

Six Sigma Basics - The Analyze Phase Part 4

IDENTIFYING TRUE ROOTS

In the previous issue in this series, we focused on the “M” in the DMAIC cycle for Six Sigma. We conveyed the processes and tools used to MEASURE the output performance of the process. This month, we will focus on the “A” in the DMAIC cycle, which is the ANALYZE phase. In this phase, we will develop theories of root causes, confirm those theories with data, and finally, determine the true root cause(s) of the problem. The true root cause(s) will form the basis for solutions in the next phase of the DMAIC cycle covered in our following issue, which is the IMPROVE phase. Many tools are used in the ANALYZE phase, so it would not be practical to cover all of them in a blog format. We will instead focus on three of the most important and effective tools used. These tools are Design of Experiments (DOE), Hypothesis Testing, and Regression Analysis.

TOP 3 TOOLS

1. Design of Experiments is an approach that effectively and efficiently explores the cause and effect relationship between numerous process variables (X's) and the output or process performance variable (Y). This tool:

- Identifies those vital few sources (X's) that have the highest contribution to variation in Y.
- Quantifies the effects of the important X's, including their interactions.
- Produces an equation that quantifies the relationship between X's and Y.

[Click here for a template to conduct 2-Factor DOE's](#)

2. Hypothesis Testing is a procedure that summarizes data so one can detect differences amongst groups. It is used to make comparisons between 2 or more groups. Due to variation, no two things will be EXACTLY alike. The question is whether the differences one sees between samples, groups, processes, etc. are due to random, common cause variation, or if there is a substantial difference. To help us make this decision, we utilize various hypothesis tests that provide ways of estimating common cause variation for different situations. Each test will indicate whether a difference is significantly bigger than the common cause variation we would expect for a certain situation. If the answer is “no,” there is no statistical evidence of any difference. If the answer is “yes,” we can conclude the groups are significantly different. There are four types of Hypothesis Tests that can be used to compare data.



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Hypothesis Test	Purpose
T-Test	Compares 2 Groups of Averages
Pair T-Test	Compares 2 Groups of Averages When Data is Matched
Anova (F-Test, Analysis of Variance)	Compares 2 or More Groups of Averages Compares 2 or More Groups of Variances
Chi-Squared Test	Compares 2 or More Groups of Proportions

3. Regression Analysis generates a line that quantifies the relationship between X and Y. This line, or regression equation, is represented by $Y = B_0 + B_1X$, where:
 B_0 = intercept (where the line crosses $X = 0$)
 B_1 = slope (rise over run, or change in Y per unit increase in X)

PREDICTIONS WITHIN RANGE

Once we establish the equation for X's effects on Y, we can make predictions on points that fall within our tested range. Trying to extrapolate outside of our tested range is equivalent to shifting from solid ground to thin ice, so it is not recommended. One should always test the extremes of one's concern area, so one doesn't get caught on thin ice.

By the end of the Analyze Phase, one will be able to show his or her sponsor which causes he or she will focus on during the IMPROVE phase by describing the following:

- Which potential causes he or she identified.
- Which potential causes he or she decided to investigate and why.
- Which data he or she collected to verify those causes.
- How he or she interpreted the data.

The next issue in this series will be focused on the "I" in the DMAIC cycle, which is the IMPROVE phase. In the IMPROVE phase, we implement our solutions and VERIFY that they are effective.

Do you have long standing problems that have not been fully resolved? Do you struggle with engaging all people in effective problem solving? Are you struggling to fully satisfy customers due to quality issues and recurring problems? We offer foundational, intermediate, and advanced level problem solving including practitioner certifications. For a no-obligation introduction meeting, please contact Paul Eakle at paul.eakle@driveinc.com or 865-323-3491.

