CAPABILITY ANALYSIS

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Capability is defined as the likelihood a product will meet its designed specifications. *Capability Analysis* is a set of statistical calculations performed on a set of data in order to determine the capability of the system. A system is said to be “capable” if it meets 100% of its specifications. However, to be 3-sigma it only needs to meet 99.73% of specifications. Specifications are also referred to as requirements, goals, objectives, or standards.
Formulas used to calculate capability are:

- Cpu = (USL – mean)/ 3 * standard deviation
- Cpl = (mean – LSL)/ 3 * standard deviation
- Cpk = min {Cpu, Cpl}

The Cpk is the most commonly used index for calculating capability, however some have found that the Ppk index is actually better. The Cpk is used to gauge the potential capability of a system, or in other words, a system’s aptitude to perform. The Ppk (and relative pp and Pr) actually measure the performance of the system. To determine which of the indexes to use, determine whether you want to analyze the actual performance (Ppk) or the potential capability of the system (Cpk). Cpk is calculated with sigma equal to 3, which is an estimated sigma. Calculating Ppk uses a calculated sigma from the individual data.

Understanding the need for capability indexes is an important part of the analysis. The indexes help to determine the system’s ability to meet specifications. The problem found in using the Cpk, is that it does not account for the average. This will not only let you see what the systems potential is, not necessarily what the average of the system looks like. For example, a Cpk of 1 indicates that the system is at least 99.73% within its specifications.

Some organizations have a minimum requirement of Cpk = 1. A company would use the capability analysis in their company to assess their current production situation, determine if an investment in improving the analytical process is necessary, or to analyze the results of efforts made towards improvements.

Steps to the process are as follows:

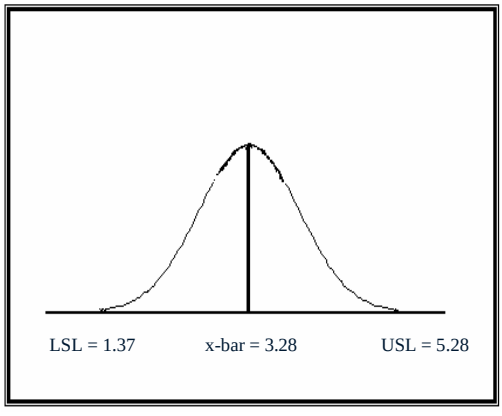
- ***Gather relevant data.*** Take a sample of the data. Determine the acceptable variation, determine the USL, LSL, Cpk, standard deviation, and the mean.
- ***Construct a histogram.*** This is done to see the distribution of the data
- ***Sketch the distribution curve*****.** This will show whether the data is within the specification limits. At this point, find the standard deviation and the upper and lower limit (LSL = x-bar – SD and USL = x-bar – SD)
- ***Calculate the percentage outside the specifications.*** To see how the system looks overall.
- ***Analyze the results.*** Determine if the data stays within the limits and whether the histogram shows even distribution. Analysis the data against the specifications

A Real World Example - Auto Body Specialists

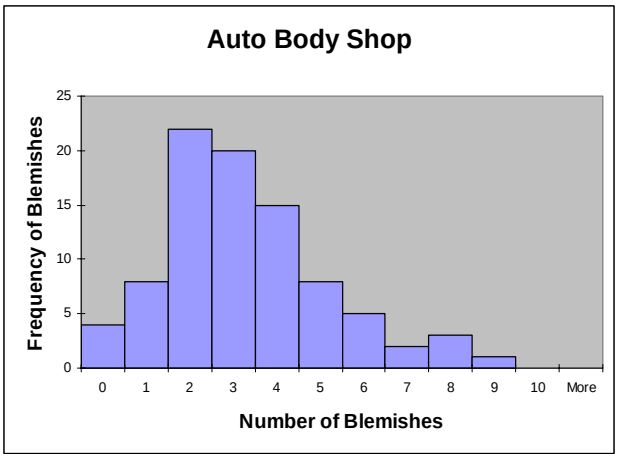
This example will show how to implement the analysis into a real world situation.

- *Range of acceptable blemishes in the paint*
    - Ultimate goal be within the following limits:
        - Upper limit = 5.20
        - Lower limit = 1.37
        - X-bar = 3.28

- *Distribution Curve*



- *Histogram Example:*



- *Analysis of data:* Determine if there is an even distribution, if the data stays within the limits, if the data appears to be capable. There appears to be even distribution, but there are points outside the limits:
    - Cpu = .25
    - Cpl = .26 *Overall, this is not a capable process; the Cpk should be closer to 1.*
    - Cpk = .25

The capability analysis is a powerful tool to assess the systems ability to perform and to study the results of improvement efforts. Before determining whether an improvement is needed in the system, analysts must understand the as-is system thoroughly. Capability analysis will aid them in finding necessary information to decide if improvements are needed. Companies will also use this analysis to see if changes made to the system are beneficial.

Works Cited

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