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THOMAS R. CUTLER | 01/30/2013

Keeping Lean Initiatives Lean

First apply the theory of constraints

In an unforgiving and increasingly competitive marketplace, manufacturers struggle to squeeze 5 percent to 7 percent from operational cost reductions. Those who fail often don't survive, and more than 1,000 North American plants closed last year because continued improvement to the bottom line came at the expense of critical quality controls and quality assurance.
Manufacturers that can increase throughput with the same or fewer resources have the best chances of continuing operations in North America; otherwise, their only recourse is to move to lower-cost regions around the world.

Decades after Eliyahu Goldratt first introduced the theory of constraints (ToC) in his book, *The Goal* (North River Press, reprint 2004), the manufacturing world is experiencing another paradigm shift, this time by combining the elements of ToC with lean techniques. ToC acts on the common idiom, "A chain is no stronger than its weakest link." The phrase underscores the concept that processes and the organizations in which they occur are vulnerable because the weakest part or person can always damage, break, or at the very least adversely affect an outcome. To address this vulnerability, it's important to track improvement, and by using a synthesis of ToC and lean manufacturing techniques, manufacturers can track performance improvements at a rate that matches the current pace of business—i.e., over a period of weeks rather than years.

ToC emphasizes the underlying principle and importance of identifying and eliminating bottlenecks (or constraints) in the manufacturing process. This focus increases productivity and serves as a tool for measuring and controlling the flow of materials. The challenge is figuring out how to actually identify these constraints while never compromising quality.

The fundamental approach to lean manufacturing is to strive for true one-piece flow by reducing waste and matching flow to customer demand. Balanced flow buffers excess inventory between each point in the process, making it immediately apparent which process is underperforming. This knowledge allows quality assurance and operations managers to dispatch resources to address the situation, known as "go and see."

"While both ideas are productive, the key to unlocking true value and performance improvement is in merging the two approaches," says Mark Woeppel, a ToC pioneer and founder of Pinnacle Strategies, a project operations management consulting firm. "Maximizing go-and-see efforts by focusing resources on the true constraint generates a result… a seamless flow of production that generates the highest possible return."

By taking a constraint-based approach to maximizing throughput, fewer data are netted, but more critical, decision-enabling information from the plant floor is used. This is accomplished by limiting and prioritizing data collection and identifying the key chronic constraints that must be corrected to meet a specified throughput target. As a result, quality personnel can focus their efforts on corrections that will lead to the greatest improvement in plant performance.

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Finding the true bottleneck

Recently, the idea of synthesizing lean and ToC was used by a tier one automotive supplier to achieve two goals: Provide better clarity and focus by identifying true constraints, and spend less time collecting data and more time solving problems. During this project, weekly *kaizen* events were chosen based on these goals. By measuring the identified constraints before and after focused *kaizen* events, the true value of the method was quickly revealed.

Almost immediately, constraints on one line that had remained unidentified even after a year and a half of lean initiatives were now completely visible. The constraints-based system proved that resources were being misdirected toward downtime issues that had no direct bearing on throughput (see figures 1 and 2). Using ToC to identify the greatest non value-added constraint and then applying lean techniques to resolve it is dramatically more effective.

Before combining ToC and lean, the supplier had been focusing on maintenance downtime, since there had been numerous complaints from the operations team about the skill and work ethics of the maintenance team. Ed Kincer, Pinnacle Strategies' theory of constraints, lean manufacturing, and Six Sigma expert, trained one experienced operator to monitor and record observations while another ran the two machines as stipulated in the company's standardized work documentation. After observing the process, it became clear that the particular set of the two machines, not the maintenance crew, was the constraint. The machines ran in tandem and created waste from extra setup time and by performing the same operation. Total runtime was 83 percent. The bad news: The machines were not running 17 percent of the time. The good news: There was a 17-percent opportunity for improvement.

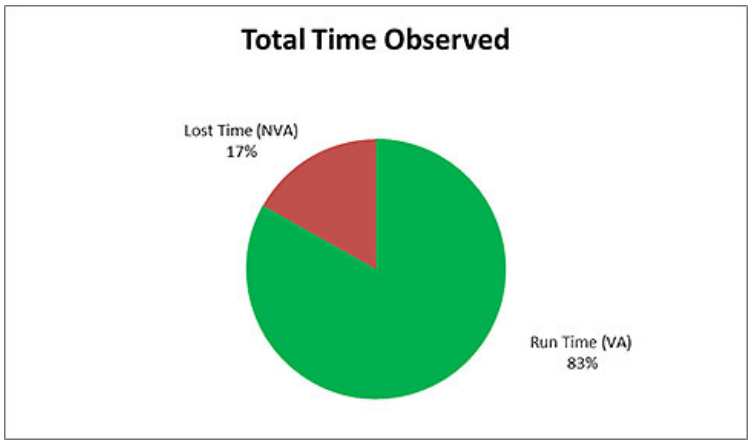

Figure 1: Lost time vs. run time in total time observed. Source: Pinnacle Strategies

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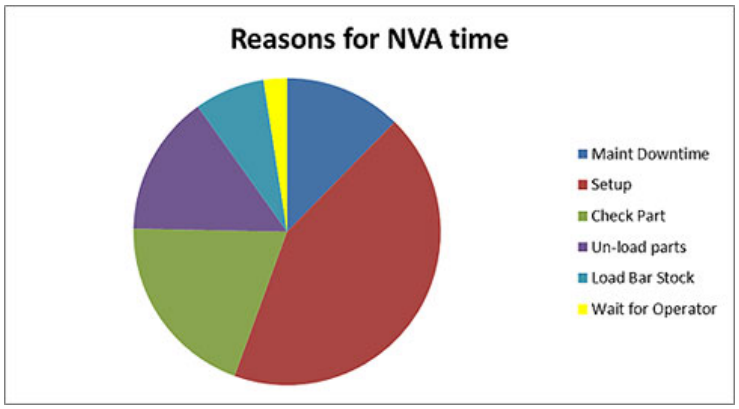

Figure 2: Sources of non value-added (NVA) time identified by process. Source: Pinnacle Strategies

The company focused its efforts on reducing non value-added time at setup, the true constraint, rather than maintenance, which observation showed was pretty far down on the list. This is an important point. Sometimes our preconceptions about a constraint's root cause can be far from the truth, which can cause us to spend time and energy fixing something that may not need to be fixed.

Because the key constraint was setup, the company improved its planning to reduce the number of setups without building wasteful inventory; additionally, it implemented several single minute exchange of dies (SMED) initiatives to reduce setup time at the constraint. In lean initiatives, SMED has become a generic acronym for setup reduction, i.e., the effort to reduce the amount of downtime involved in changing over from one part or process to another.

Overall performance improvement

Through better workplace organization and standardized work, the supplier also reduced the necessary gauging time. Based on this success, improvement efforts were directed to areas where other constraints existed, resulting in overall performance improvement and project acceleration. In just seven weeks, throughput for this tier one supplier increased by 6.6 percent. The manufacturer estimated an annual savings in overtime costs of $840,000.

Reductio ad absurdum is a Latin adage pointing out how a statement can be proven true by demonstrating that a false, untenable, or absurd result will follow from its denial. When ToC was first introduced at the company, some balked, suggesting that if there was nothing constraining a system from achieving higher throughput, that throughput would be infinite—which they were quick to point out is impossible in any real-life system.

The reality is that ToC can accommodate the ever-changing quality and production requirements of manufacturers worldwide. It is a quality process that addresses the fundamental notion that all systems contain bottlenecks. Bringing lean tools to the identified constraint is the long-needed breakthrough.

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Original Article appeared in Quality Digest
http://www.qualitydigest.com/inside/quality-insider-article/bringing-lean-constraint.html