

Understanding Statistics for Business Problem Solving

Demystifying sample size and p-value

Act I Scene I:

Green Belt: “As indicated by the low p-value of 0.002 the factor is significant and hence, we should consider investing in the new dryer technology as it results in *statistically* significant reduction in drying time.”

Champion: “So how much is going to be the pay back period for the Rs 1 crore investments that you are proposing.”

Green Belt: “Well the change is statistically validated. Isn’t that sufficient to justify the investment?”

Champion: “Hmm...”

Act II Scene I:

Green Belt: “But we should not make the proposed changes to our order management system as the statistical significance of changes is not confirmed by the p-value of 0.10.”

Champion: “I thought in the last month we have seen a dramatic drop in our order processing cycle time from 10 to less than 3 days. Even the sales people are happy with the user friendliness and experience of the system!”

Green Belt: “How can that be? The statistical analysis indicates otherwise! The improvement must be just by chance.”

Champion: “Hmm...”

Both the scenarios above are often repeated situations that stakeholders aware of business significant improvement face while managing the focus of their process improvement teams. Whereas the practitioner tries to cling to the rigor of his statistical analysis and conclusions thereof, the business leader does not buy into the insights *revealed* by data. There is a large gap between the Six Sigma expert and the business leader, which could be compared to the ‘*generation gap*’.

Where do we draw the line on our understanding of statistics for business problem solving? The most commonly used statistics like p-value are used as a replacement of business ‘common’ sense, which ironically, is not so common. The superficial knowledge of statistics and not understanding the relationship with business could prove detrimental for an improvement effort.

The above mistakes/ gaps can be corrected by understanding the impact of sample size in determining statistical significance. In the enthusiasm typical of new found knowledge practitioners ignore the minor *inconvenience* of determining the right sample size to arrive at the hereto strongly held conclusions. Did we select the right sample size to run the analysis? Below is how we should have verified the statistical results on the bed of business significance:

Act I Scene I:

Green Belt: “As indicated by the low p-value of 0.002 the factor is significant and the results with the new dryer technology are *statistically* significant in terms of reduction in drying time.”

Champion: “So how much is going to be the pay back period for the Rs 1 crore investments that you are proposing.”

Green Belt: “Well the difference in the sample means is of *only* 2 mins. The productivity increase will generate additional revenue of Rs 1 lac per month. Based on this the payback period is going to be more than 8 years! Looks like I ran the analysis on a very large sample size. I see your point. We should not make the investment!”

Champion: “Good...”

Act II Scene I:

Green Belt: “But we should not make the proposed changes to our order management system as the statistical significance of changes is not confirmed by the p-value of 0.10.”

Champion: “I thought in the last month we have seen a dramatic drop in our order processing cycle time from 7 to less than 3 day. Even the sales people are happy with the user friendliness and experience of the system!”

Green Belt: “Oh! Now I see the fallacy. We processed only 10 orders in the last month. Whereas based on the past variability in processing time we should have at least 30 orders to evaluate the improvements. I believe given the exigency of the situation and the opportunity loss involved we should go ahead with the new system.”

Champion: “Thank You!”

The above conversations are role model interactions between Champions and Project Leaders. Both the parties have been convinced by the results and their practical inference. This can happen if the Project Leaders always relate or translate the statistical results into practical inferences considering the business impact, which can enabled by the mentor/ trainer of the Project Leaders.

One in a series of thought articles from Breakthrough Management Group India

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