# Prescription for Improved Profits: Optimize Six Sigma®[i] by Finding Root Causes Faster

*"The significant problems we face cannot be solved at the same level of thinking we were at when we created them."* – Albert Einstein

Typical businesses today make a 4% profit, while losing 10-20% of sales revenue to poor quality. Top management's fundamental challenge is to turn this situation around. Companies have pursued all manner of quality initiatives to become more successful, including Six Sigma. Unfortunately, recent studies have shown that even the most successful of these initiatives have generated only 1-3% improvement in ROS – helpful, but just the tip of the iceberg.

A higher level of thinking is necessary to move performance to the next level. Such an approach does exist. Companies can easily optimize Six Sigma by adding new tools to the Define and Measure steps that focus on customer requirements and "Listen to the Output First". These tools shorten project duration by tenfold, which has a huge impact on profits, ROI, and ROS. In one example, a $100 million manufacturing plant used this approach to achieve 19% improvement in ROS in less than two years, a swing of $20 million. These tools increase Six Sigma's focus on critical customer requirements, and make it easier for employees, suppliers, and even customers to use.

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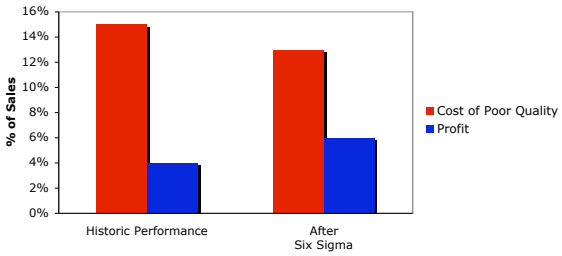
Many companies have embraced Six Sigma as the best way to capture much of the 10-20% of sales revenue lost to poor quality. Most have reported limited positive results. Some have found that their savings failed to cover their investment in Six Sigma training and implementation. Figure 1 shows typical results of a successful Six Sigma implementation as measured by percent of sales.

The primary reason for Six Sigma's limited success is speed. It is a good process for developing solutions once it has found root causes, but the root cause phase typically takes 6-9 months or more. Optimizing Six Sigma means finding root causes faster.

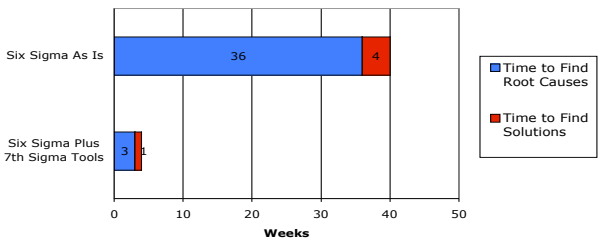
Figure 1 –
Cost of Poor Quality and Profit as Percent of Sales




Source: www.isixsigma.com/library/content/c020729a.asp

Now tools are available that identify the root causes of any repetitive problem in just days to weeks, reducing project duration by an order of magnitude. See Figure 2.

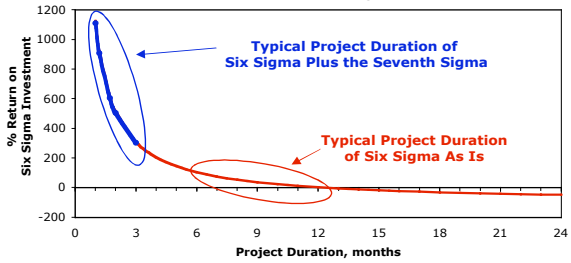
Figure 2 – Typical Six Sigma Project Duration
With and Without 7th Sigma Tools




Source: World Class Quality: Using Design of Experiments to Make It Happen, (2nd Ed.), Keki R. Bhote and Adi K.Bhote. American Management Association, 1999.

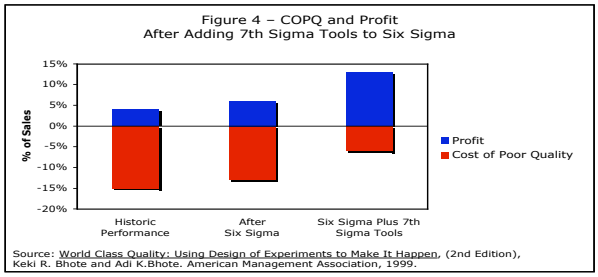
When teams solve problems ten times faster, they can solve ten times as many problems and deliver ten times the return for the same investment in training and time. Figure 3 documents this impact. The curve shows how the percent ROI for the current Six Sigma system changes as a function of project duration. When the typical project takes 6 to 12 months to complete, the ROI is in the range of 0% to 100%. When each team can solve 4 to 12 projects per year, the ROI ranges from 200% to 1100%.

Figure 3 – Effect of Project Duration
on Percent ROI of Six Sigma




Source: Young Associates, Inc.

Finally, Figure 4 shows the impact on ROS when the 7th Sigma Tools are incorporated into Six Sigma. Reducing the Cost of Poor Quality (COPQ) directly translates into increased profitability. For the first time, companies are able to reverse the percentages in Figure 1. Some companies have driven COPQ below 1% of sales revenue.



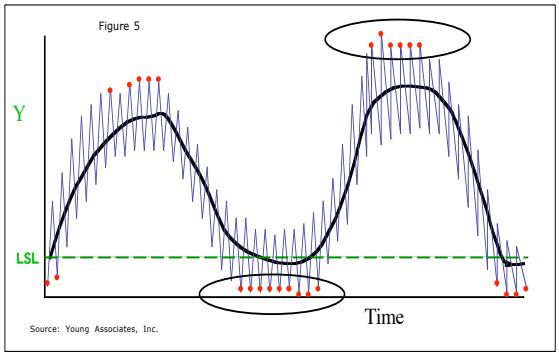

**Compare Performance Extremes**

Six Sigma approaches problems by focusing on process improvement. Consider a hypothetical situation where a repetitive operation usually generates output that the customer considers acceptable, but occasionally does not. Six Sigma assumes that this process is broken and looks for ways to improve it. Process focus is useful later, but not during the early stages of problem solving. The first step should be to "Listen to the Output". Think like an inventor to solve problems more effectively.

Consider Edison and the light bulb. He tried over 1,000 different filaments and conditions before he found a combination that worked. When he found the first combination that did work, did he assume his 1-out-of-1000 process was broken? Of course not – he knew that for one particular set of conditions and materials, the process worked. He had developed one specific process that was fundamentally sound. His next challenges were to make that process more robust by determining which parameters were critical, and how much tolerance was allowable.

This same approach enables people to quickly solve problems in any repetitive operation. This includes manufacturing, administrative and transactional processes – every facet of a company's operations. It makes no difference whether an operation works well 99%, 75%, or even just 5% of the time. The basic principles are the same.

1. An operation is fundamentally sound if it ever creates output that is acceptable to the customer. (Obviously, this means first knowing what customers require.)
2. Something inside the operation has changed when the process creates defects.
3. Excessive variation of just 1-3 critical variables creates ≥ 85% of all defects.
4. Compare output extremes offline to discover the root causes of the defects quickly. See Figure 5.
5. Ask the critical question: "What is consistently different when the operation generates acceptable output, and when it does not?"
6. All the consistent differences between good and bad outputs are important. They provide clues about the 1-3 root causes of defective performance.




These principles are simple and intuitively obvious, but Six Sigma's process focus does not use this logic. Six Sigma begins to examine the process while still considering hundreds, or even thousands, of variables as possible causes. This makes formulating hypotheses much more complex than it needs to be. Applying the 7th Sigma Tools first eliminates the unimportant variables fast, which greatly simplifies the rest of the problem solving process. Complexity is undesirable in design, and the same is true in problem solving.

Companies need to return to the basics to take problem solving to the next level. "Listen to the Output First" to make problem solving faster and easier. Wait until the output has

identified the root causes before focusing on the process.

**Tighter Control of the Critical Variables**

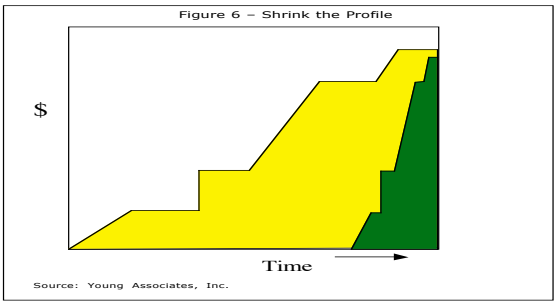
If a repetitive process generates acceptable output 95% of the time, then the critical variables are within their Realistic Tolerances 95% of the time. Defects occur 5% of the time, when the critical variables drift outside of these realistic tolerances.

The surprising fact is that 90% of the time, existing specifications for critical variables are wrong – they are different from the realistic tolerances. The realistic tolerances may be narrower, off-center, or both. This means operators may be controlling a variable within its specified limits, but the setting is actually outside the realistic tolerance, and the process will generate a defect. The team must first learn what the realistic tolerances are. Then, they must adjust the existing specifications so they match the realistic tolerances. Fortunately, it is usually reasonably easy to achieve tighter control of a variable, if its settings are already correct most of the time.

Historically, in about 70% of the cases when the 7th Sigma Tools have been applied to chronic quality problems, it takes just days to weeks to identify the realistic tolerances and establish them as the specification limits. These processes attain defect-free (or nearly defect-free) status by simply controlling the critical variables more tightly. In the other 30% of cases, the 7th Sigma Tools reduce the number of possibly critical variables to a manageable few, so subsequent Six Sigma analysis is faster. The team focuses on process change only after they have listened to the output to identify and tighten control of the critical variables. By using this approach, the primary process change issue is cycle time reduction.

**Reduce Cycle Time**

The easiest way to reduce cycle time is to eliminate dead time. A Cost-Time Profile is an easy-to-understand picture of a process. See Figure 6. Dead time appears as horizontal lines on the graph. The area under the line is cash flow. The Cost-Time Profile clearly shows the opportunities to reduce cycle time and improve cash flow. A reasonable goal for dead time is not to exceed active time. (Dead time < 50% of total time.)




The overall goal is to make an operation first effective, then efficient. Specific goals include "Being defect-free" and "<50% dead time", respectively. This will generate maximum profit and optimum cash flow.

**Case Study: A Plant Turnaround**

The Philips Electronics N. V. plant in Dendermonde, Belgium, employed about 800 people and generated $100 million per year in sales, but was losing money. Management terminated 300 workers to cut costs, but the plant was still losing $15 million per year, largely due to quality problems. The company considered shutting down the operation.

In one last effort to improve performance, the 7th Sigma Tools were introduced to 40 of the technical staff. They began using the tools on three projects immediately. These were successful, so they quickly started 12 more projects, and then 30 more after that.

At this point, plant management decided to begin teaching the tools to line workers, who formed their own problem solving teams with supervisors as facilitators. Momentum built, and they trained 75% of the line workers in about nine months. The line workers solved 70% of all the problems they addressed all by themselves, using just three of the 7th Sigma Tools. In the other 30% of cases, these screening tools eliminated hundreds of unimportant variables quickly. The subsequent process-focused problem solving was much faster because teams formulated accurate hypotheses right away.

With line workers doing most of the problem solving, engineers became free to develop new products that would contribute to top line growth.

Quality improvement ranged from 2:1 to 100:1. (50-99% defect reduction) The median was 15:1, and the average was 28:1. (94% and 97% defect reduction, respectively, well beyond what previous efforts had yielded.)

Bottom line impact: the plant went from 15% loss to 4% profit, a swing of $20 million, in less than two years! (Source: World Class Quality: Using Design of Experiments to Make it Happen. (2nd Edition) by Keki R. Bhote and Adi K. Bhote, American Management Association, 1999.)

**Summary**

A higher level of thinking is required to solve problems faster. This is of fundamental importance to top management for two reasons. First, it is the easiest way for a company to achieve rapid, long-lasting profit improvement. (Many would argue that it is the only way.) Second, maximum impact occurs only when the entire organization solves problems, which requires additional tools not found in traditional Six Sigma.

Problem solving should begin by comparing performance extremes because any process that usually generates output the customer considers acceptable is fundamentally sound. Something is changing inside the process when it produces defects. Excessive variation of just 1-3 critical variables creates at least 85% of all defective output. Teams should begin by comparing performance extremes offline, looking for consistent differences. The larger the differences for any one variable, the more likely that variable is to be important and to be related to a root cause of the defective output. Better control of the 1-3 critical variables will reduce defective output by a minimum of 85%.

Focusing on the output first, before addressing the process, takes problem-solving skills to a higher level. It results in higher profits and improved cash flow. Companies that use this approach achieve results in just days to weeks.

When top management has made this higher level of thinking a priority for the entire organization, the results have been astounding. Improvement of the bottom line begins almost immediately. Customer loyalty increases. Supplier relationships improve as win-win partnerships develop. Moreover, and perhaps most importantly, employee morale soars, as line workers become effective problem solvers. The most exciting and far-reaching transformation is that workplace attitudes begin to shift from TGIF to something entirely new, TGIM, "Thank Goodness It's Monday."

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