

Creative Improvement

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Six Sigma is being presented as the current methodology to “focus all work on those aspects which lead to customer satisfaction and then improve the way work is done so that waste is eliminated and defects or mistakes are not produced”

(Motorola – Using the Six Steps to Six Sigma)

A standard Six Sigma methodology follows the steps:

Define, Measure, Analyse, Improve, Control

A key part is the step of Measure. Some improvement strategies, in the past, have struggled because the measures have not been clearly defined. This has been acknowledged and many other improvement models have recognised the importance of measurement. The EFQM Excellence Model has four of its nine sections focussing on measures (results). The use of the ‘Balanced Scorecard’ has become important in identifying and monitoring improvement. Each model identifies its own preferred measures and Six Sigma is no different.

In Six Sigma, the key measure is Defects per Million Opportunities (DPMO). The formula to calculate this is:

$$\text{DPMO} = (\text{Defects per Unit} * 1,000,000) / \text{Opportunities for error in one unit}$$

This DPMO value is then converted to a “sigma” value. The aim is to achieve a value of Six Sigma.

Six Sigma states that DPMO provides an equivalent comparison of products and services of varying complexity. It all sounds very technical but what does this really mean to the customer? I believe that in an attempt to chase the goal of six sigma the very measurement system has forgotten the customer.

For example, an electronic product had a 15% failure rate. From the customers point of view we would expect to see 150,000 product failures in every million products.

However when Six Sigma looks at this, the view becomes very different.

Defects per unit (DPU) = 0.15

But this particular product is made up of 80 components, which could go wrong. In addition each component has two solder joints which could fail. (The solder joints are probably the weakest part of the product). There are also ten process

steps at which a mistake could be made resulting in a subsequent failure. This gives us 250 (80+160+10) opportunities for error. If we calculate DPMO we have:

$$\text{DPMO} = (0.15 * 1,000,000) / 250 = 600$$

So we now quote 600 defects per million opportunities, which from tables equates to 4.74 sigma. It sounds like we are well on our way to six sigma, but the product failure as seen by the customer is 150,000. Which view is more realistic?

This becomes even more exaggerated when the number of opportunities per unit increases. For example a television set may have up to 1,000 components and process steps. For a 15% failure rate this equates to a DPMO of 150 (5.14 sigma). Sounds impressive!

The goal for Six Sigma is 3.4 defects per million opportunities. So let us work backwards to see what this means for the customer for our electronic product.

$$3.4 = (\text{DPU} * 1,000,000) / 250$$

$$\text{DPU} = 0.00085$$

Which equates to 850 product failures per million products (assuming only one failure per product). Whilst this is a big improvement on the original failure rate, one has to recognise that it is not quite as good as the DPMO value suggests. For the television set, this would give us 3,400 set failures per million sets.

It is acknowledged that, however one measures failure, any improvement has to be welcomed but with Six Sigma the danger is that we concentrate so much on DPMO we forget the customer and the impact on them, despite the fine sounding words at the beginning of this article.

Could this explain why a colleague having bought two mobile phones from a manufacturer, claiming that they had achieved 5.7 sigma, found that both failed to work correctly?

This leads me to ask; "could Six Sigma be a method of accounting for 'creative' improvement?"

See www.sigma-engineering.co.uk/elearn/elearn.shtml for information on the sigma metric.