"Lean"-ing Into Simulation

The Link between Simulation and Lean Six Sigma

Simulation has a lot to offer to the world of Lean Six Sigma (LSS). LSS is traditionally a hands-on, manual process that requires the participation of all people involved beginning from the Kaizen (good change) events through the standardization of processes. In an evolving world where technology is becoming the foundation of many industries, LSS is still working to embrace tools that are readily available in order to progress in its philosophy.

LSS, when successful, is the ultimate advantage in any competitive industry. The ability to identify and eliminate waste can lead to exponential improvements before actually fixing the existing system. Waste is one of the biggest inhibitors to businesses in many industries, particularly in manufacturing and supply chains.

Identifying that waste is difficult when unrealized waste is a part of the training. Statements such as "It has to be done" or "This is more comfortable" should lead to asking "Why?" and "Why?" and "Why?" until key personnel realize that a change needs to be made. Once identified, the cycle begins and good change (Kaizen) becomes a reality.

Implementing a lasting LSS effort is an obstacle that most companies still have. Change management is one of the most difficult programs to execute, specifically in a process that has existed for 10, 20 or even 50 years. Identifying ways to encourage others and provide a vision for what the future holds is difficult in a process where the future may look exactly like the present. Change is scary, but change is necessary to exist 10, 20 and 50 more years.

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The Common Goal

Muda (waste), the foundation in the world of LSS, is not a concept that is typically applied to the use of simulation. Yet, simulation, in its purest form, is a tool to eliminate muda throughout the entire process. In the world of LSS, simulation is often seen as muda when looking into a telescope from the wrong end. Simulation holds a much greater value to LSS as a tool to identify waste, because eliminating waste is inherent to the process.

Table 1: *Different types of muda (waste) and the impact simulation can have on eliminating the Muda*

| Muda	Simulation Impact
Defects	Identify areas where defects may occur in a new system
Overproduction	Test system in an environment without physical product
Waiting	Reset and retest with limited waiting
Over-processing	Simulation can identify areas of over-processing
Transportation	No transportation needed in simulation
Inventory	No inventory needed in simulation
Motion	All items needed simulated within a controlled environment
Employees Underutilized	Test ideas quickly without shutting down production

Naturally, simulations use the DMAIC (Define-Measure-Analyze-Improve-Control) and the PDCA (Plan-Do-Check-Act) improvement cycles in LSS. As simulation capabilities continue to grow, the application of simulation is paramount to "leaning" any process in any industry.

For the manufacturing industry, 3-D simulations have been used to identify critical problem areas. A goal or a problem must be defined prior to building the simulation. Once established, the system must be measured by collecting all the data. This data includes processing times for each machine, fork lift travel times, and machine downtime data. This will help identify gaps that may exist in the current state, as well as, the

desired state. The data is then used to build a simulation, and the simulated results are validated against the real-world results.

At this point in the process, analyzing the system is where the true impact is identified by the LSS team. Problems can be seen faster with simulation than attempting to identify potential causes in real-time. The simulation model provides the ability to quickly create a list of problems over an accelerated time span by observing the model instead of observing the familiar day-to-day operations. Simulation allows the team to see the system both at a high level and a low level of detail, providing a holistic perspective into their daily processes and work environment.

Figure 2: *Simulation's potential in accelerating the continuous improvement cycle (PDCA)*
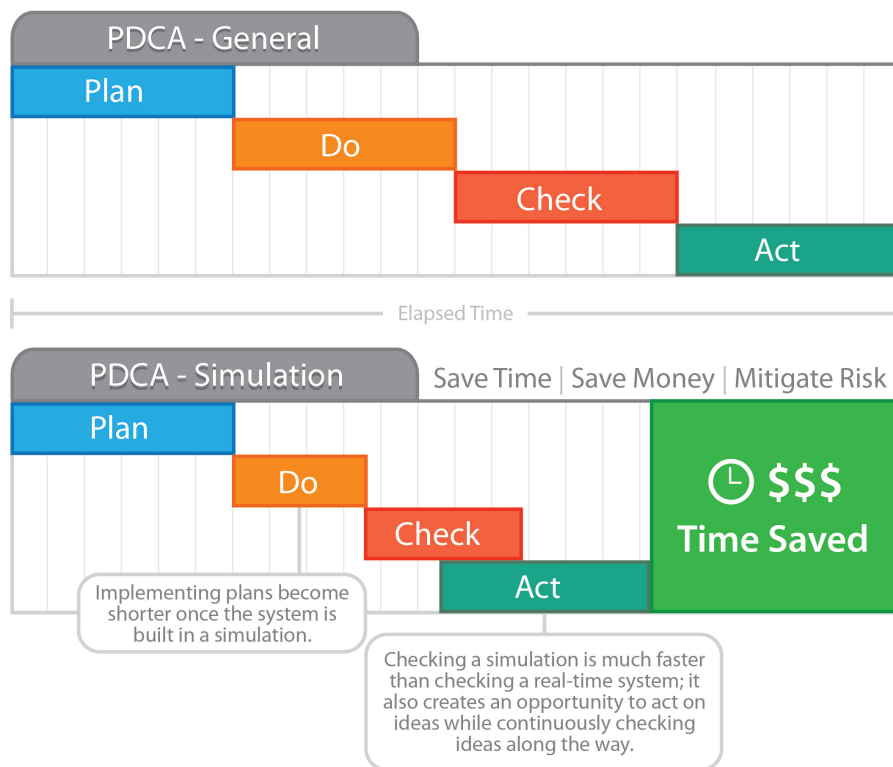
Within any industry, the goal is to continuously improve. With simulation, the ability to create a new and improved system is simplified and the ideas are limitless. Any team member is able to contribute to creating new ideas with the ability to test those ideas in an environment that does not create additional muda or undermine the minds of members on a team. The simulation can be used to quickly test concepts in a fraction of the time. Plan the idea, implement (do) the plan, check the results, and act accordingly. With simulation, the time spent in the Gemba (in the system) for extended periods of time to test and evaluate ideas is cut drastically. Implementing those ideas also take a shorter period of time. Proposed ideas are tested and validated in the model, mitigating the risk of carrying out a plan that is not proven.

The foundation of LSS is to control the system. In other words, sustaining, maintaining and creating a new plateau are what LSS teams strive for. As the bar continues to rise in a system, the simulation will continue to evolve along with the system. When a system begins to fall below that bar, the simulation becomes a reminder of what the team needs to strive toward. Because the simulation model functionality has now become the new standard, additional improvements can be identified when making the decision to begin a new journey in the system.

Teaming Up

Although very diverse in its many applications, there is one thing that simulations consistently identify: Potential. The most difficult challenge of LSS teams is change management. When workers see the system the same way they have seen it for 10+ years without changes, it is an uphill battle to implement and sustain LSS philosophies. Simulation provides a platform to promote the potential benefits a LSS team aims to instill in the base of its operations.

Simulation Enhances the Lean Toolbox

A model of the system becomes a permanent part of a team's LSS journey and a necessity to achieving acceptable results during any improvement process.

You Cannot Play the Game without Knowing the Score

Competition is inevitable and is a healthy component to progressive environments. The ability to present a long term improvement plan provides tangibility to the desirable targets established by a LSS team. Using simulation to highlight the journey can lead to more inspiring performances from all teammates.

Simulate through the Execution

When executing a plan, many things can happen throughout the process. As things change, a model can provide immediate input to those changes in a plan during an execution. Simulating to fine tune the critical details of a plan can ease minds and catch additional issues that may arise with the changes.

Simulation Is a Value Added Process

Simulation models present a value that is seen from the results and not the physical model itself. When using the model, the ultimate goal is to get a glance at the way it could be, which to some, is a luxury and not a necessity. When the need is to mitigate risk, improve quality, save time and reduce costs, the necessity is undeniable.

Typically, the questions asked are, "Is this something that can be accomplished without simulation?" or "Does the cost of the simulation warrant the need to validate these ideas?" The answer to both is more often yes than no. Enterprise risk (which includes safety, financial, operational risks) is a top priority in manufacturing. A simulation's number one priority in LSS is to minimize any risks associated with any ideas being executed.

Conclusion

Simulation has limitless potential within the LSS philosophy and the manufacturing environment in general. From identifying waste in the system to minimizing waste in the continuous improvement cycle, a simulation is more than just something that is nice to have. It is a necessary tool now and in the future evolution of Lean Six Sigma.
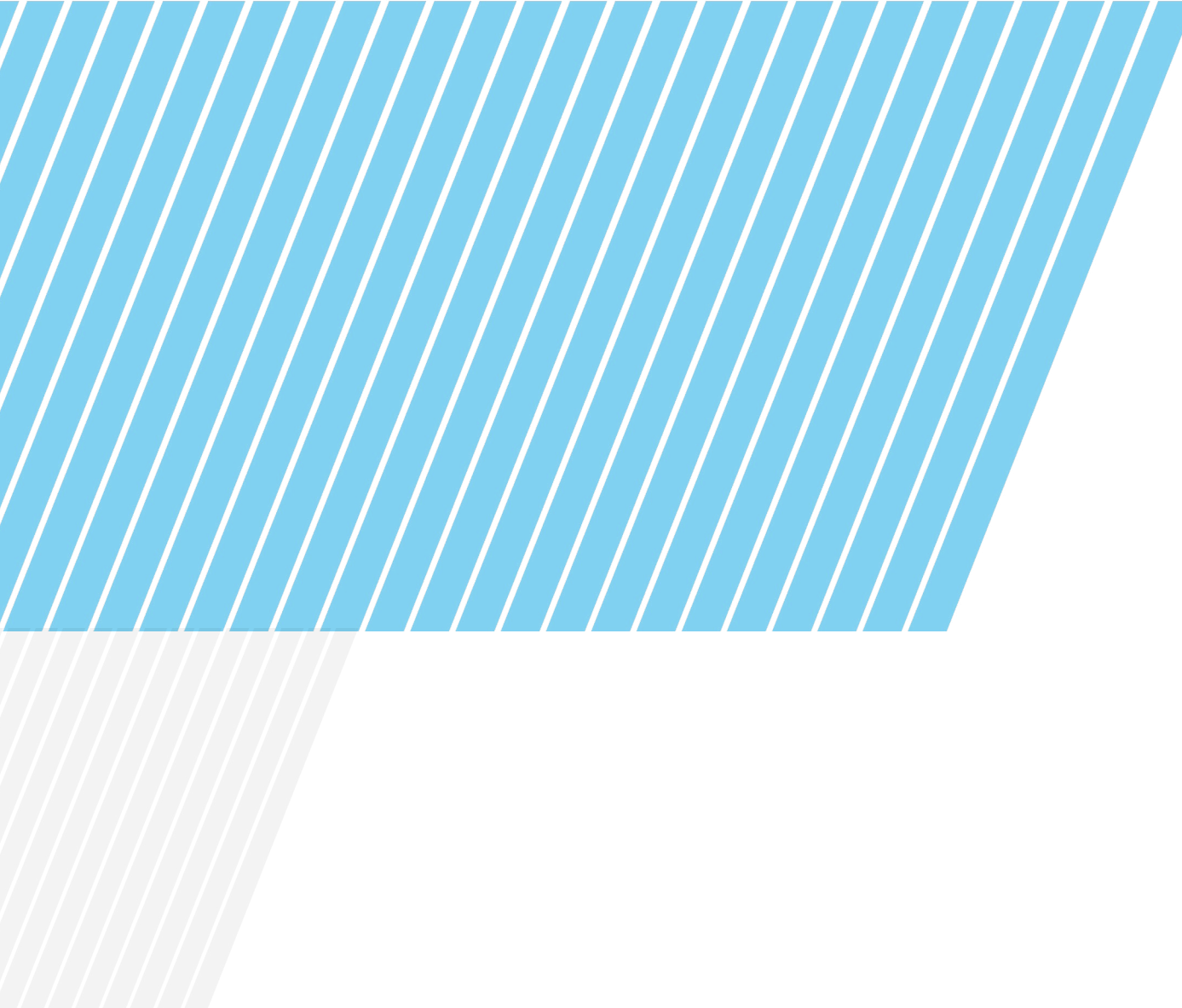
Have questions? Contact us.

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