Three Rules for Data Analysis: Plot the Data, Plot the Data, Plot the Data

The following case study helps to illustrate the methods for analyzing supplier data, and shows how organizations can benefit from closer analysis.

By Uwe H Kaufmann

The job of any purchasing department is to source for reliable suppliers who deliver products conforming to specification on time and within a certain price range. The more data is available about potential suppliers, the better the decision will be. The question is, how should that data be analyzed? The following case study helps to illustrate the methods for analyzing supplier data.

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Case Study: FridgeMaker

FridgeMaker used to get supplies of a very crucial part, the spacer, from Supplier X. Unfortunately, over the last months, Supplier X has been struggling with waves of reorganization, resulting in unreliable deliveries and hence line stoppages for FridgeMaker.

FridgeMaker is looking for new suppliers for all parts coming from Supplier X. Purchasing has already started the supplier qualification process for the spacer (10.5 +/-0.3) and has received parts from Suppliers A, B and C. The data is shown in Table 1.

Table 1: Supplier Qualification Data for Spacer (USL = 10.8, LSL = 10.2)

	A	B	C
Sample	58	45	45
Mean	10.45	10.44	10.51
Standard Deviation	0.14	0.16	0.16
Yield	100%	100%	100%

From this data, purchasing could make the decision on price. All of the suppliers meet the requirements set out in the tender document. However, it may pay to take a closer look at the data before making a final decision.

Data Examination

Examining the samples purchasing received from the suppliers may lead the organization to reconsider its decision. First, it is always beneficial to evaluate the distribution, or the shape, of any given data set. Histogram, dot plot and box plot are simple tools to perform this task.

Checking the histograms in Figures 1, 2 and 3 does not reveal any new findings. A histogram can only give valuable information if it is based on a certain number of data, i.e. 100 pieces of data or more. A dot plot does not help in this case either.

Figure 1: Histogram of Spacer Data for Supplier A

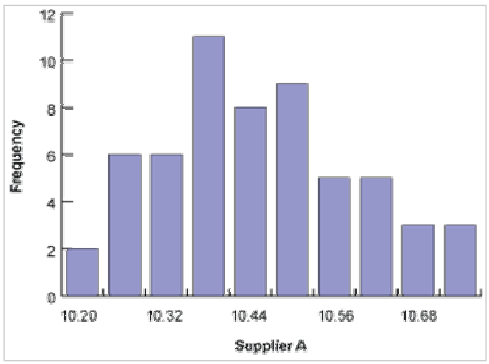


Figure 2: Histogram of Spacer Data for Supplier B

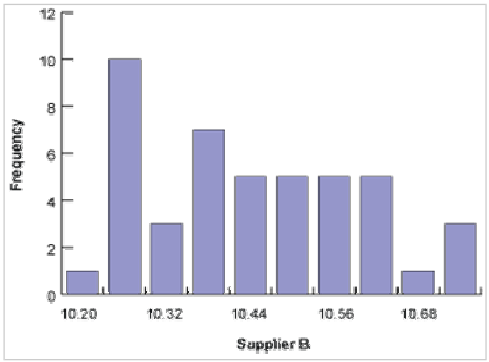
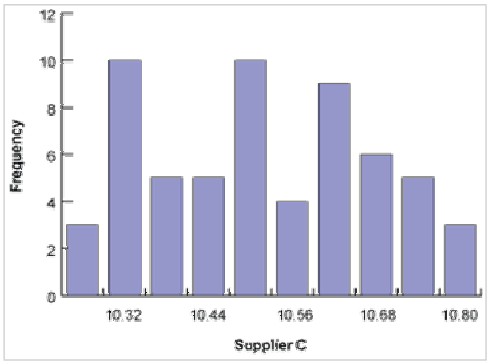
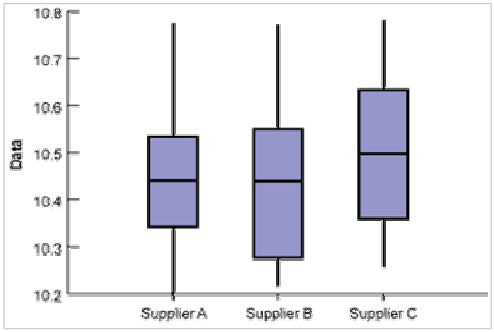


Figure 3: Histogram of Spacer Data for Supplier C



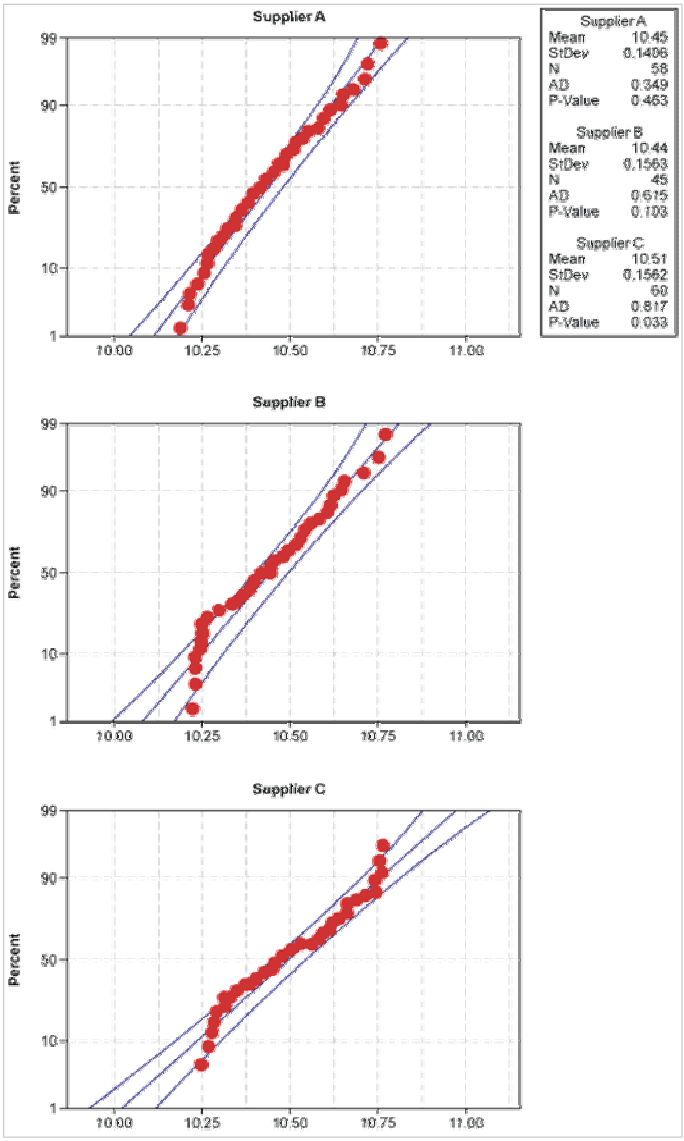
Plotting the data in a box plot, however, does give some more information: Supplier A seems to run the most capable process with the lowest variation (see standard deviation in Table 1). Supplier B runs a process that does not look symmetric, hence data does not seem to be normally distributed. While there are certainly processes that do not produce normal data by nature, the spacer process should definitely do so.

Figure 4: Box Plots of Spacer Data



The display of normal probability plots in Figure 5 reveals additional findings.

Figure 5: Normal Probability Plots of Spacer Data



Supplier A seems to have a “smooth” process delivering stable and capable data.

Supplier B would have a similar process if it did not show an unusual pattern at the lower specification limit. This pattern is usually not a result of an undisturbed process, but is man made. In this case it would be a good bet to assume that Supplier B has filtered out the data below the lower specification limit by means of inspection. Because the data is normal, only the pattern of the plot would disclose this unusual pattern.

Supplier C does not show normal data, although the nature of the process would usually demonstrate this common behavior. The reason may lie in a process factor that drives this non-normality. The pattern of the normality plot suggests something like a change in the process. The best plots to show changes over time are time series plots, run charts or control charts. But these plots can only be created if the supplier sends data in a time order.

Figures 6, 7 and 8 show control charts for all three suppliers. While Suppliers A and B exhibit stable processes, Supplier C's data proves that there has been a change, or a shift, in the process, which may have been caused by altering a setting on the machine or the use of two different machines. Further investigation must be done with the supplier to find the truth.

Figure 6: Control Charts of Spacer Data for Supplier A

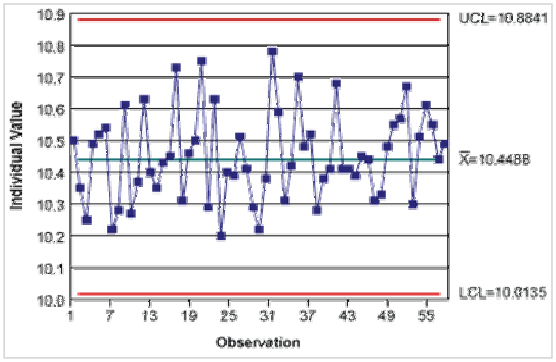


Figure 7: Control Charts of Spacer Data for Supplier B

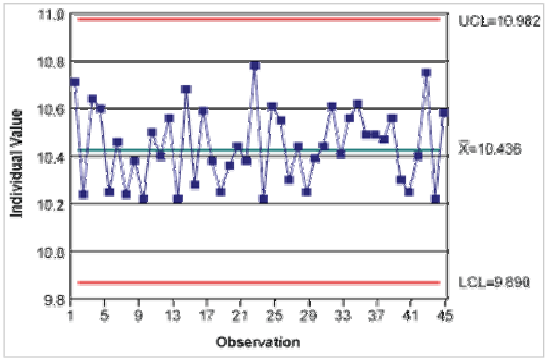
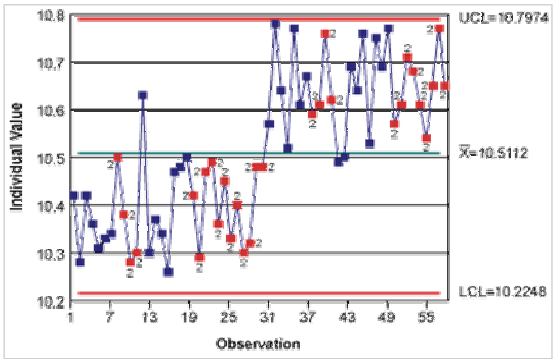


Figure 8: Control Charts of Spacer Data for Supplier C



Most interestingly, supplier C would be able to deliver the best performance with the lowest process variation if the root cause for the shift was eliminated and the process stabilized.

Making Valuable Conclusions

Very often organizations draw conclusions and make decisions based on a limited data perspective. They may just look at means and evaluate yield and defects. However, some simple yet powerful tools can help to make much more out of the data that is available. Consequently, to gain the most value, the first three steps of any data analysis shall be: Plot the data, plot the data, plot the data.

About the Author: ***Dr. Uwe H. Kaufmann*** *is the Singapore-based managing director of Centre for Organizational Effectiveness Pte Ltd., a management consulting company focusing on the Asian market. He has extensive experience in implementing process and organization improvements for various industries. Uwe is a German national and can be reached at uwe.kaufmann@coe-partners.com .*

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2 comments

Monday, 24 January 2011 14:49 | posted by Mayukh Ghosh Comment Link

Fascinating article.It would be interesting to know the data was collected over multiple runs, multiple raw stock batches that would be an additional item I would recommend.Thank you for taking the time to write this article and providing insight into supplier selection

Thursday, 29 April 2010 16:58 | posted by Luis Vazquez Comment Link

As a rule of tomb, if the target is met, Std. Dev is key to judge the risk of the supplier, or x new process. However if the component is not critical for the application, then the supplier that offers the best on-time-delivery would be the main factor for selection, right?. Otherwise it would stop the manufacturing chain.

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