Six Sigma Process Capability Analysis for Normal and Non-Normal: Methods, Measurements, Applications and Computer Analysis - Case Studies

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Abstract

This paper explores the process capability analysis using normal and non-normal data using case studies. The methods, measurements, applications and computer analysis of process capability are demonstrated. Most Six Sigma process capability analysis is based on the assumption that the process data are normally distributed. However, many processes, particularly those involving life data and reliability, do not follow normal distribution. Evaluating Process Capability using the assumptions of normality in such cases may lead to erroneous evaluation and wrong conclusions. In cases, where the process measurements do not follow a normal distribution, special techniques are required to deal with non-normality. This paper examines the evaluation techniques for non-normal process data, and provides cases and analysis techniques for such data. The following non-normal process capability techniques are used to evaluate non-normal data: (1) Box-Cox Transformation, (2) Johnson Transformation, and (3) Clements Method using Pearson Curves. Using the real world data, the results of the three methods are compared. Using the distribution fit approach; an appropriate distribution is fitted to describe the data. Then that distribution is used to determine the process capability. The most common methods for handling non-normal data including sub group averaging, segmenting data, transforming data, using other distributions (Wiebull Distributions, Log Normal, Exponential, Extreme value , and Logistic), and non-parametric methods are discussed with real data. Determining the correct process capability in a Six Sigma projects is critical to assessing the current and improved process capability of any process. During a Six Sigma project, the process capability is evaluated twice, first during the Measure phase to show the impact of the problem and again after the Improvement phase to show how the process has improved. This paper addresses the importance and correct evaluation of process capability.

Keywords
Process Capability Analysis, Six Sigma, Data Transformation, Non-normality.