

Six Sigma's Best Kept Secret – Part II

The Five Fundamental Principles of Best Practice Six Sigma®

By Gregg Young

Part I established that the process Motorola used to win the Baldrige Award employed Shainin® Methods to deliver its superior results. **Part II** introduces Five Fundamental Principles that explain why the Shainin® Methods delivered these results, increasing its Net Income by over 4% ROS, doubling profits.

The Five Fundamental Principles

- Pareto's Law is universal.** (The 80/20 Rule) When applied to problem solving, this means **90-100% of all defects in any operation are the result of changes in just 1-3 critical factors out of dozens or even hundreds of possible factors.**

Most Six Sigma processes start with a one-in-dozens or one-in-hundreds chance of choosing correctly from a brainstormed list of possible factors. Teams go through several iterations before they ever find a root cause. Once they have found one critical factor, they usually stop. If there are actually three critical factors at work, and if they fix one, the other two remain active and continue generating defects. Teams typically achieve 20-50% defect reduction after several months of analysis when they use this approach.

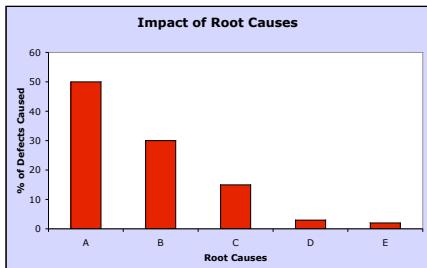
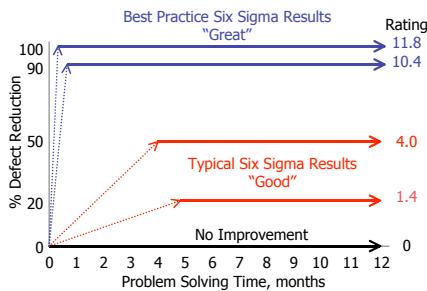
When they use the Shainin® Methods, teams eliminate all the non-critical factors right away. They discover all 1-3 critical factors in just days, so they quickly eliminate 90-100% of defects.

Consider an analogy that uses Plain and Peanut M&Ms. The critical factors are 3 Peanut M&Ms in a large pile of Plain M&Ms, the non-critical factors. Brainstorming is like adding more Plain M&Ms to the pile, and then spooning M&Ms from the pile, hoping to capture the 3 Peanut candies. It usually takes many spoonfuls to find the first Peanut M&M. People rarely continue to search exhaustively until they find all 3 Peanut candies. Similarly, most problem solving teams stop after finding one root cause, and therefore they only develop partial solutions.

The Best Practice approach first observes what is different about Plain and Peanut M&Ms. Peanut M&Ms are almost spherical, while Plain M&Ms are less than 0.25" thick. Then, it uses this difference to isolate the 3 Peanut M&Ms, while ignoring all the Plain M&Ms. An investigator could put all the M&Ms in a dish with a 0.25" slot cut out of one side or put them on a chute that runs under a bar with a 0.25" gap. Every Plain candy slides out, leaving all the Peanut candies behind. When teams use Shainin® Methods to discover all the critical factors, they develop complete solutions. By ignoring the non-critical factors, they develop these solutions faster.

- If an operation usually works well, but occasionally generates defects, then the operation is fundamentally sound.** Every condition is right when the operation works well. The Shainin® Methods start with these correct conditions, and then they discover which factors are critical and are varying excessively whenever defects occur. The solution is simply tighter control of these critical factors.

Traditional Six Sigma processes assume an operation is flawed if it occasionally generates defects. These Six Sigma teams focus on process change and overlook the fact that an operation usually works well. Making



process changes to an operation that usually works well is “throwing the baby out with the bath water.”

3. **Effects have causes.** Whenever an operation that usually works well generates a defect, something about the operation has changed. The Best Practice solution is to identify what has changed and tighten control.

Traditional Six Sigma processes distinguish between White Noise and Black Noise in an operation. Black Noise defects have a specific root cause that can be found and eliminated. Whenever Six Sigma finds one root cause and stops looking for more, it is wrongly attributing all other variation to White Noise.

Shainin’s Best Practice approach views all (or nearly all) White Noise as really being Black Noise coming from other root causes that have yet to be identified – like the other Peanut M&Ms still lurking the pile of Plain candies.

4. **Compare Performance Extremes to Identify Consistent Differences.**

(Note: If you remember nothing else, remember this. Base your future problem solving on this principle, and you will see immediate improvement.)

The Best Practice approach focuses only on performance extremes – the very best and very worst outputs. Whatever 1-3 critical factors are causing the defects to occur, the values of these critical factors will be most different whenever extreme performance occurs. *The best way to discover why things go right is to observe what is different when things go wrong.* Any factor that is consistently different in the best and worst outputs is critical – pursue it. Any factor that is not consistently different is non-critical – ignore it.

This one simple concept is the heart of the Shainin® Methods. Simply integrating this concept into any other problem solving process eliminates most of the performance gap between the Best and the Rest.

5. **90% of all specifications are wrong.** Some supposedly acceptable settings of the critical factors actually generate unacceptable output. The Best Practice approach first identifies all the critical factors, and then quickly determines their Realistic Target Values and Tolerances, making Zero Defects a readily achievable goal.

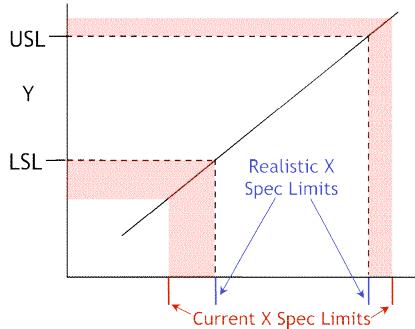
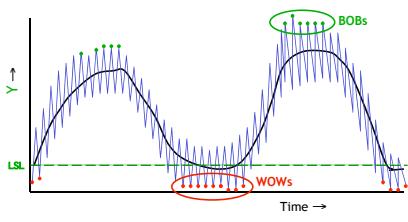
When Zero Defects becomes reality for a supplier, they will have achieved a significant competitive advantage over competitors who still generate defective output. A business can become the Low Cost Producer while producing the Most Consistent Product, which leads to higher profits and increased market share.

The Shainin® Methods based on these five principles quickly identify every factor in the operation as being either critical (related to a root cause) or non-critical. Teams do not waste time on false starts. They ignore the hundreds of non-critical factors and concentrate on the 1-3 critical factors right away. When a team knows all the root causes in just days, it is no wonder they achieve 90-100% defect elimination every time.

The financial impact of these two approaches on profits is not surprising. Traditional Six Sigma’s 20-50% improvement usually increases company Net Income by up to 1-1.5% ROS. The Shainin® Methodology with its 90-100% improvement increases Net Income by over 4% ROS and doubles profits.

Four Case Study Examples

Out-of-Square Grills. A Mexican appliance manufacturer makes grills for barbeques out of heavy wire that comes on large spools. They straighten the



The best way to discover why things go right is to observe what is different when things go wrong.

About the author

Gregg Young, President of Young Associates, Inc., helps companies improve quality, increase profits, and develop successful new products. He has spent over 20 years developing, teaching, and implementing Quality Improvement systems in both large corporations and small businesses and has experienced both their successes and frustrations. His discovery that Shainin® methods were the heart of Motorola's Baldrige Award winning performance sparked his passion to share this knowledge, so every company can achieve Zero Defects and achieve its full potential. Young is author of *Seventh Sigma™ Tools: Best Practices in Six Sigma* and two e-book sequels, *Productivity Tools for Decision Makers: Go from Good to Great* for any manufacturing company and *Best Practice Problem Solving: The Six Universal Tools* for any area of human endeavor.

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wire, cut it to length, and send it to the assembly line. The line workers put pieces of wire in fixtures and weld the grills together. Usually they make flat, square grills, but sometimes they make warped, out-of-square grills. The problem was 7 years old. Company engineers had studied the problem repeatedly, but they could never identify the cause of the problem.

The direct line workers learned a few of the Best Practice tools in a one-day workshop and then used rulers and protractors to compare 6 flat, square grills to 6 warped, out-of-square grills. They solved the problem completely in just one week.

They made 17 measurements on each grill looking for consistent differences between the good and bad grills. Measurements included lengths, angles, and the straightness of various pieces. They discovered that straightness was the only critical factor, which guided them to the root cause and the solution. Once they eliminated the root cause, they never made another warped grill again.

Can you solve the problem? The answer appears at the end of the article.

Noisy Micro-motors. (An original Motorola example) The company made vibrating pagers that used a small motor to create the vibration. Most of the motors worked well, but some of them made an unacceptably loud noise as they vibrated. The company had 50,000 unusable noisy motors.

The project team examined several good, quiet motors to an equal number of noisy motors to discover why the motors were noisy. They planned to measure 8 different properties on each motor.

The first four properties they measured showed no differences. The fifth property was motor speed. All the Good units operated at 4800-5200 rpm, while all the Bad ones operated at 6500-7200 rpm. Speed was clearly critical.

They took two actions to eliminate the problem. First, they wired a one-cent resistor to each defective \$5.00 motor to reduce its speed to 4500-5000 rpm, and the motors became quiet. Then, they created a new speed specification.

(Note: Companies often discover that the specifications of incoming raw materials and components limit their own performance. These companies use the tools to improve their suppliers' processes in order to become more successful. Both parties win, achieving better consistency, lower costs, and higher profits.)

Pigment Dispersion. A chemical manufacturer makes a pigment material that is a dispersion of solid particles. Usually they make an excellent dispersion of fine particles, but occasionally a second material precipitates out with the pigment, and the batch must be reworked. This intermittent problem is three years old.

In many situations, including both of the previous examples, little or no data on the operation exists, so workers have to make non-invasive measurements to look for the critical factors. Today, most chemical reactors have the opposite problem – data overload. Automated controllers record large amounts of data on every batch, and problem solvers have no idea which data are critical. In this case, the automated controller was tracking 105 factors on every batch.

To sort through this mountain of data, the team focused on 8 good batches and 8 bad batches. They assembled a spreadsheet of all 105 factors for these 16 batches and looked for consistent differences. In just one day, they determined that 104 of the factors were non-critical, and just one, the percent solids of the

finished dispersion, was consistently different. Low solids dispersions were always bad, and high solids dispersions were always good.

This guided the team to focus on how batches ended up at different solids levels, when all the reactants are fed to the reactor automatically. It turned out that the reaction must be done at low temperatures, colder than the reactor's cooling jacket can achieve. Operators manually add ice to the reactor to keep it cool. The amount of ice varies, and this determines the percent solids of the product. In just one day, the team knew that the answer was to limit the amount of ice addition in order to achieve good dispersions every time.

Accounts Receivable. A hospital with receivables averaging over 65 days used a similar approach. They examined 300 records that were most overdue, looked for consistencies, and discovered a few small issues and one overwhelming factor – insurance companies were not covering a few test procedures. They then worked with physicians to develop other treatment options that would still serve patients well, and that the insurance companies would cover. A year later, the average receivables were down to 45 days and still declining.

Cycle Time Reduction

Six Sigma processes focus on reducing variation to eliminate defects. Other improvement processes focus on cycle time reduction to improve cash flow and profitability. A truly Best Practice company will do both, so two additional Best Practice cycle time reduction tools based on very different assumptions are included below. These provide two very different views of an operation, which enables managers to make better decisions about how to improve it.

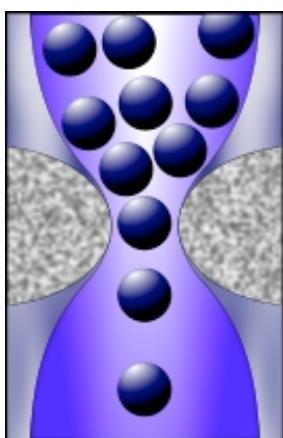
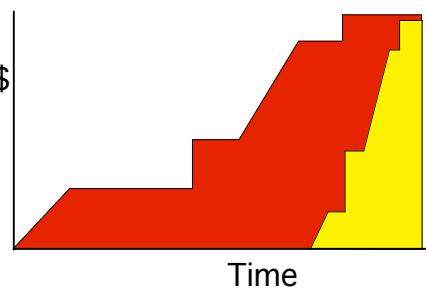
The traditional perspective identifies which steps in a process do and do not add value. Then, it looks for dead time in the process and works to streamline the operation. It treats direct labor as a variable cost and overhead as a percentage of direct labor, which was the case 100 years ago when today's accounting systems were developed.

This approach has yielded impressive improvement over the years, and it continues to be useful. The Westinghouse Cost-Time Management technique with its Cost-Time Profile methodology (left) is the most powerful of these traditional approaches and is included as a Best Practice.

The other Best Practice cycle time reduction tool reflects two dramatic changes of the last half-century. First, direct labor has become a fixed cost and has shrunk from 50% of the total cost of a product 100 years ago to less than 10% of the total cost today. Second, overhead costs have risen from 5% of the total a century ago to 50% today.

Eliyahu Goldratt's Theory of Constraints (TOC) incorporates these changes. TOC optimizes the flow of a process by focusing on its bottlenecks or constraints. It seeks to fully deploy the constraints in order to maximize the capacity and profitability of the entire system. In TOC, the cycle time of the constraint is critical; the cycle times of non-constraints are non-critical. TOC optimizes the flow of the entire operation, which is in direct contrast to conventional management techniques that optimize every individual step in the operation and automatically sub-optimize the whole process.

Cost-Time Management and the Theory of Constraints are Best Practice Tools because they create multiple competitive advantages based on time. Suppliers can offer the Shortest Standard Lead Times at the same time that they achieve 100% On-Time Delivery with unmatched Rapid Response capability.



Integrate These Variation Reduction and Cycle Time Reduction Tools into any Six Sigma Process to Become a Best Practice

These Best Practice Tools make it possible for a company to create multiple competitive advantages simultaneously. One supplier can become dominant by achieving Zero Defects, while also being the Lowest Cost Producer and providing 100% On-Time Delivery with the Shortest Lead Time.

How Close to Best Practices Are You? (A Self-Assessment Tool)

- Do your teams achieve 90-100% defect elimination every time?
- Do your teams deliver complete solutions in just days?
- Can your teams work on your most critical, sensitive production operations?
- Is dead time in your operations no more than half the total elapsed time?
- Does your process generate a minimum of 10:1 ROI?
- Has your process increased your Net Income by 4% ROS or more?
- Has your process created multiple competitive advantages for your company?

If you answered "Yes" to all these questions, Congratulations! You are achieving Best Practice results.

If not, you can add the Best Practice Variation Reduction and Cycle Time Reduction Tools to your current process and start achieving Best Practice results in as little as one week.

The Choice

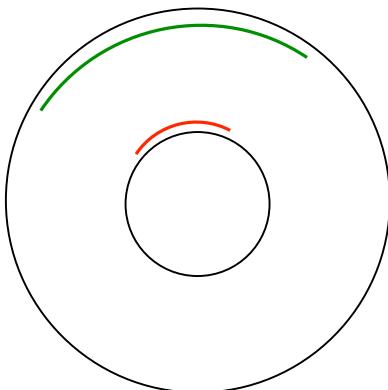


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Motorola's Baldrige Award winning process was based on Shainin® Methods, but these tools were omitted from its DMAIC Six Sigma curriculum. Consequently, Motorola solved problems much faster and more completely and generated 4 times larger returns than any of today's DMAIC processes do.

Readers now have two choices: either to maintain the status quo with an existing Six Sigma process (and hope it improves its performance in spite of its inherently weak brainstorming approach), or to upgrade it to become a Six Sigma Best Practice with increased productivity and profits.

The Solution to Grill Problem



The root cause is the curvature of the wire on the spool. At the beginning of the spool, **the arc is mild**, and the straightener makes it straight one in just one pass. At the tail end of the spool, **the arc is much tighter**, and the wire retains a small amount of residual curvature after one pass through the straightener. The workers put all the same length pieces, straight and slightly curved, into a bundle that goes to the welding line. The line workers randomly select the pieces from the bundles, which is why the engineers were never able to discover any patterns. Everyone assumed the slight curvature was negligible, that the fixtures provided the final straightening as they held the wire in position, but the opposite was happening - the curved pieces were bending the grills.

The solution is to check the straightness of the pieces coming out of the straightener, and run them through again if there is any residual curve.

The plant has never made another out-of-square grill.

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