

FOURTH INTERNATIONAL CONFERENCE ON LEAN SIX SIGMA

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CONTEXT: This project is developed in a Peruvian manufacture company of electrodes for welding. Currently, there are four packaging lines with 100% of utilization on pick seasonal demands. There is a gab of 22.6% in the productivity with respect to the ideal value.

SCOPE: In the packaging line n°1 focus on 3/4 types of electrode diameters. It represents 80% of total production.

OBJETIVE: Identify improvements to reduce the gab in the productivity to 14% (i.e. from 9 to 10 bags/min).

IMPACT: This improvement would give to the company an estimate of \$0.25M per year.

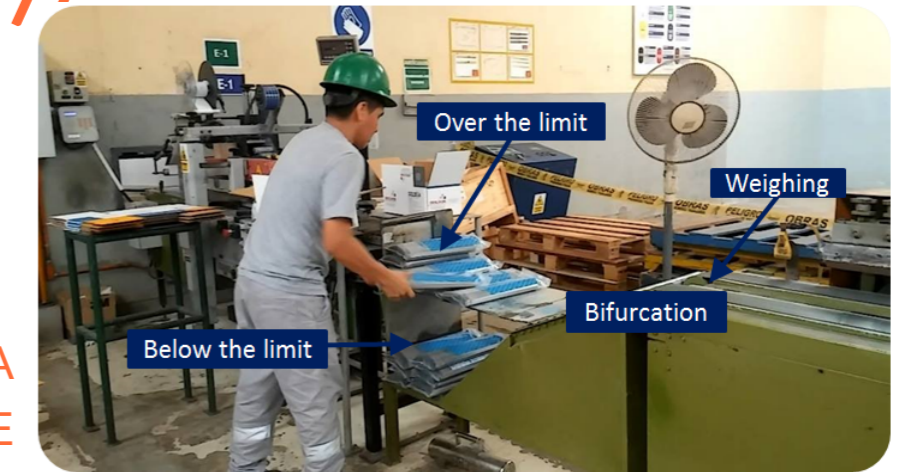


Figure 7. Bifurcation System

DEFINE



MEASURE

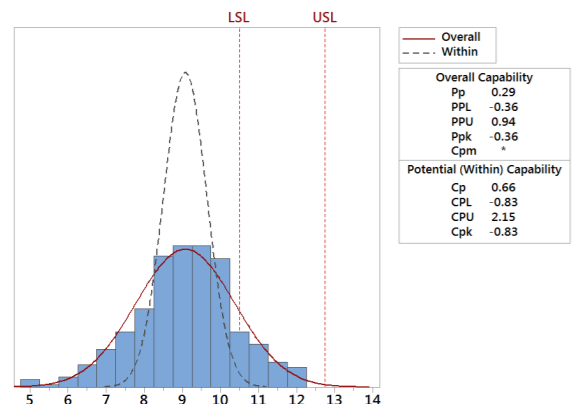


Figure 1. Current Process Capability

Cpk: -0.83
Process not centered
Cp: 0.66
Process not capable

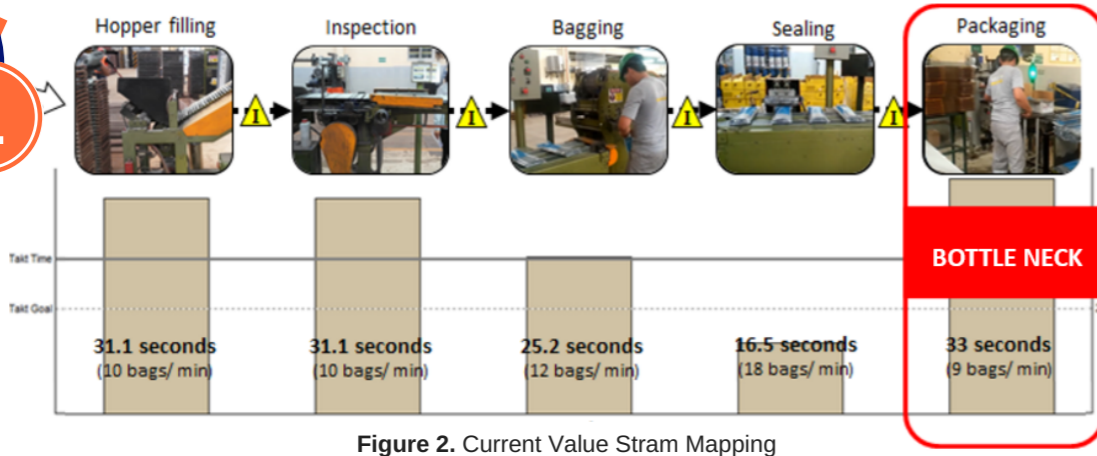


Figure 2. Current Value Stram Mapping

From the VSM it was determined that the productivity of the process is given by packaging operation, 9 bags/min

Process	Potential Failure Mode	Potential Failure Effect	SEV	Potential Cause	OCC	Detection Method	DET	RPN
Bagging	Jam of the counting machine (in the entrance)	Line stop	9	High electrode diameter	7	No control	10	630
		Waste	6	Inadequate design of the meter strip for different diameters	7	No control	10	420
	Jam of the counting machine (at the exit)	Line stop	8	Belt conveyor speed unknown	8	No control	10	640
		Delay on the line	6	Inaccurate counter sensor	8	No control	10	480
	Variability in the numbers of electrodes	Waste	6	Belt conveyor speed unknown	6	No control	10	360
	Electrode breakage	Delay on the line	6	Design of ejection device	6	No control	10	360

Figure 3. Failure Modes Effects Analysis

74% of the failure modes exceed the accepted level of risk (100). The process is unstable.

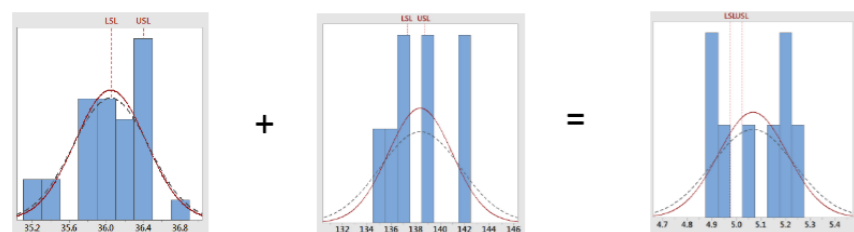


Figure 4. Cause and effect diagram

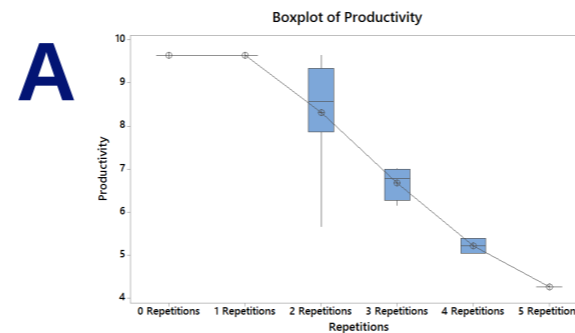


Figure 5. ANOVA test for repetitions

The variability of the bag wieght affects productivity.

$$R^2 = 89\%$$

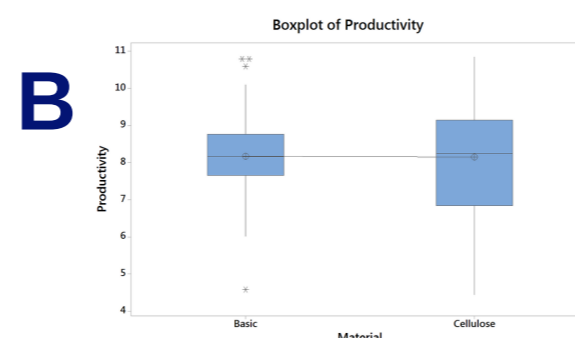


Figure 6. ANOVA test for materials

The type of material affects productivity.

$$R^2 = 0\%$$



CONTROL

The control chart allows to monitor the external causes of variation and statistical statistics.

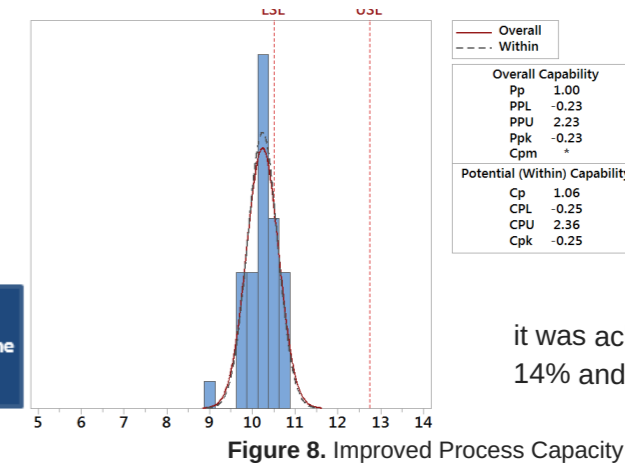


Figure 8. Improved Process Capacity

Cpk: -0.25
Process not centered

Cp: 1.06
Process capable

it was achieved to reduce the gab to 14% and obtain a productivity of 10 bags/min

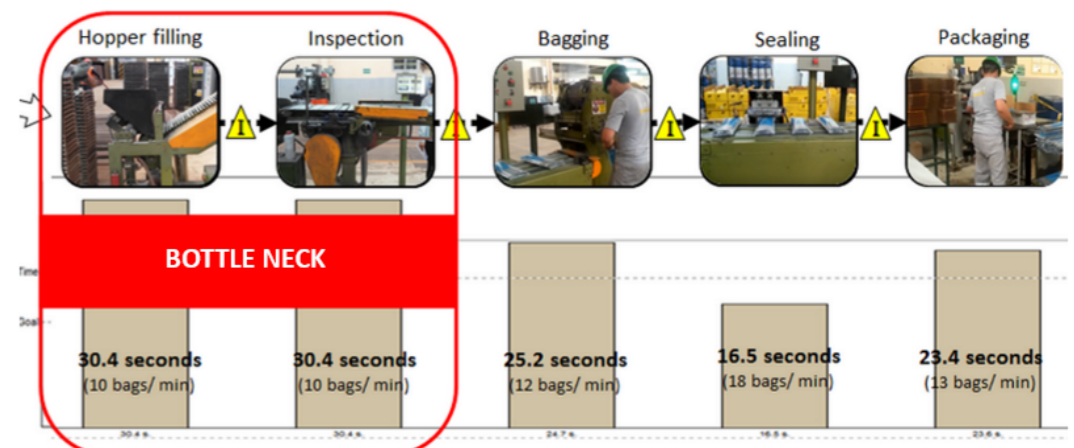


Figure 9. Improved Value Stram Mapping

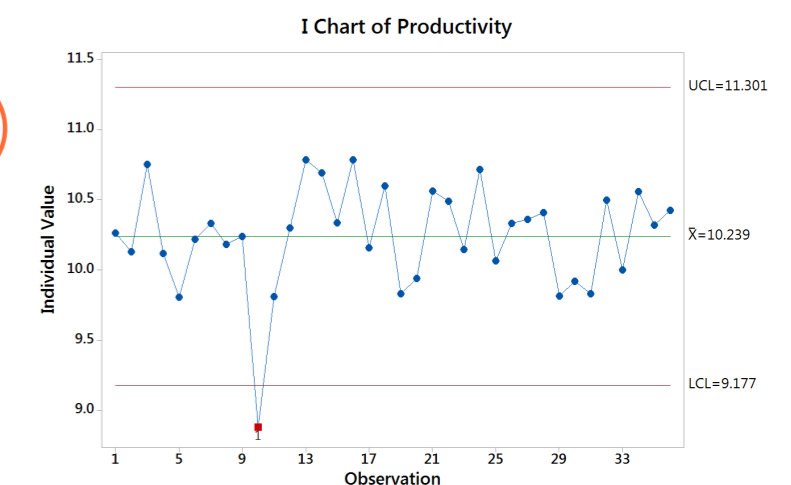


Figure 10. Improved Process Control Graph

σ electrode weight

σ counter machine

σ bags

