and improve system performance”.
- Discrete event simulation models the effects of the events in a system as they occur over time.
- Statistical methods are used to generate random behavior and estimating model performance.

Reference: Simulation using ProModel, Harrell, Ghosh, Bowden

Simulation can be used a tool within Lean Six Sigma to provide understanding and optimization of complex systems:

- Creation of generalized models for complex capacity and/or customer throughput analysis
- Comprehensive ROI analysis
- Optimization of facilities layout

When is Simulation Appropriate?

- An operational (logical or quantitative) decision is being made.
- The process under investigation has been standardized, and is well defined and repetitive.
- Activities and events are interdependent and variable
- The cost of the doing the model is less than the cost impact of the model benefit
Assignment:
• Assignment #4 due this week
• Analyze Presentation due next week

Additional Reading: Repenning and Sterman article