Description or Analysis?

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The supervisor for Department 17 has just been asked to write a report—the in-process inventory for his department was at an all-time high of 2800 pounds last month. He has to "explain" this value at the next management meeting. So he began by "analyzing" the numbers.

First he looked at the current value. The value of 2800 pounds was 42% above the "plan value.". It was also 12% above the value for the same month last year. Thus there is no joy to be found in the current value.

Next he looked at the year-to-date average for the in-process inventory for Department 17. This value was 2160 pounds, which was 9.6% above the plan and was 5.9% above the year-to-date value for the same time last year. Two more bad values.

Next the supervisor looked at how these percent differences compared with the changes for other measures in other departments. He prepared a bar graph for all the measures reported on the monthly report and discovered that the 42% value was the largest percent difference on the report. No luck here either. In fact, with the largest percent difference, he realized that the managers would start the meeting by asking for his report.

No matter how he packaged these numbers, the story looked bad. While he was required to explain these values, he had no idea what to say—so he made up something that sounded plausible and which shifted the blame to forces beyond his control. He then hoped that no one would quiz him too closely on his report.

Sound familiar? It ought to since this little drama is acted out thousands of times each day. Of course there are two problems with this "write a report" approach. The first is that these reports are usually works of fiction whose sole purpose is to allow some manager to pretend that something is being done about a perceived problem. The second is that the whole approach is based upon the assumption that the current value for the in-process inventory is actually a signal. But is it a signal—or is it just noise? How can you know?

Before you can detect a potential signal within the data you must first filter out the probable noise. And to filter out noise you must start with the past data. In short, the supervisor, with his limited comparisons, was not able to fully understand his current values, and he suffered the consequences of this ignorance.

The traditional "analysis" is nothing more than a collection of descriptive statistics. Most of what passes for statistical analysis these days is little more than description. Bar graphs comparing unlike measures, pie-charts showing proportions, and rudimentary comparisons like those in the story above are more a matter of description than anything else.

Descriptive measures are concerned with how much or how many. They provide no insight into *why* there are so many or *why* there is so much. Analysis is concerned with the whys. And that is why analysis requires us to place all data in their context and then to separate the potential signals from the probable noise. Thus, analysis should always begin by looking at a measure in a time series plot, and it should always include some method for filtering out routine variation.

So what would have been the story for Department 17 if the manager had actually analyzed

the values for the in-process inventory? Some of the past monthly values for the in-process inventory are seen on the *X*-chart in Figure 1. The limits on this chart define how large or how small a single monthly value must be before it represents a definite departure from the historic average. Here, a monthly value in excess of 3160 would be a signal that the amount of in-process inventory had shifted upward. Likewise, a monthly value below 850 would be taken as a signal of a downward shift. In either case, one would be justified in looking for a special cause of such a shift.

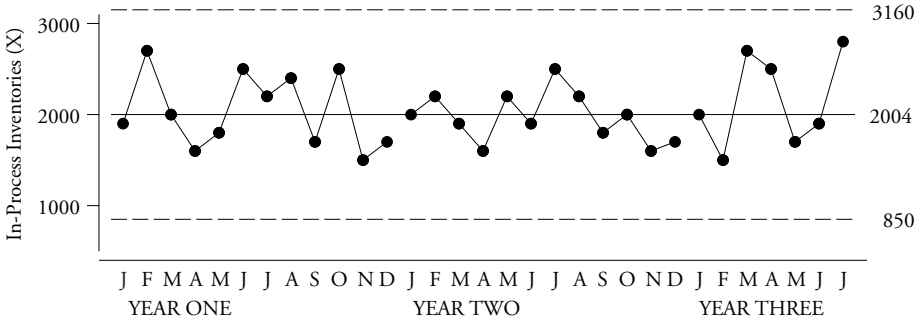

Figure 1: An *X* Chart for the In-Process Inventory for Department 17

Thus, the July value of 2800 is not a signal. There is no evidence of any real change in the in-process inventory. This means that asking for an explanation for the July value was an exercise in futility. There was nothing to explain. Department 17 had 2800 because they were averaging 2004, and the routine variation will cause about half of the values to fall between 2004 and 3160. End of report. There is no other explanation for the value of 2800. Anything else is pure fiction.

Now some may feel disconcerted when they see limits which go from 850 to 3160. Surely we can hold the in-process inventory more steady than that! But that is precisely what cannot be done. At least it cannot be done unless some fundamental changes are made in the underlying process. The Natural Process Limits are the *voice of the process*. They define what the process will deliver *as long as it continues to operate as consistently as possible.* The way to calculate these limits from the data is discussed in manuscript no. 83: "Lies, Damned Lies, and Tens Who Smoke."

When a process displays a reasonable degree of statistical control it is operating as consistently as possible. The process doesn't really care whether or not you like the Natural Process Limits, and it certainly does not know what the specifications may be (specifications should be thought of as the voice of the customer, which is distinctly different from the voice of the process).

Therefore, if you are not pleased with the amount of variation shown by the Natural Process Limits, then you must go to work on the system to change the underlying process, rather than setting arbitrary goals, asking for reports, jawboning the workers, or looking for alternative ways of computing the limits.

Mere description encourages inappropriate actions. It makes routine variation look like signals that need attention. In this case there were no signals in the data, yet none of the traditional ways of looking at the data revealed this absence of signals. Analysis discourages inappropriate actions by filtering out the noise before any potential signals are identified. This is why the difference between description and analysis is profound.