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Continuous Improvement Trio

The top elements of TOC, lean, and six sigma make beautiful music together

You hear it all the time. Consumers want reduced costs and, at the same time, require higher levels of quality and value. This infamous phenomenon results in a race for survival and profitability as companies attempt to meet these customer needs. Time and again, the winning businesses turn out to be those strong, conditioned firms that have lots of experience in operations and exceptionally well-tuned processes. Companies typically achieve these qualities through process improvement methodologies.

In fact, in an effort to please consumers, businesses often will employ numerous different approaches, including—but certainly not limited to—Just in Time, lean, six sigma, and theory of constraints (TOC). Very often, each manager in the firm has a tendency to use the approach that shows the best results for a given type of project or the method with which he or she is most comfortable.

Take, for example, a global electronics contract manufacturer with 21 plants, 45,000 employees, and 211 team leaders. This California-based business was facing growing demand from its major customers in the medical, aerospace and defense, precision machining, telecommunications, and storage computing industries. At the upper management level there was concern that the best approach was not being deployed at each plant location, and leaders were anxious to find a solution and establish the proper processes.

Determining which methodology would bring the most effective long-term result was an ongoing challenge for this organization. "We were struggling as a management team in trying to determine which tool or strategy would help our group get to the next level in terms of process improvements," explains the company's vice president and general manager. "We have always had a culture that drove continuous process improvement, but ... we were frustrated at not being able to show tangible results of our hard work."

In order to respond to the dissatisfaction among its team leaders, the company hired consultants, who came to a unique conclusion: Combine the best components of TOC, lean, and six sigma to form "TLS." Company leaders hoped this new process improvement methodology would help them achieve maximum cost savings and quality benefits.

Initial conditions

The organization in this study had been using continuous process improvement to expose and eliminate root causes of

its problems; however, its approach was fragmented. Lean and six sigma were the two predominant methods that had been deployed and locally adopted. Both practices successfully prompted operations personnel to work on a series of projects that resulted in cost savings and process improvements; however, company decision makers were still hopeful that TLS could provide even higher yields and be systematically deployed across its global organization.

The company consultants designed an experiment that would enable the business to establish TLS as its foremost approach to continuous improvement. Data were collected for more than two years during the trial, and the results were statistically analyzed for significance among the methodologies. The success of each approach was determined by its aggregate contribution to verifiable financial savings as a result of process improvement projects. These savings were validated by the organization's plant controllers and senior management.

TLS was introduced as a complement to the existing lean and six sigma practices and deployed at 21 plants in a pilot program. A plant in this study was defined as a production facility that was fully capable of prototyping, designing, producing, and distributing customer products located in various regions in the United States. (Only U.S. operations were studied in order to reduce the effects of cultural, socio-economical, political, and other influences on the results.)

The means of assigning the 21 plants with their particular methodology was a natural process due to local preferences, experience with a certain approach, and unique expertise. The assignment of methodologies was as follows:

- 11 plants applied six sigma
- 4 plants applied lean
- 6 plants applied TLS.

The 211 team leaders in these 21 plants had been trained in—and were using—one of these three methodologies. Over the more-than-two-year study, the plants completed 101 projects in all. These tasks were studied for accuracy in claimed improvements, savings, and approach.

While the results from all projects were documented, the plant personnel and the trainers were unaware of the ongoing comparative study, as the research was designed in a double-blind format to cut down on any potential biases.

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The firm measured and tracked a series of process indicators as its key measurements, which became drivers for project selections. These measurements included on-time delivery, warranty costs, customer returns, inventory reduction, cycle time reduction, and scrap expense. Company leaders always kept in mind the main goals: to be able to make quantitative decisions and select the process improvement approach that best helped the business achieve the necessary quality and financial savings requirements.

Applying TLS

The TLS model is deployed as a standard approach for continuous process improvements across the organization. The sequence of activities begins with application of the TOC management philosophy. This enables users to investigate the problem "at 30,000 feet" and identify the existing or potential constraints.

1. Identify the constraint.
2. Exploit the constraint.
3. Subordinate other activities to the constraint.
4. Elevate the constraint.
5. Avoid negative inertia.

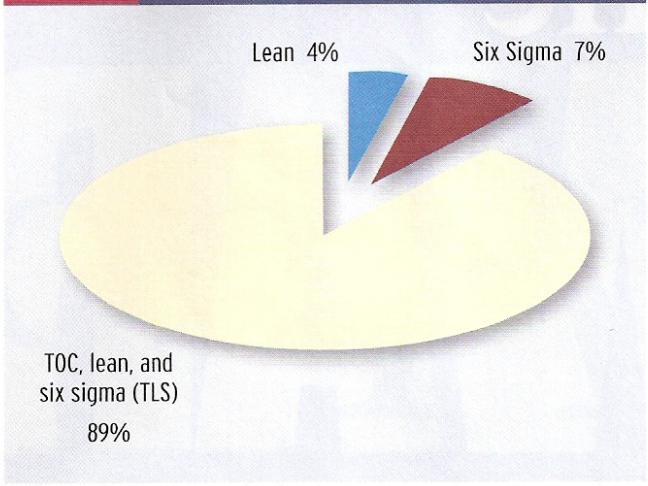
After identifying the problem statement at a system level, the mobilized teams develop a specific problem definition that addresses the organization's bottleneck. At this stage, the first four steps of the six-step lean process should be applied. These phases identify waste and help users target ways to improve.

1. Specify the value.
2. Identify the value stream (the specific process of creating, producing, and delivering a good or service to the market).
3. Make value flow without any interruptions.
4. Let the customer pull value from the producer.

A parallel application of lean's 5S—sort, simplify, scrub, standardize, and sustain—also should be considered at this point. These steps can bring order and discipline to the process, assist in sustaining any gains achieved, and promote continuous improvement as a way of work life. The value added—the effort the customer is willing to pay for these advancements—should be identified through a value stream mapping process. A "wasteless" value stream simplifies activities so that extraneous queues, inventory, and work in process can be minimized or even eliminated.

Next, users should implement pull systems, which make sure that material is not issued until a signal comes from the user. As a result, the company will be able to develop

Figure 1 Percentage of contribution to savings realized



products or services only upon customer requirement. The focus here is to produce the correct amount, at the requested time, to be delivered to the exact location.

The new process flow then should be established. At this stage, the process input variables need to perform consistently and repeatedly with minimal variability to achieve the best results to minimize waste, scrap, and rework. This leads to steps five and six of the lean process methodology.

5. Pursue perfection.
6. Implement with agility.

To pursue perfection, six sigma's "design-measure-analyze-improve-control" improvement model now should be applied. This enables workers to identify and isolate the sources of process deviation and systematically remove or minimize those variations.

During this stage it may be necessary to perform design of experiments—a quality management technique used to evaluate the effect of changes to input process variables on the output variables. This will help determine the optimal settings for the critical factors that have been identified.

Upon establishing the most favorable process variable settings, it is necessary to institute standard operating procedures and control mechanisms. It is recommended that users implement some of the mistake-proofing techniques found in poka-yoke to help sustain process gains and provide an early warning system to prevent process variability. Statistical process control is another valuable task at this time as it enables users to apply statistical techniques to monitor and adjust operations.

Finally, a process audit should be designed to examine performance over time. If any deviations are observed during the audit process, they should be the triggers for corrective and preventive action plans.

The winner is

The TLS process improvement methodology delivered considerably higher cost savings to the company. Specifically, its application resulted in a contribution of 89 percent of the total savings reported. Six sigma by itself came in a distant second with a 7 percent contribution to company savings; followed by 4 percent from stand-alone lean applications. (See Figure 1.)

An operations manager at the firm reports seeing the value in TLS at all levels of the company. In post-trial interviews, he says that the employees have been energized and are feeling a renewed sense of pride for their accomplishments. He is also enjoying the positive results firsthand, noting, "I have been the beneficiary of more than a tenfold return on this investment."

The vice president and general manager is no longer frustrated. Rather, he calls the TLS program a complete success and can see the results of his employees' hard work. "After being introduced to the TLS approach," he says, "we all knew within a very short period of time that this was what had been missing in our efforts."

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