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Wysowl Pty Ltd
Newsletter Number 17
April 2006

But It Meets Specifications!

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ABSTRACT
A problem found nearly everywhere is dependence on specifications, targets and budgets to tell managers whether or not they have problems or issues to address.

If we depend on such measures, we are almost certainly going to get caught unawares, at least occasionally.

There is nothing intrinsically wrong with specifications, or with measuring defectives, but this can lead to a binary or attribute type of mind set (in-out…good-bad…on time-not on time…meets spec-doesn't meet spec) that can conceal as much as it reveals. It is nearly always better to study the original data than merely to convert them to some sort of measure of defectives.

SOME LESSONS FROM GREAT BRITAIN
In a post to the Deming Electronic Network, Alan Meekings gave some telling examples from Britain. He started with rail travel.

Alan explained that prior to privatisation in 1995, British Rail conducted customer research that indicates passengers were reasonably content if their commuter trains arrived within five minutes of published arrival times and their inter-city trains within ten minutes.

Unfortunately, this led to a mental model that led British Rail to define punctuality in terms of trains being either "on time" or "late", an attribute or binary approach, rather than in terms of actual variability around a published time.

A "late train" in this context (a measure called Non-Arrival in Right Time or NART) meant a commuter train arriving five or more minutes late or an inter-city train arriving ten or more minutes late. British Rail thought this to be a customer focussed approach, and published the NART rates. A NART figure of 20% meant that a fifth of the trains arrived more than five (commuter) or ten (inter-city) minutes late.

Doubtless, it seemed like a good idea at the time, but by now you have probably already figured out the problems likely to follow this approach.

Under this system, a train that arrives two hours late is essentially the same as a train that arrives twelve minutes late. They are both "late". Do the customers agree; or would they bring a different perspective? If a train is deemed likely to be "late" halfway through its journey, should the schedulers try to bring this train in as close as possible to its scheduled time; or should they allow it to incur further delays in order to ensure other trains are kept "on time"? In addition, we need to consider the impact on the scheduling of maintenance and the planning of crew positioning.

Even worse, perhaps, is that this binary approach fosters a culture that says five or ten minutes late is satisfactory. According to Dr. Taguchi, it is not. Quality performance will show minimum variation around a target.

Alan goes on to explain that this binary approach and acceptance of five to ten minute delays as normal significantly reduces capacity across bottlenecks in the rail network. Queuing Theory demonstrates that if trains arrive spot-on-time across choke points in the network, such as the two-track viaduct north of Welwyn Garden City on the four-track East Coast mainline, capacity is much higher than if they arrive with random variations of up to five or ten minutes (or, frequently, longer).

It gets worse. Contracts between the train operators and the infrastructure owner, Network Rail, are "incentivised" around "impact minutes" (i.e. minutes of delay for which blame has to be attributed to one side or the other). This compounds the focus on lots of small delays (the common causes), rather than the causes of big delays (the special causes).

How do operators avoid delays in this sort of regime?

This is not a difficult question. They simply add recovery time (that's to say, they add extra time beyond what it should predictably take to get from, say, Peterborough to London), in order to avoid being penalised for late running. Airlines have taken a similar approach.

Most readers have by now figured out that the capacity of the system will decline under this approach.

In order to improve punctuality, the Strategic Rail Authority authorised significant reductions in services. (Cost reduction may also have played a part in these decisions.)

Has this improved the customer experience? Not according to Alan. In fact, he says that given that all the train operators have gone down the route of building in additional recovery time, in the context of a collective culture of sloppy punctuality, customers have suffered massively. His final comment is that the experience of the past decade is a matter of record.

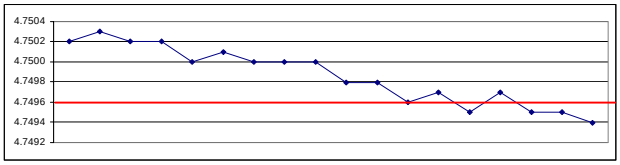
Most readers could tell similar stories about both public and private organisations in Europe, North America and Australasia. Several issues are raised by this example, but central to the problems encountered was the binary or attribute style of mental model adopted. There is nothing fundamentally wrong with such an approach, providing it is not pursued blindly and providing it is tempered with an understanding of the key variables involved together with an understanding of why we ought reduce variation, and how. However, it is common to find managers and technical people ignoring the signals in their data until some kind of specification or target has been breached. In such cases, we must actually fail before action is taken.

AEROSPACE

A company making aeronautical products asked for some help with a critical product that had begun to fail final tests. Engineers were found studying the products that failed test as well as the process conditions at the time they were manufactured. Then the chart at Figure 1 was made. The red line is the lower specification.

The trend down is obvious, but the engineers were not aware it existed until the chart was given to them. Their attitude was that if the product met specification, no action was necessary. This attitude born of binary thinking is as common as it is destructive. They were studying the process when it began to make defective product, rather than when it started to drift downwards. That approach was never going to reveal the cause of the problem.

FIGURE 1
Diameter of Aeronautical Component



ANOTHER EXAMPLE

Both charts at Figure 2 are for the same data. The first chart uses specifications to test whether or not the process is producing defectives. The second is a control chart with limits calculated from the data using Shewhart's methods. In this case the engineers were studying batch 38 in order to find the cause of the problem. This approach was doomed to failure because the change to the process occurred at batch 26. The sample that tested as out of specifications is a random point. There is nothing to learn by studying batch 38 that could not be learned by studying any batch after the change to the process. The worst of this example is that it occurred in a company that claimed it had been "doing Deming" for several years.

FIGURE 2
Specifications Versus Control Limits

Chart With Specifications

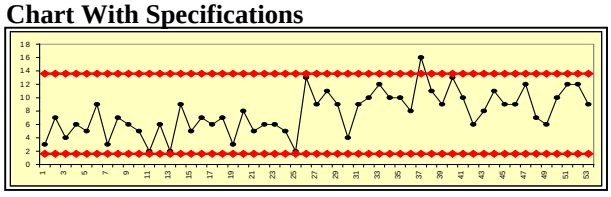
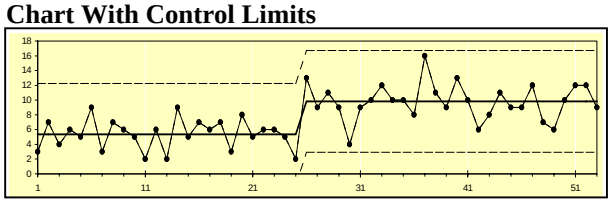


Chart With Control Limits

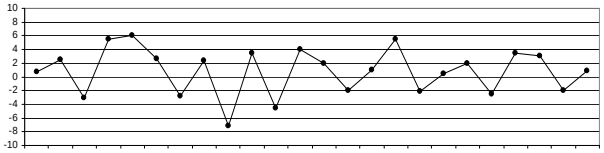


Central to Deming's approach the understanding and reduction of variation. The mind set in many businesses that use widely a binary, or go-no go, approach to handling data is quite different.

FINANCIAL DATA

The handling of financial and similar data by high level executives and boards can suffer similarly. The chart of cash flow at Figure 3 was prepared for the Australian board of a multinational company. Their attitude was to be pleased when cash flow was positive, and to seek explanations and corrective action when it was negative. For several years, the monthly data showed good stability.

FIGURE 3
Monthly Cash Flow in Millions of $



This example highlights another problem with the binary approach to studying data. In this case the data were stable with an average very close to zero. When a negative figure was recorded, explanations and corrective action were called for. Almost always, the figure for the following month would be positive, but this was random point movement. In fact, nothing had changed; the data were stable. However, both the board and the executives believed that matters had improved and that the actions they took when the figure was negative had corrected the situation. This leads to erroneous causal relationships being developed and worse still, a lack of action to improve the actual system.

Once the board realised that the data were stable and that they were chasing random points, a completely different approach to cash flow was adopted. It is this refocussing onto the process and the key variables that so often leads to a breakthrough in performance.

CONCLUSION

There is nothing inherently wrong with specifications or budgets. They are a necessary part of business. However, if we allow ourselves to be trapped in an either-or, go-no go mindset, we lose much of the information contained in the original data. There are better ways of looking at data and superior mindsets that focus us on reducing variation and shifting the centreline of the process to a more desirable location.

Post Script:

After this newsletter was released, one recipient informed me about an experience with a suburban railway network in Australia, which will remain unnamed. His tale follows:

A few years back we were asked to do some analysis about on-time running for a suburban rail network. Trains were deemed to be 'on time' if they arrived at their destination station no more than 5 minutes late (nothing about intermediate stations). A meeting was held every week to apportion blame for the trains that didn't achieve on-time running. The people at an operational level very soon became aware that this was the only measure used for their performance - there was nothing about actually stopping at intermediate stations to set down and pick up passengers! Hence was born the idea of 'skip-stop' trains - they just shot through intermediate stations to make up time and achieve the margin at the destination station!