BREAKTHROUGH
Lean Implementation & Training Resource Publication
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6σ HANDS-ON SIX SIGMA

By Harold Chapman

CUSTOMER APPLICATION: DMAIC

The following is an actual example of how LMSPI applied "Hands-On" Six Sigma to help a customer solve a problem that had crippled them since a product's inception. The client is a US manufacturer of custom thermoplastic profile extrusion that engaged LMSPI to apply our brand of Six Sigma.

THE RETURN ON INVESTMENT

Investment: $20K
Product A Savings: $198,773 annualized
Product B Savings: $296, 843 annualized
Project ROI (annualized first year): 2478%

THE PROCESS: DEFINE

We gathered what data we had and created a DECISION TREE to show where the largest problem was for this manufacturing site. The data lead us to "Surface Finish on Product A being manufactured on Line 25." Now that we had a problem and line on which to focus, we began a High Level Process Map of the line. We also created a Physical Flow Layout of the line to show all series and parallel paths.

THE PROCESS: MEASURE

We had to ensure we could measure the defect (Poor Surface Finish) being addressed. We gathered samples of the product and immediately saw that there was no common understanding of "Good vs. Bad" within the team. The team consisted of Quality, Maintenance and Operations Leaders. We used the Attribute to Variable Transform to convert the Subjective Measurement to a more Objective Measurement. We gathered 8 samples that ranged from Perfect to Terrible. We had to pull the Perfect sample from the Quality Lab, since we couldn't run one on the line. We ranked the samples from 1 (Perfect) to 8 (Terrible) with 4 being the "Can't send to the Customer" sample. We conducted a Gage R&R on samples using our new method. We passed the Gage R&R, so now we could compare the process to our measurement system. The process was running at a 3 on average. This was totally unacceptable, since this clearly showed an unstable process.

THE PROCESS: ANALYZE

Using the same measurement criteria we created a Contrast Matrix to look for contrast in the following areas:

- Location to Location within the same product.
- Product to Product within the same line.
- Line to Line within the same time.
- Time to Time with the same product and within the same line

The data showed us that we had defects on the centers of the product at all times on the same line. We didn't understand the "center of the product" contrast, so we couldn't leverage it. Using the Contrast Matrix we decided to gather data for the Line to Line contrast. Our selection of the other line (Line 15) was based on the same material type being run there with no surface issues. We planned an experiment to run the same material, extrusion die and forming tank on Line 15.

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CUSTOMER APPLICATION: LEVERAGE

THE PROCESS: ANALYZE, Cont'd

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THE PROCESS: IMPROVE

Armed with the planned experiment, the team moved the product to the new line. It quickly achieved a surface finish of 1 to 2 on the product versus the previous 3. It also only took 40mins to setup (down from 2 hours) and ran a total of 24hrs without burning the die (which previously burned every 2hrs). The biggest issue that day was running out of customer orders for the product, so we had to stop in order to avoid the deadly waste of overproduction.

THE PROCESS: CONTROL

Now that the problem had been solved, we were faced with VALIDATING the change and UNDERSTANDING the differences between the lines. All we knew at that point was the root cause lived in the extruder, since that was the only portion of the process that was swapped. The improvement was validated by placing the material, die and forming tank back on the old line. This resulted in the surface finish returning to a level 3 per our new measurement method. Normally, we would expect the team to repeat this process a total of 6 times (randomly) to have a 95% confidence of the change, but due to cost and insufficient customer orders, we decided not to repeat the experiment.

CUSTOMER APPLICATION: LEVERAGE

During our discussion around the leverage phase, we concluded that we could leverage the application of Measurement System Analysis across all products in the plant. The team also implemented the Attribute to Variable transform on another product that had a Subjective Measurement.

There were two other projects (Product B and C) running during the same timeframe related to setup and measurement. This seemed to be a trend at this site, so we concluded that there was a systemic issue with the release of new products to the production area. The uncontrolled variables per product upon release made it impossible to repeat part quality at each setup. This would lead to long setup times and large quantities of scrap. This systemic issue has cost the company millions in lost business, wasted labor and scrap. The next step is to overhaul the design value stream for this site (which flows from concept to launch).

The team also leveraged what they had learned and improved the output on another product by 50% while attaining a quality that could not be matched by their competitors. This allowed them to increase the sales from this particular customer making them the sole supplier for this product. By improving the quality to such a high level this company created a barrier to market for their competitors.

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