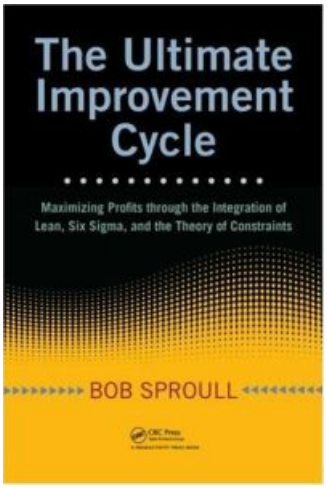

Book The Ultimate Improvement Cycle

Maximizing Profits through the Integration of Lean, Six Sigma, and the Theory of Constraints

Bob Sproull
CRC Press, 2009

Recommendation

Many business professionals have practiced Lean, Six Sigma and the Theory of Constraints. Many others have a working knowledge of the benefits, claims and limitations of these three widely acclaimed methods of improving business processes. Bob Sproull combines the strengths of these three methods into a blended set of process upgrades he calls the "Ultimate Improvement Cycle." If you are familiar with manufacturing operations and these various schools of thought on process improvement, the book's language, charts and graphs will be accessible and useful. It may rely too much on insider jargon and data for those who are new to the field, although many of the concepts apply to nonmanufacturing firms as well. *BooksInShort* recommends this book to professionals with an operational orientation because they will best appreciate Sproull's refreshing approach to combining the three most common process-improvement methods.

Take-Aways

- The "Ultimate Improvement Cycle" combines the best features of three popular methods of improving business processes: Lean, Six Sigma and the Theory of Constraints (TOC).
- By combining the best of these three approaches, the ultimate improvement cycle minimizes their individual weaknesses.
- Six Sigma inspires controls that will minimize – though not eliminate – output variation.
- TOC centers on identifying and handling your constraints or most constrained process.
- Lean is a "whole-systems approach" for "eliminating non-value added activities" from your processes.
- Make all internal operations as efficient as possible to dilute the attention you must pay to constraints.
- Maximize the way work flows through your most constrained process, even though that could make a new constraint appear.
- Your most limiting constraint may be external to your production process.
- Adapt to the limitations your constraint imposes. Just ignoring it could be costly.
- Encourage all employees to share a vision of ongoing operational improvement. You can build on your improvements only if everyone shares the same goals.

Summary

A Blended Approach to Process Improvement

Lean Manufacturing will help you identify waste and eliminate all nonvalue-adding activities from your business processes, but it won't help you provide high-quality products and services. Six Sigma will help you improve quality, but it won't help you remove constraints and lags from your production cycle. The Theory of Constraints (TOC) will help you identify and remove lag from your production cycle, but it may not adequately address quality and waste. You need a method that integrates Lean, Six Sigma and TOC in a blended approach to ongoing process improvement. That is the "Ultimate Improvement Cycle" (UIC).

> "Just as a chain has a weakest link, there will always be a resource of some kind that limits the system from maximizing its output."

The UIC combines the strengths of Lean, Six Sigma and the TOC, and eliminates their individual weaknesses. It is a step-by-step process that can help your company exploit its improvement capabilities and enhance its return on investment. The UIC helps you maximize "throughput," (the way products move through your manufacturing process), minimize inventory and restrain operating costs. It has four steps:

1. Identify what needs to be eliminated or improved to reach your financial potential.
2. Develop your plan and its goals, measure performance and analyze results.
3. Make the improvements needed; modify your process as you learn more.
4. Gain control of the process you are improving. Whether managing a constraint, reducing variation or eliminating lag, learn to control the process so you can alter and upgrade it.

Mitigating Constraints, Waste and Variation

Identify and analyze your **"**value stream" – every task involved in taking unfinished materials and turning them into products. Map your value stream so you can see its constraints (limiting factors), dependencies, lags, variations and defects more clearly. Make production scheduling explicit and determine the best metrics to use to assess production performance. Identify and focus on your primary constraint or most constrained process. Every process that does not limit your organization's throughput is a "nonconstraint." The Theory of Constraints helps you make the distinction. Nonconstraints require less attention because these processes are closer to optimal than constrained processes. Pay attention to external factors that constrict your company, not just internal ones. Consider what new blockages could emerge if you eliminate the current one.

> "By integrating Lean, Six Sigma and the TOC, life becomes much easier on the shop floor."

Lean Manufacturing helps you locate waste within your system, but look before you leap into using Lean. This school of managerial thought urges eliminating waste as soon as you identify it. Examining how the waste accumulated in the first place is a better response. For example, you may be better off using a Six Sigma approach to making your most choked up operation into a source of quality, rather than a contributor to variation and defects.

> "To improve the system's performance, it is imperative that you locate the weakest organizational link and focus your improvements there."

Take time to diagram the actual work flows in and out of the problematic process. Where do they originate? Where do they go? Waste within your constraint can reduce revenue or add to such expenses as transporting, storing and financing inventory. Quickly eliminating some excessive spending may be easy. Throwing out other types of waste without creating more problems requires planning and taking a new approach to your constraint. Variation in output is wasteful and resists easy elimination. Two dimensions of variation apply: uneven physical measurements of a product or process, and uneven results from the measurement system itself. If you repeatedly measure the same thing and get the same value, your instrument is precise and the measurement is repeatable. If several individuals repeatedly use the same instrument, measure the same thing and get the same value, the measurement is reproducible.

Concentrating on Your Chief Constraint

Deal directly with your primary constraint. Once you identify the most limiting obstacle in your creation cycle, find ways to make the constrained operation more efficient. Take these steps:

- **"Waste reduction"** – Remove anything that causes the constraint to remain idle.
- **"Implementing visual controls"** – See the status of a process at a glance.
- **"Changeover time reduction"** – Produce goods in smaller lots with less variability.
- **"Variation reduction"** – Use control charts to monitor process status.
- **"Defect reduction"** – Maximize throughput by eliminating the root cause of errrors.
- **"Standardized work"** – Use statistical methods to uphold standards and cut cycle time.
- **"Overall equipment effectiveness"** – Maintain it, monitor it and quickly arrange repairs.

> "When you break one constraint, your improvement efforts move from one operation to a completely different one."

You will be more successful if you have a well-developed team committed to continual efficiency improvement of your most constrained process. Train employees to understand the constraint and mitigate it. Explain why other processes are subordinate to the constraint and why they must carefully account for throughput in the constrained process. Create a sense of urgency within the team, and help them communicate with each other and with management to make improvements.

> "Improvement efforts that focus on areas other than the constrained operations are, for the most part, generally fruitless."

Low inventory may be insufficient evidence of constraint. You might be using a so-called "pull system" and operating with limited amounts of work-in-process inventory. Look for the way the operation affects throughput to distinguish a constraint from a nonconstraint. Because your slowest process sets the overall pace of production, adapt other processes to make the constraint less restrictive. Measuring the efficiency of your workers or your equipment means little if you pay insufficient attention to your constraint.

> "Always consider the entire process, including the most likely next constraint."

Balance internal and external constraints. A well-designed manufacturing line or service process may optimize the flow of output. But if you produce more goods than your customers want, surplus inventory will accumulate. If you operate at 100% of capacity, you may forfeit revenue if you lack the flexibility to expand in response to new opportunities. Never starve your most constrained process. Since your constraint is the limiting factor to your throughput, you have to keep this process operating at its maximum level to get maximum throughput. You cannot perfectly match capacity to your throughput target. Stay close to your target by organizing your line to achieve the efficiencies of continuous work flow, also known as "one-piece flow."

Push Systems, Pull Systems and Constraint Management

Scheduling work is an initial step in implementing the ultimate improvement cycle. Work scheduling varies depending on whether your company has a push system or a pull system of production. In a push system, current and forecasted market demand determines when work gets done. Many manufacturers use push-oriented

"Material Requirements Planning" (MRP) systems. Bad forecasting is a hazard of the push environment.

> "Improving the output of a nonconstraint operation not only increases [the] carrying cost of inventory, but also lengthens the product cycle time."

To create a pull system that addresses inventory accumulation, take three important steps:

1. Create a map of how your materials and data flow through your production system.
2. Send information upstream that causes material to flow downstream, in so-called "pull loops."
3. Decide how to operate the pull loops. Various types of signaling systems in pull loops, including "Kanban" and "Constant Work in Progress" (CONWIP), trigger the replenishment of raw materials at busy production-line stations.

> "One-piece flow has been proven to be the best and most efficient way possible to process material through a factory."

Using the ultimate improvement cycle, you can increase the throughput capacity of your most constrained operation without having to buy more capacity. For example, you can operate your constraint more frequently to augment its throughput. That is, keep the most problematic process running while the regular operator is at lunch and on breaks, or pay employees overtime to run it before and after the regular shift. The UIC encourages you to create and monitor controls to sustain gains in throughput. Outsourcing part of your most constrained process may boost effective throughput. However, outsourcing has some risks, including impaired product consistency.

> "From a management perspective, it is clear that the ability to recognize and deal effectively with variability is perhaps the most critical skill."

Some constraints are external to your manufacturing operation. For example, if public demand for one of your products falters and you sell less than you produce, your company faces a market constraint. Do everything you can to increase the capacity of your most constrained process before spending money on it. Calming one constraint by purchasing more capacity may intensify another constraint, reducing the value of your investment in new capacity.

Sustaining Gains

Actively control the gains you make using the ultimate improvement cycle. If you fail to do so, you will find that as your attention shifts to new concerns, the areas you just improved will tend to revert to their previous, unproductive ways. You can use flags at workstations to signal their status quickly. For example, green means everything is running fine, red means corrective action is needed and yellow means the operator needs some assistance. Simple and clear, these flags (and others) can help you keep products up to specification. Keep pacing sheets at each workstation to track downtime. Collect information about the amount of downtime and the justification for it, so when the station's status changes from green to red or yellow, you will have documentation about why it happened and what was done to fix the situation.

Constraints Beyond the Production Line

Your company may have constraints unrelated to physical throughput. Some managers use H. William Dettmer's seven classes of system constraints to find and mitigate obstacles beyond the production line. They are: "market, resource/capacity, material, supplier vendor, financial, knowledge/competence and policy." If you identify one of these as your company's main constraint, dig for the root cause. Since constraints can be external as well as internal, consider your entire system.

> "The worst possible thing that can happen is that as cycle times are reduced, or defects and downtime are eliminated, people get moved out of their jobs or, worse yet, laid off."

Think of your root cause as the deepest part of the constrained process that you can control or at least influence. To identify the root cause of your constraint, use a "current reality tree" to explicitly define your system's goals and boundaries, the conditions for successful operations and the measurements that indicate success. Document the root cause and its negative effects, why it exists and what you can do to uproot it. Avoid loops of negative events that end up reinforcing each other. Use your current reality tree as the basis for a "future reality tree" with defined desirable results and processes for achieving them.

Cost Structure and Cycle Time

List all the reasons why your company has small profits now and determine which factors could prevent you from making more money. You may be surprised at the length of the list you create. Just selling more products is not a solution. You not only need to generate more top-line revenue, you need to earn that revenue with goods and services that cost less to produce than to purchase.

> "Very little time in a typical process actually is spent on value-added work."

To change your cost structure, you have to change your cycle time from the receipt of raw materials to the release of finished products. "Little's Law" governs this process. It states that cycle-time equals work in progress divided by throughput. You can reduce cycle time three ways:

1. Add value in less time.
2. Eliminate waste that adds no value.
3. Do both.

> "First law of forecasting: Forecasts are always wrong! Second law of forecasting: Detailed forecasts are worse than aggregate forecasts! Third law of forecasting: The further into the future, the less reliable the forecast will be!"

Jumping in right away with both feet may not work. Get everyone involved first. Be sure that all your employees have a unified approach. Everyone needs to subordinate their other concerns to the mission of optimizing your most constrained process. This means working to achieve continuous improvement by focusing on the right metrics, eliminating waste and variation, and adopting a culture of problem solving. If you can do all that, you will reap the benefits of the ultimate improvement

cycle.

About the Author

Bob Sproull, an experienced manufacturing executive, consults with manufacturers on improving their operations and advises private equity firms about investments in manufacturing turnarounds.