



## **58th Advanced Manufacturing Forum**

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## **Creating Sustainable Change – The Lean Transformation**

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Caterpillar Inc., the world's leading manufacturer of construction and mining equipment, diesel and natural gas engines and industrial gas turbines, has been integrating 6 Sigma and Lean together over the last four years. Recently this has led to the formation of the Caterpillar Production System modeled after elements of the Toyota Production System. John Barkhouse discussed the history, integration and current deployment of the Caterpillar Production System across Caterpillar's global organization.

Barkhouse focused on the key elements of the lean journey which are necessary to create sustainability: the Operating System, Cultural System and Management System, along with how the three sub-systems are integrated through the value stream transformation.

Caterpillar began its journey by implementing fragmented initiatives of Lean and 6 Sigma Lean throughout areas of the company. This created varying degrees of sustained results and resulted in "islands of excellence". Many of the lean projects that occurred during this time were outside the original intended scope of the program. The Caterpillar Production System (CPS) was built on years of progress and experience gained from this time. CPS is part of a larger vision of 6 Sigma deployment in the Lean Vision of Caterpillar. CPS was created to be a blueprint for the integration of 6 Sigma and Lean concepts for companywide implementation. It would allow local cultural transformation with one playbook, providing the unified enterprise approach missing from earlier 6 Sigma Lean initiatives. Ultimately, CPS was implemented throughout the company and into the supply chain, resulting in the intended "enterprise cultural transformation". The goal of the program: create a synchronized value chain with common systems, common processes and a common approach that would make sense for each of Caterpillar's businesses.

Lean and 6 Sigma can exist independently, but the benefits of integration for Caterpillar were tremendous. Integration provided a single channel for employing limited resources rather than a divided focus and a destructive competition for resources. There was one improvement strategy for the organization making for a highly productive and profitable synergy instead of separate and unequal messages for improvement.

The 6 Sigma Lean supply chain principles at Caterpillar are based on customer requirements and are in place to improve performance and to increase the velocity of the chain. A value stream map is used to see the problems in the chain – a first step toward enabling improvement. The next steps are to contain problems, optimize the system using Lean principles and then control the chain.

The Caterpillar Production System is loosely built around the Toyota Production System.

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CPS is focused on systematic waste elimination to increase asset utilization, improve quality, reduce cost and lead times, and improve safety. Creating sustainable performance with a consistent, integrated methodology aligns Caterpillar's whole business, not just manufacturing. Caterpillar also recognizes that pace is a critical aspect of Lean integration. If projects take too long to complete, they will fail. Projects must be quickly implemented, and far reaching, to be successful.

There are three aspects to the CPS integrated system. The cultural system is about people - how they think and feel, how they conduct themselves in the workplace, how they are rewarded, etc. The operating system manages resources and assets to create value and minimize waste. The management system contains the formal structures, processes and systems through which the operating and cultural systems are integrated to deliver the businesses objectives. The feedback from these systems comes from the controls that are in place. These controls are driven by metrics. It is only through a careful monitoring of these metrics that sustainable performance can be maintained.

Dealing with people is the most challenging aspect of this or any other management system. One never knows what may be affecting the people in the system, how they are thinking. There is no formula for correcting the problems that are found with people. These problems are addressed by leaders who can observe and find the solutions to the problems of the individuals. Often, it may be that individuals are not in the place that they need to be. Managers should be mindful of finding the right place for individuals where they can really succeed. Trying to "fit a square peg into a round hole" may be what is holding an employee back from being truly successful. It is also absolutely necessary to listen to and understand the problems of employees. Giving them the right tools and the ability to succeed is absolutely critical.

The ultimate vehicle for CPS is its Value Stream Transformation (VST) process where the management, operating and cultural systems are incorporated. Implementation happens by way of a "learn - do - deliver" process over a 16- to 22-week time period. The "pre-work" (learn) stage - preparing for VST - lasts approximately six weeks. During the next four weeks, the "Find-it" (do) stage identifies improvement opportunities (using value stream mapping and other tools). The final stage is to "Fix-it" (deliver) by implementing improvements. The system then enters the "Sustain-it" phase of continuous improvement. This VST approach is at the heart of the CPS.

The benefits to Caterpillar come first to their people through improved safety and engagement: clear direction and dialogue, capability building, and greater work area ownership are examples. Improved quality (through standardized work and detection, elimination and avoidance of errors), improved delivery (both capacity and velocity), and cost reductions have all enhanced Caterpillar's business model.