

Optimization of the Final Inspection process

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SOLUTIONS FOR YOUR IDEAS



Solutions for Our Future



Zollner vertical Integration



Top 14 Best EMS WW & #1 EMS in Europe and Germany



9/1/2020

A company profile • Confidential

Zollner³

Zollner Costa Rica-High Class EMS company

CERTIFICATIONS

- ISO 9001:2015
- ISO 14001: 2015
- IATF 16949:2016
- ISO 9100 Rev D
- IEC 61340-5-1:2016
- ANSI/ESD S20.20-2014
- IPC Member facility

MARKET

- Automotive Technology
- Industrial Electronics
- Medical Technology
- Aerospace



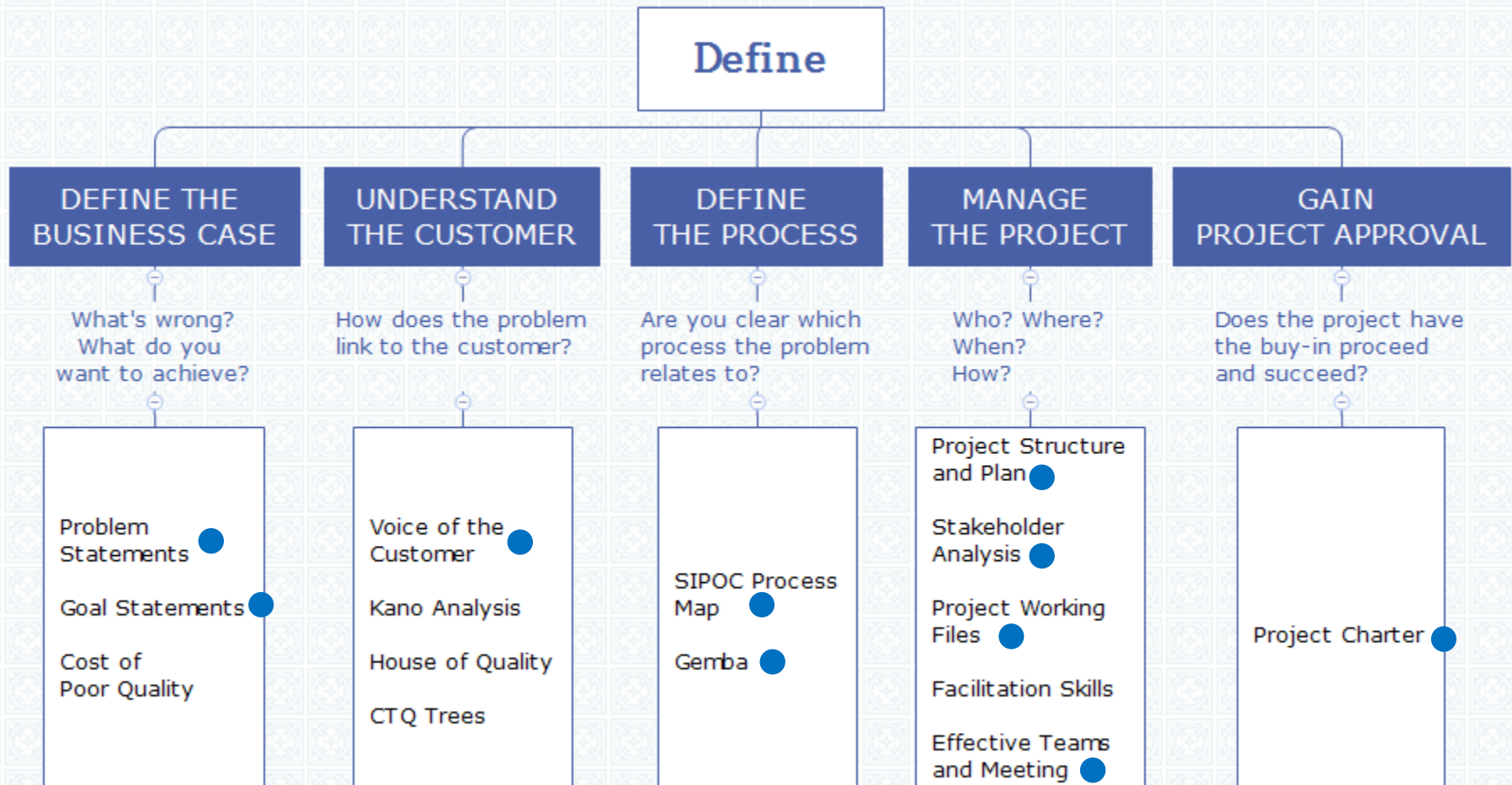
Zollner Costa Rica-High Class EMS company



- Start operations in 2015
- First EMS in CR
- State of the art [ESD floor](#)
- Full [traceability](#) in place
- Temperature and humidity online monitoring system ([BMS](#))
- 302 employees (276 Automotive)
- 24 hours, 6 days per week, 50 weeks per year
- Free Zone regime
- [Lean/Six Sigma](#) environment
- Second Building-Expansion 2021



Define Phase



Define Goal Statement

- Optimize the capability of the quality inspector team in 30% in March 2019.

Key Process Output Variable

*Quantity of inspected box

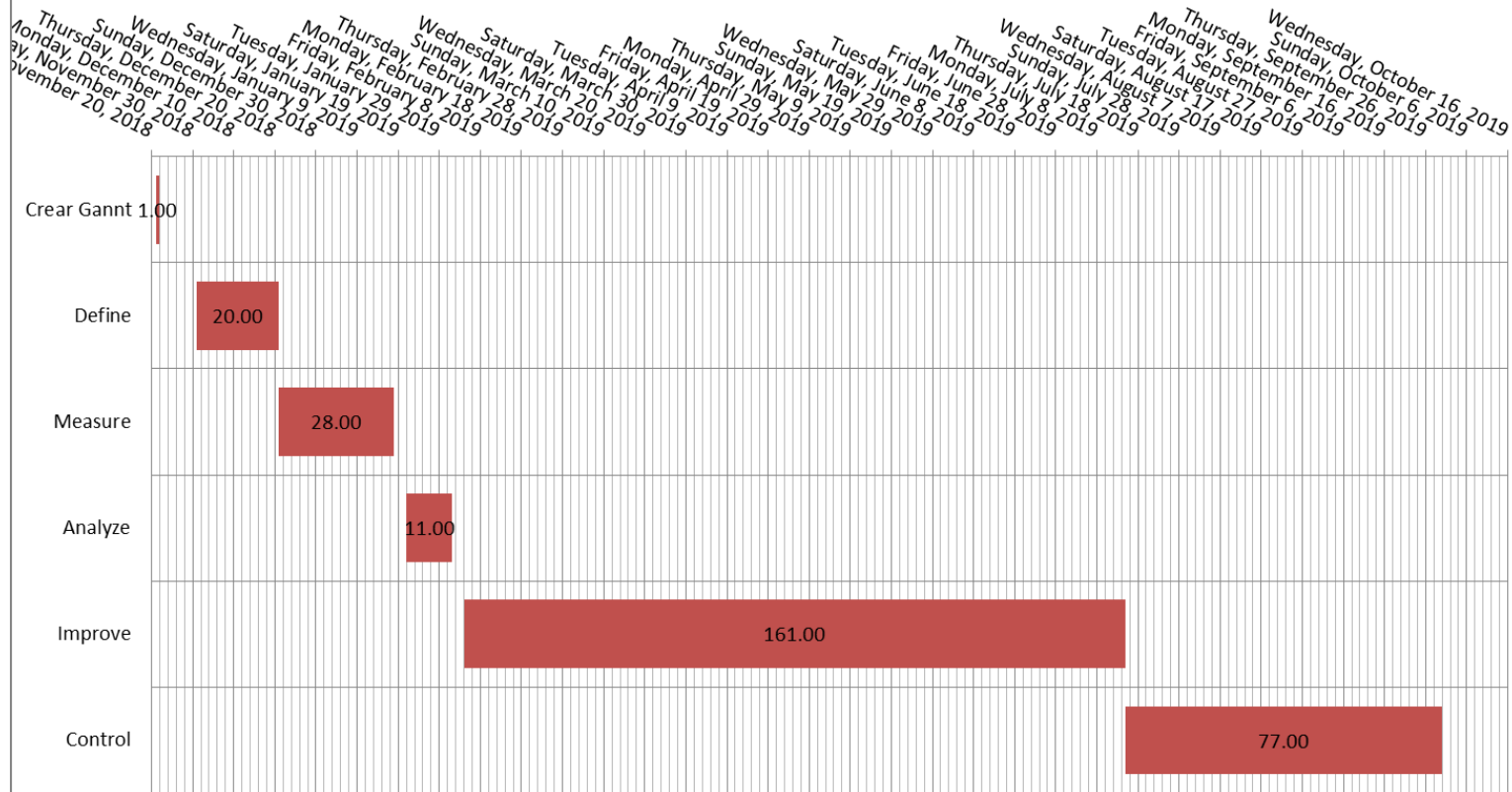
*Inspection Time per piece

Tier 1	Tier 2	Tier 3
Capability	FPY	Reduce the defects that are detected in Final Inspection
		Increase the good confirmation culture
	Efficiency	Fulfillment the target per shift
		Standarize the inspection Method
		Reduce the inspection time in other areas i.e Outgoing
	Availability	Reduce the Downtimes i.e Excessive time for breaks or personal activities
		Create programed downtimes i.e Inventory

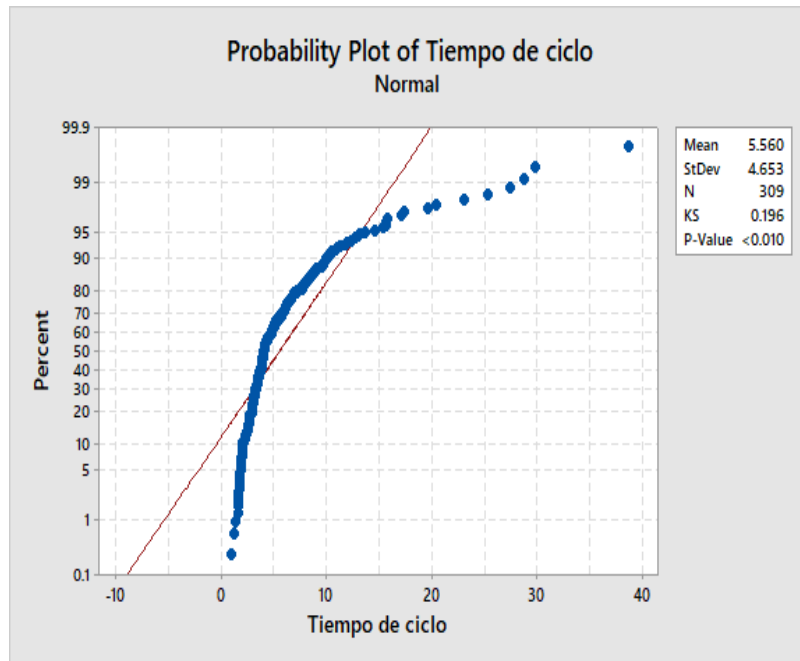


Define Project Gantt

Gantt Chart Final Inspection Optimization Project



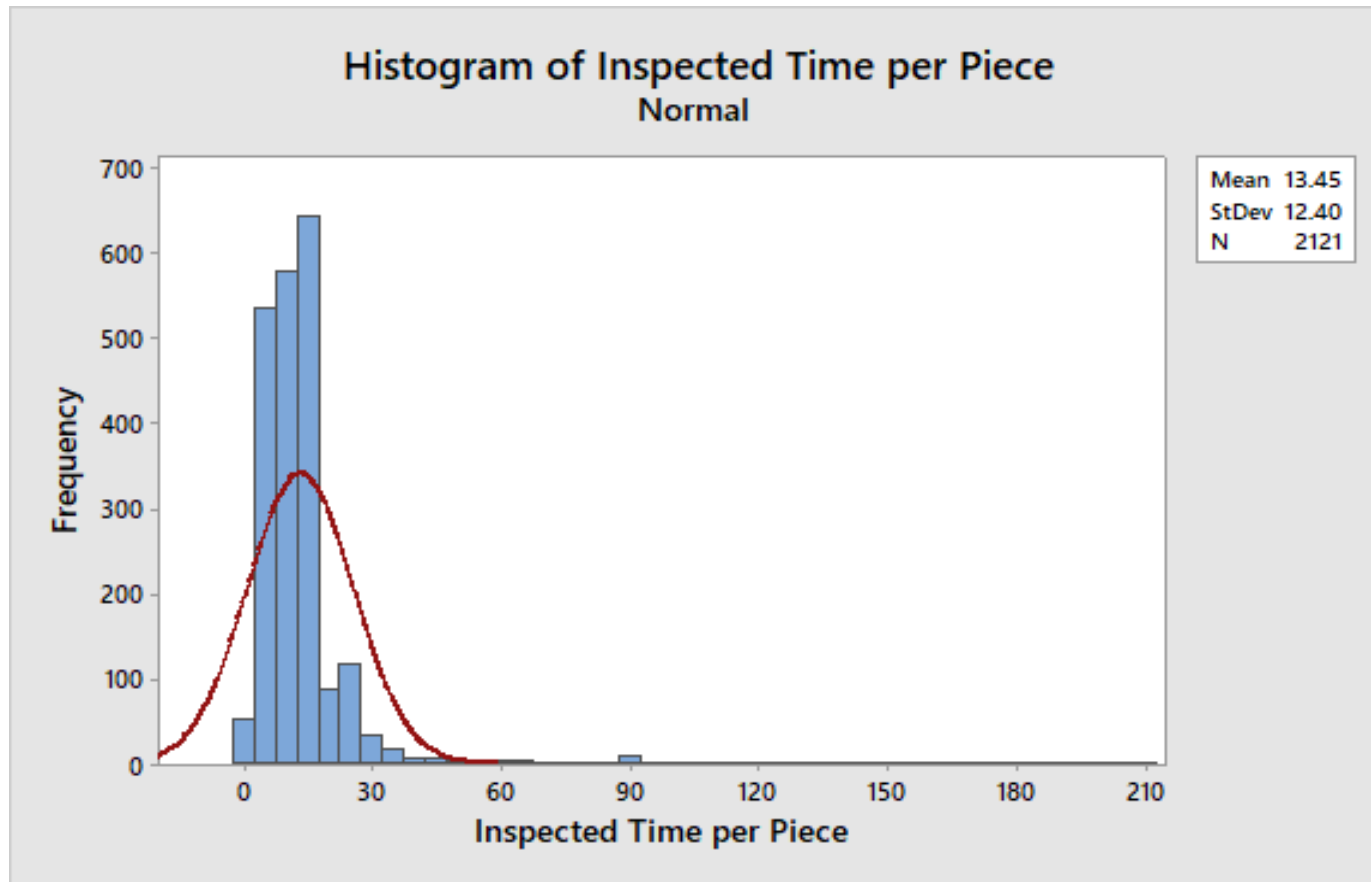
Define Current state



During the taking of time it is determined that the data are not normal, the inspected time per box is not normal between inspectors ($P < 0,05$)



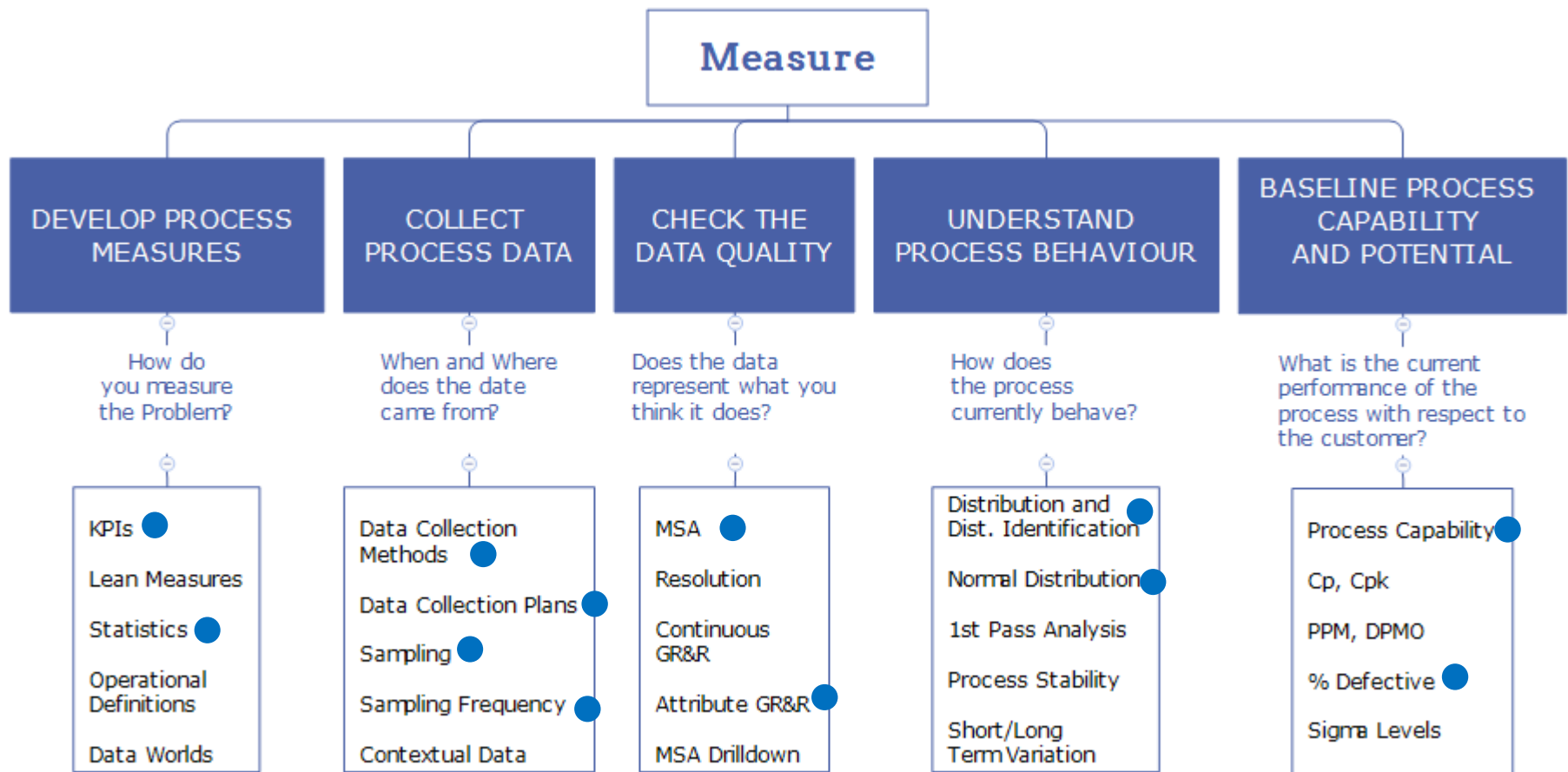
KPOV : Inspection time per Piece (Using SAP ZPP030)



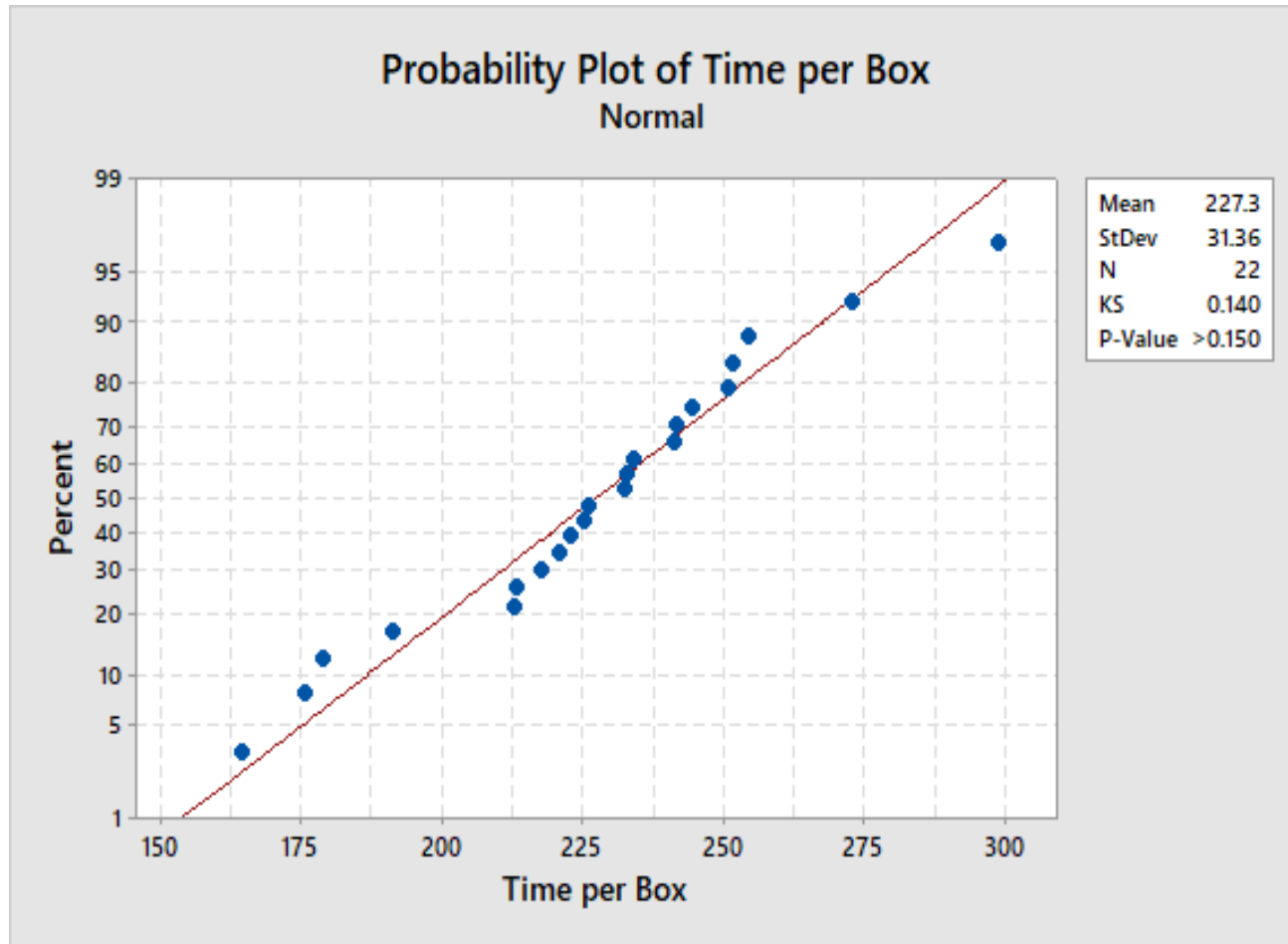
Calculated inspection time per piece is 13.45 +/- 12.40



Measure Phase



Measure Normality Test



The cycle time follows a normal distribution



To determine the correct sample size, a preliminary sample of 22 data was taken, with the deviation of this data and being able to detect errors of 10 seconds, it is concluded that 41 samples are taken to be conclusive.

Sample Size for Estimation

Method

Parameter	Mean
Distribution	Normal
Standard deviation	31.3602 (estimate)
Confidence level	95%
Confidence interval	Two-sided

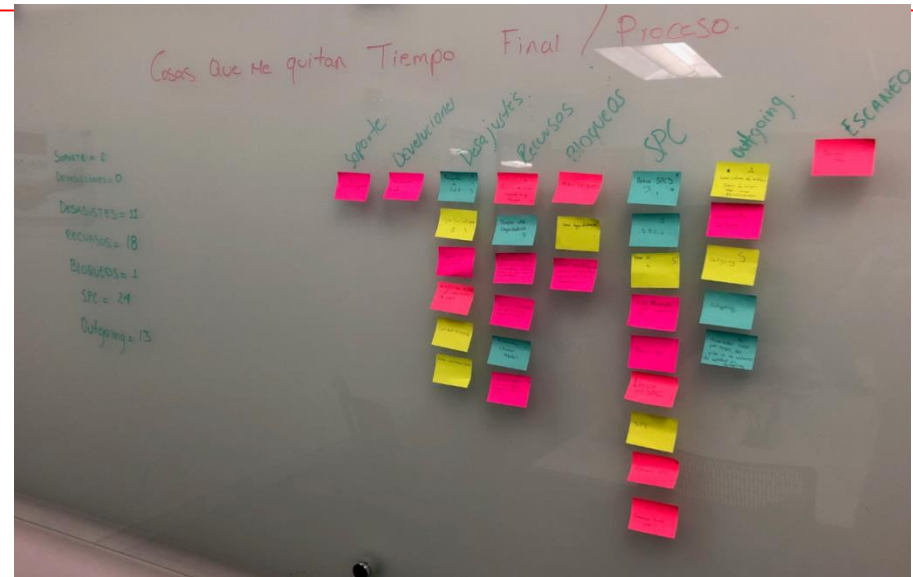
Sample Size Estimation

Results

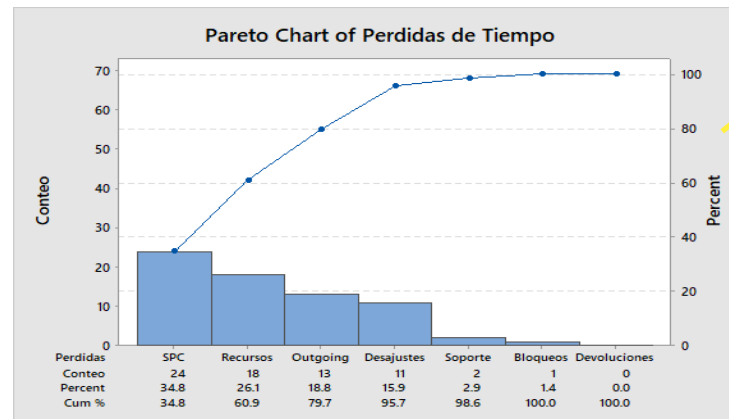
Margin of Error	Sample Size
10	41



Measure Affinity Diagram



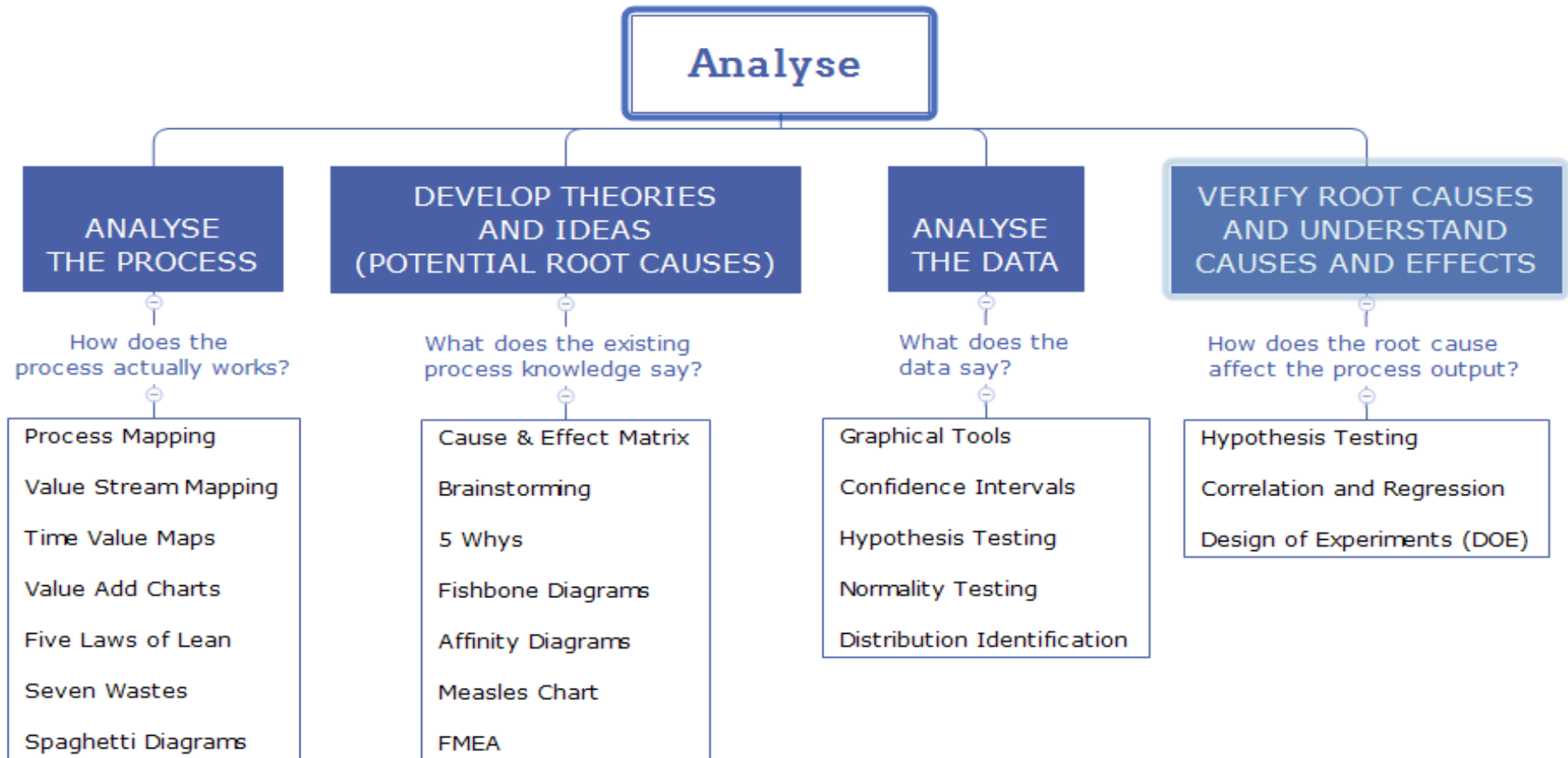
An affinity diagram was implemented with the inspectors in order to understand the process opportunities to avoid NVA.

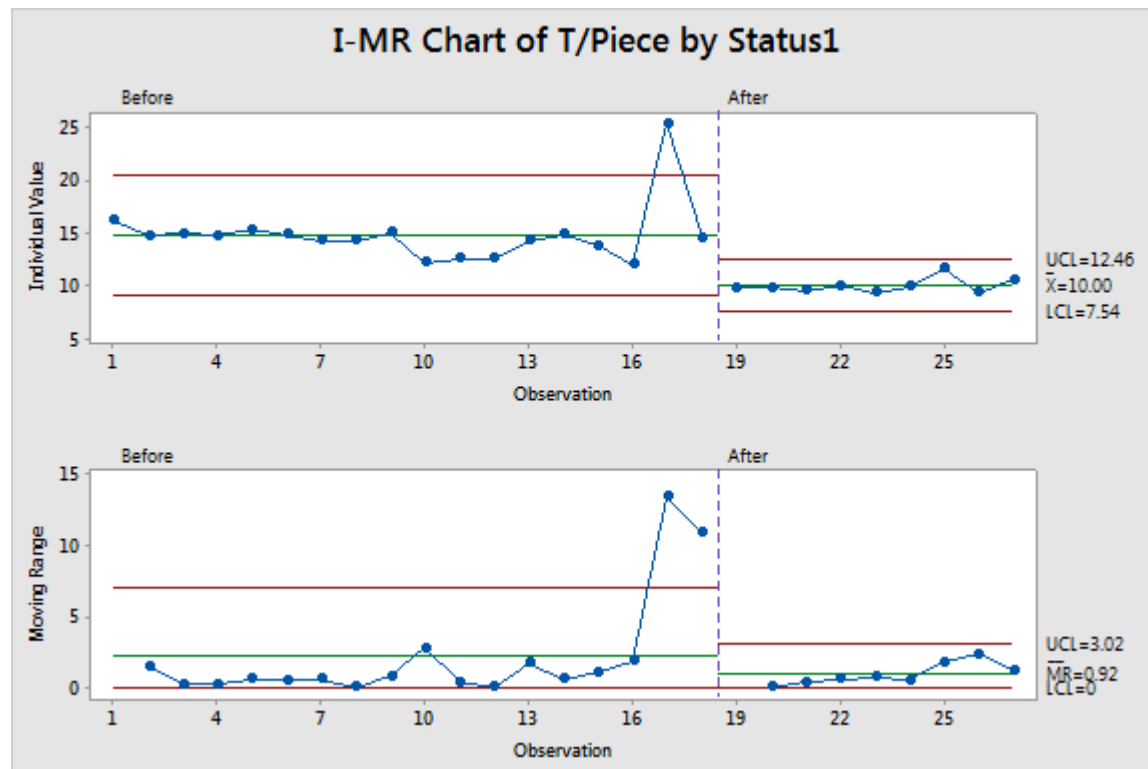


A Pareto Chart was implemented in order to analyze the opportunities defined by the Inspectors



Analyse Phase



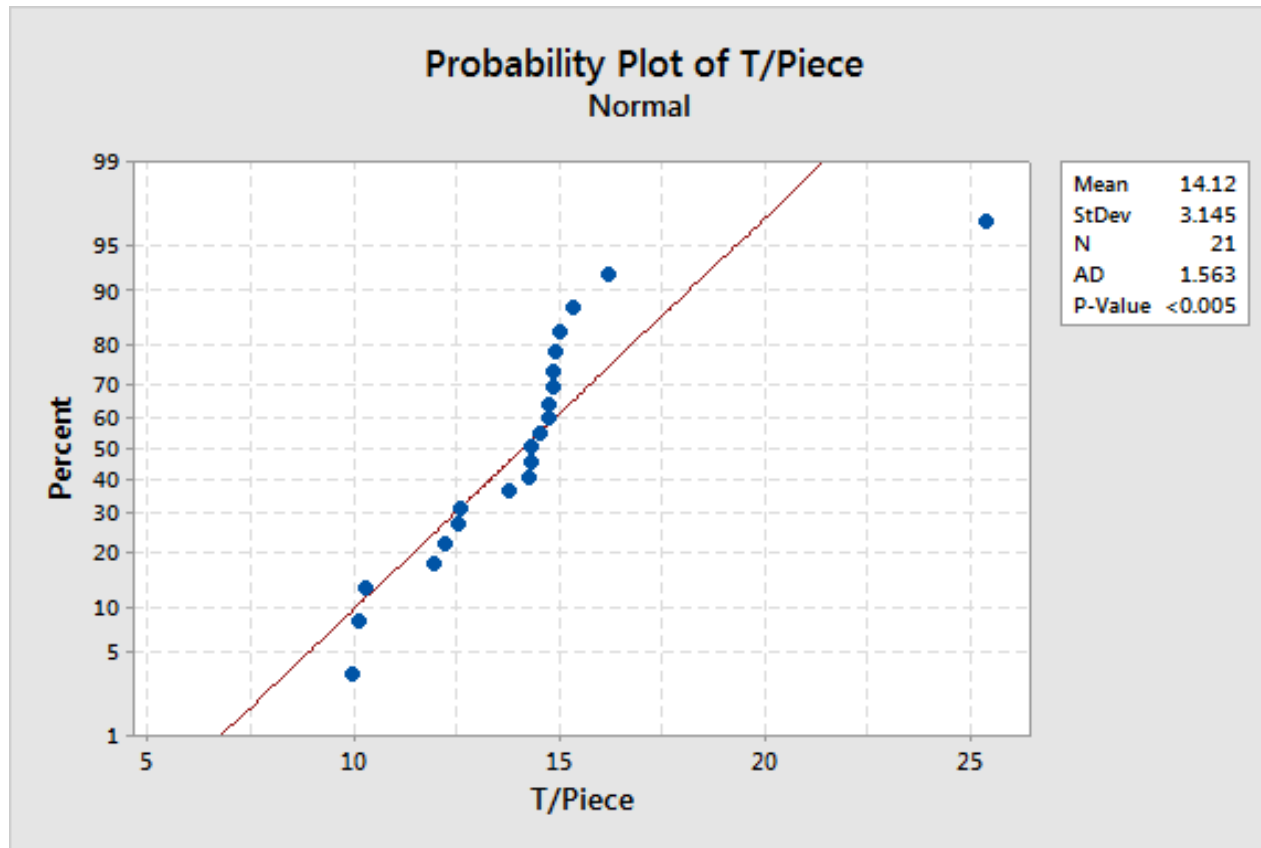


The inspection time per piece is calculated by dividing the cycle time between the sample size. From week 2 the data collection and the quick wins of the measure are implemented.

$$\text{KPOV Time per piece} = \frac{\text{Cycle time}}{\text{Sample size}}$$

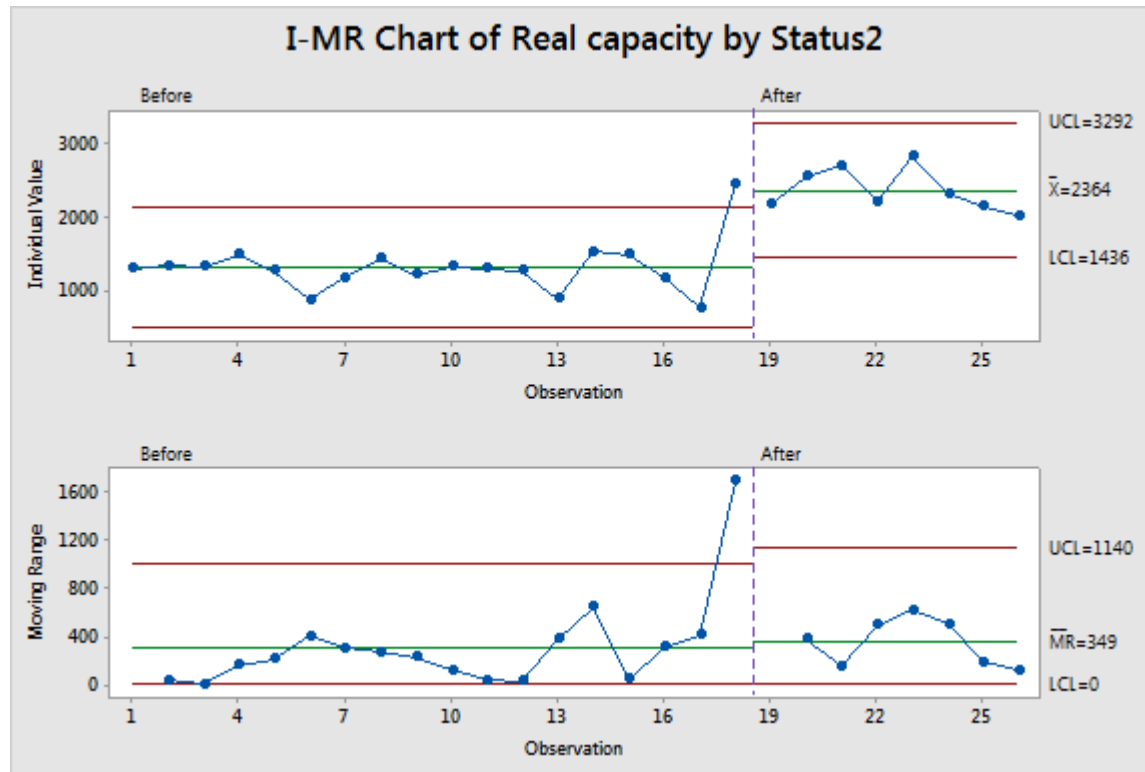


Analyze Normality Test



The Normality test fail because, the average Time per piece chage according to the specific Project. See the second plot.





The inspection time per piece is calculated by dividing the available time between the Week average sample size per the week average time per piece. From week 2 the data collection and the quick wins of the measure are implemented.

$$\text{Available Time} = (3(\text{shifts}) * 2(\text{persons}) * 8(\text{hours}) * 60 * 60) - \text{schedule downtimes}$$

$$\text{KPOV Capacity of inspected Boxes} = 6 * \frac{\text{Available Time per day}}{(\text{Week average sample size} * \text{Week average time per piece})}$$



Diferences between Shift and pieces inspected on September 2018

Method

Null hypothesis All means are equal
 Alternative hypothesis Not all means are equal
 Significance level $\alpha = 0.05$

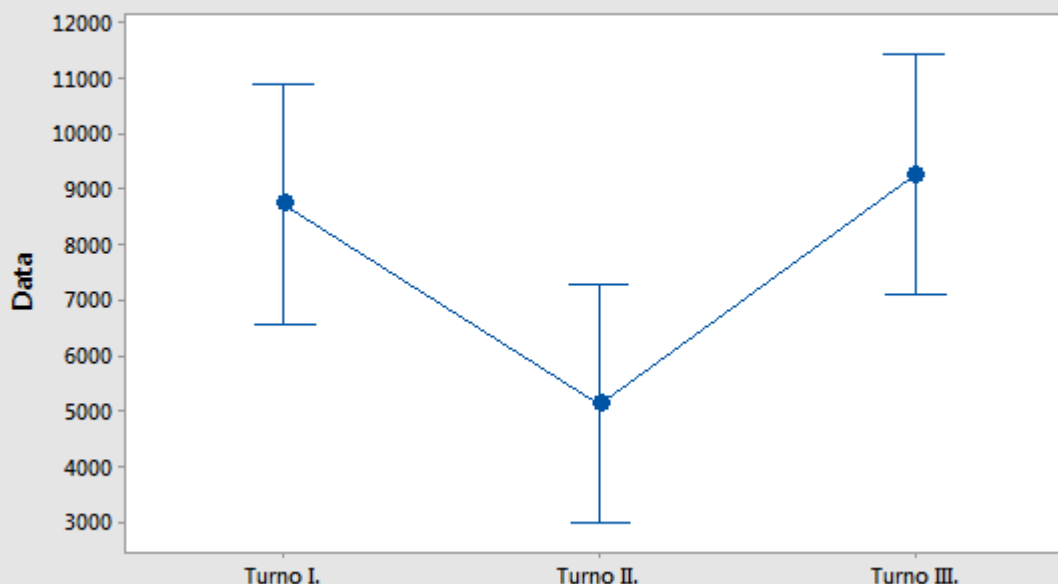
Equal variances were assumed for the analysis.

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Factor	2	121816033	60908016	4.52	0.018
Error	33	444405861	13466844		
Total	35	566221894			

Different Populations

Interval Plot of Turno I, Turno II, ...
 95% CI for the Mean



The pooled standard deviation is used to calculate the intervals.

Cause

Means

Factor	N	Mean	StDev	95% CI
Turno I.	12	8719	3144	(6564, 10874)
Turno II.	12	5113	3273	(2958, 7269)
Turno III.	12	9256	4450	(7101, 11412)

Pooled StDev = 3669.72



Differences between Shift and Box inspected on September 2018

Method

Null hypothesis All means are equal
Alternative hypothesis Not all means are equal
Significance level $\alpha = 0.05$

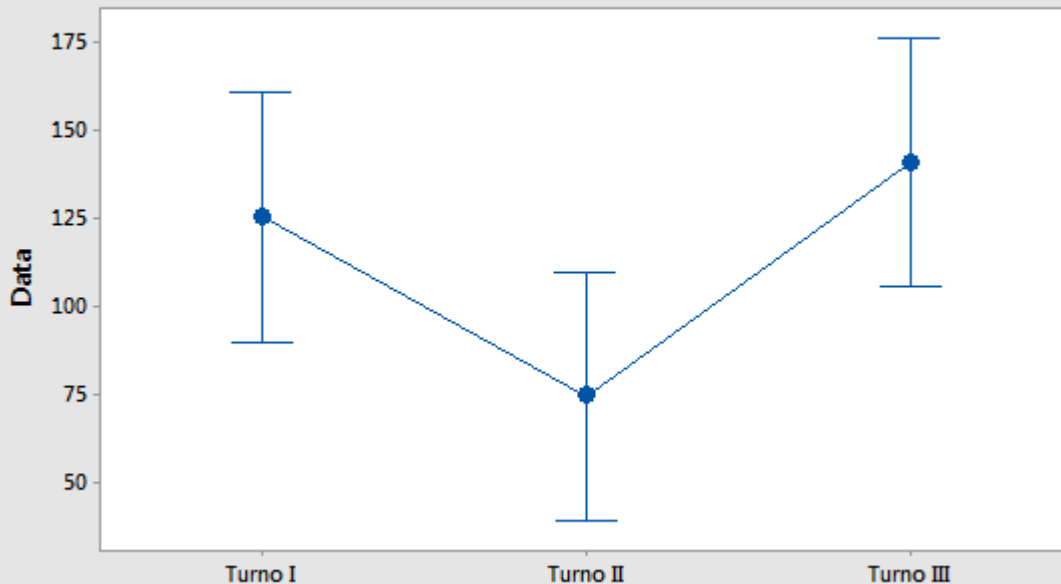
Equal variances were assumed for the analysis.

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Factor	2	28976	14488	3.99	0.028
Error	33	119831	3631		
Total	35	148807			

Different Populations

Interval Plot of Turno I, Turno II, ...
95% CI for the Mean



The pooled standard deviation is used to calculate the intervals.

Causa

Means

Factor	N	Mean	StDev	95% CI
Turno I	12	125.3	59.8	(89.9, 160.6)
Turno II	12	74.3	48.6	(38.9, 109.7)
Turno III	12	140.8	70.4	(105.4, 176.1)

Pooled StDev = 60.2598



ANOVA, Box inspected per inspector, september 2018

- A considerable difference between shifts and the amount inspected by each inspector is determined

Method

Null hypothesis All means are equal
Alternative hypothesis Not all means are equal
Significance level $\alpha = 0.05$

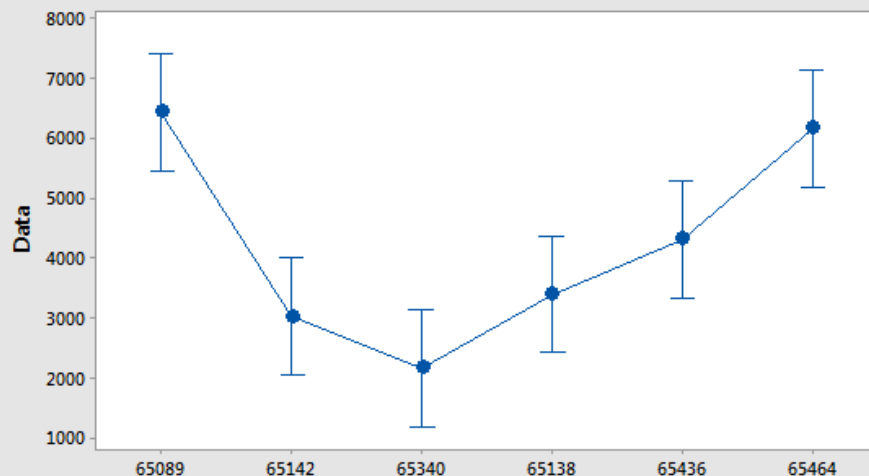
Equal variances were assumed for the analysis.

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Factor	5	150391605	30078321	12.65	0.000
Error	54	128351674	2376883		
Total	59	278743278			

Different Populations

Interval Plot of 65089, 65142, ...
95% CI for the Mean



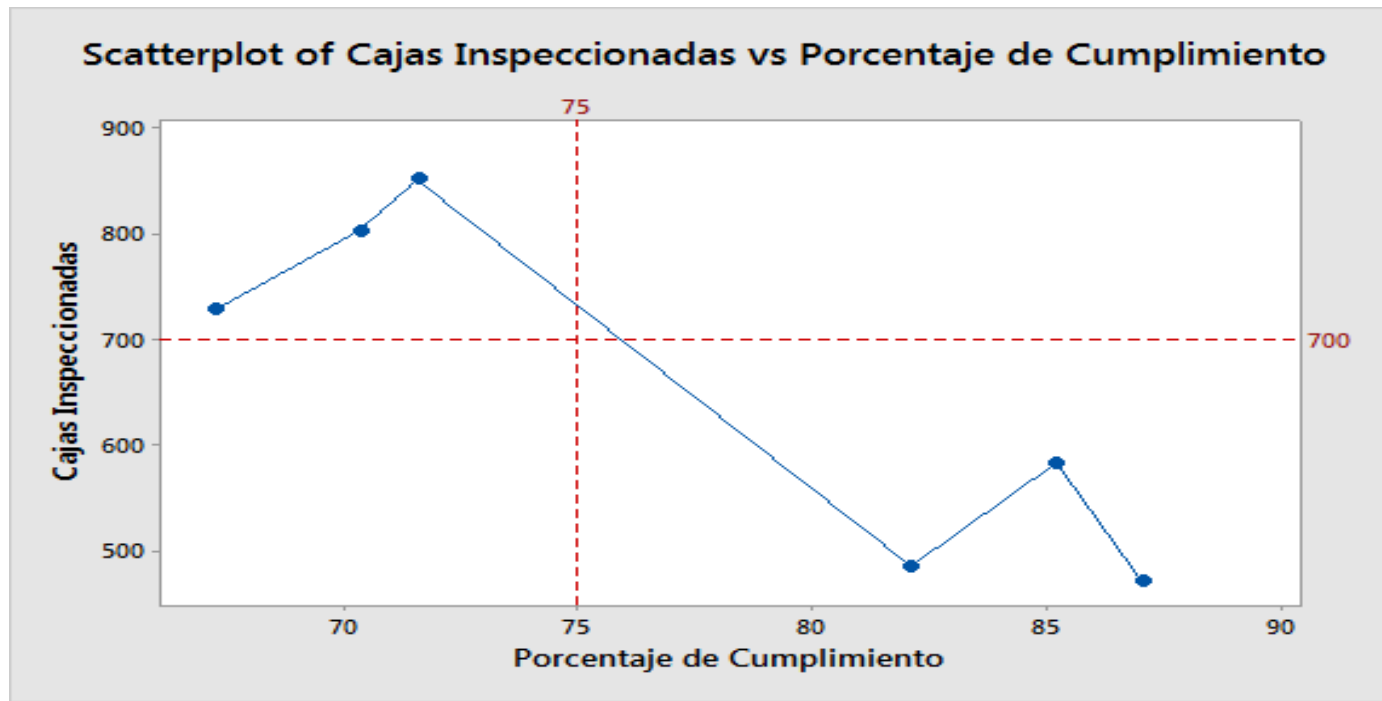
The pooled standard deviation is used to calculate the intervals.

Means

Factor	N	Mean	StDev	95% CI
65089	10	6432	1402	(5454, 7409)
65142	10	3014	1054	(2037, 3992)
65340	10	2157	1482	(1180, 3135)
65138	10	3389	1586	(2412, 4367)
65436	10	4304	1226	(3326, 5281)
65464	10	6155	2229	(5178, 7132)

Pooled StDev = 1541.71



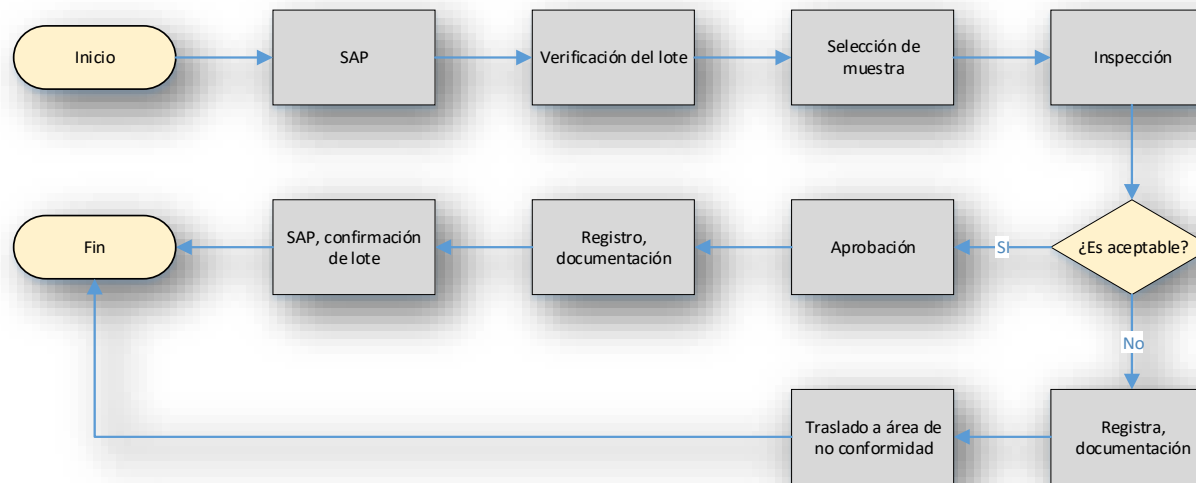


Código	Porcentaje de Cumplimiento
65089	67.28
65142	85.19
65138	87.04
65340	82.10
65436	70.37
65464	71.60



Standardize the Process

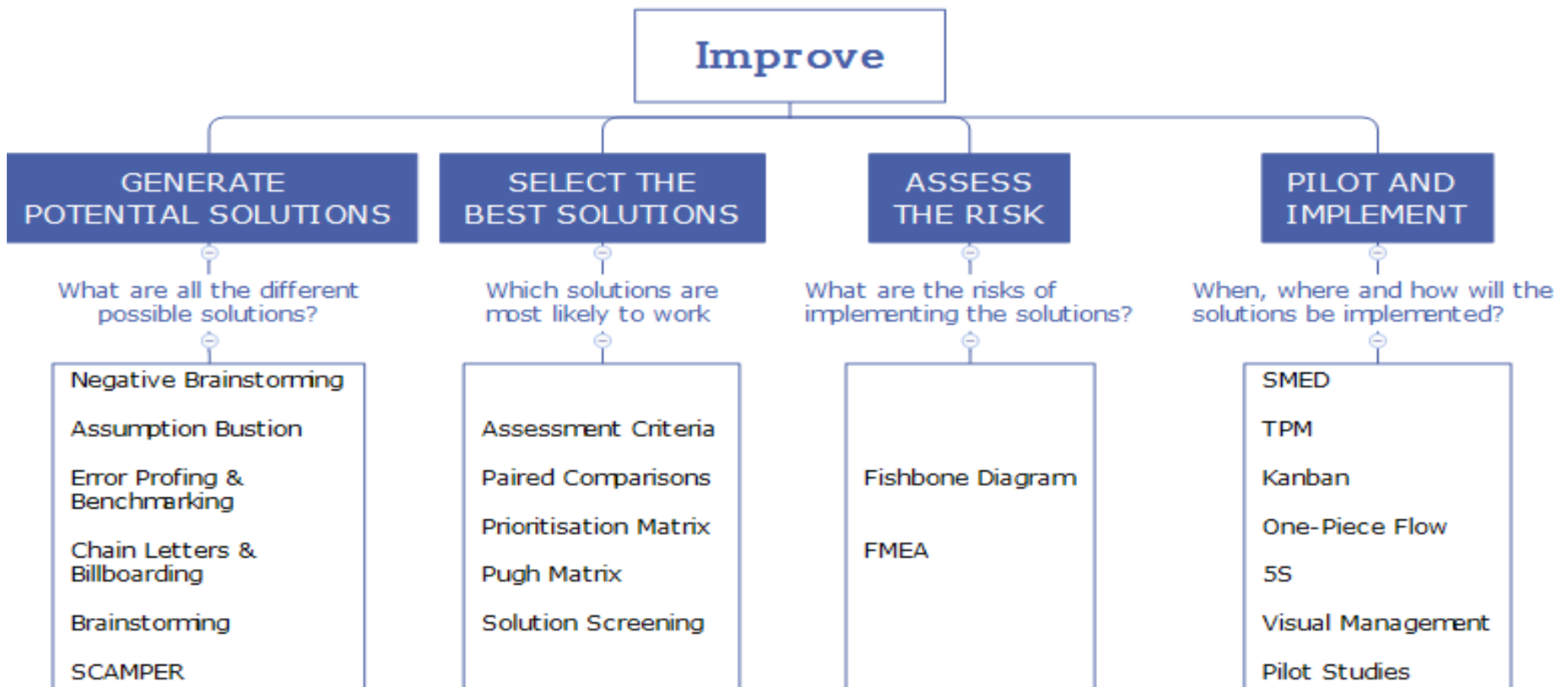
Diagram of process before



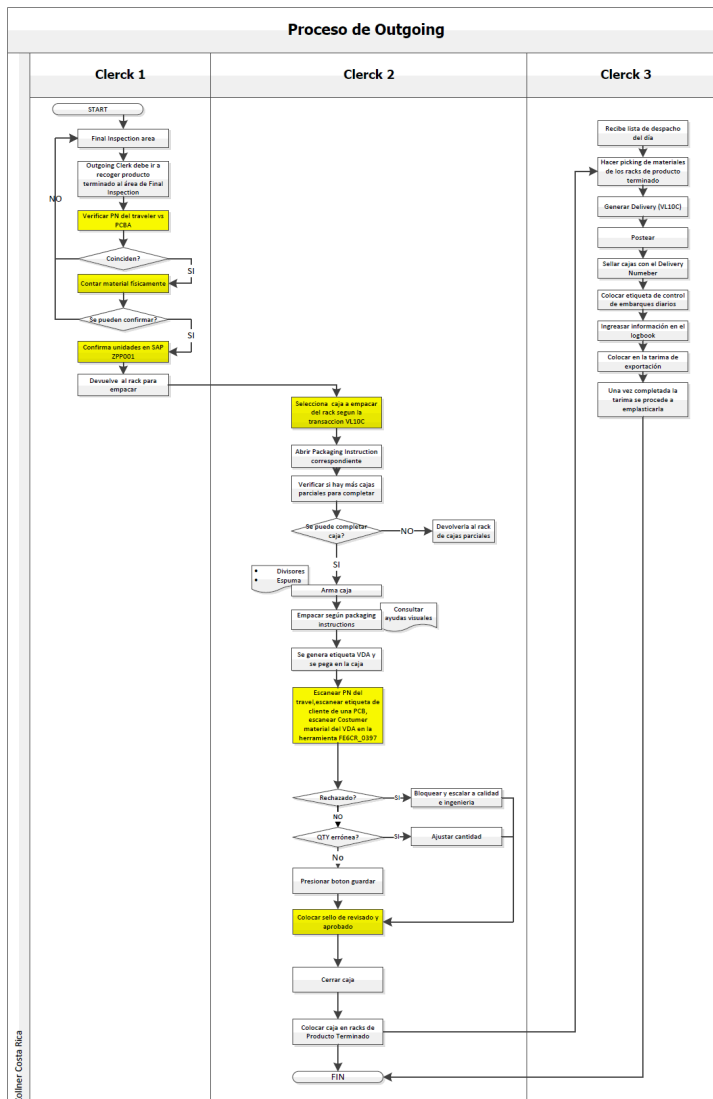
Actual process of final inspection



Improve Phase



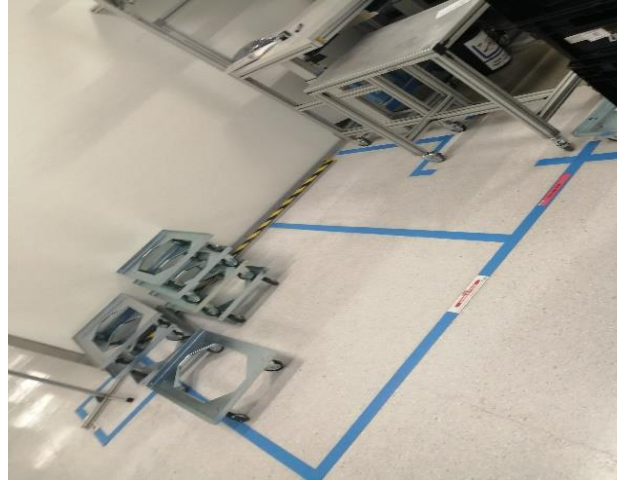
New outgoing inspection one process flow



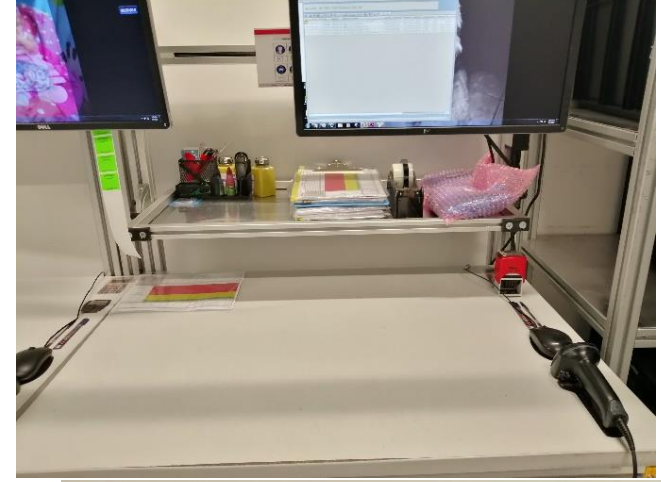
E-04-01730 updated

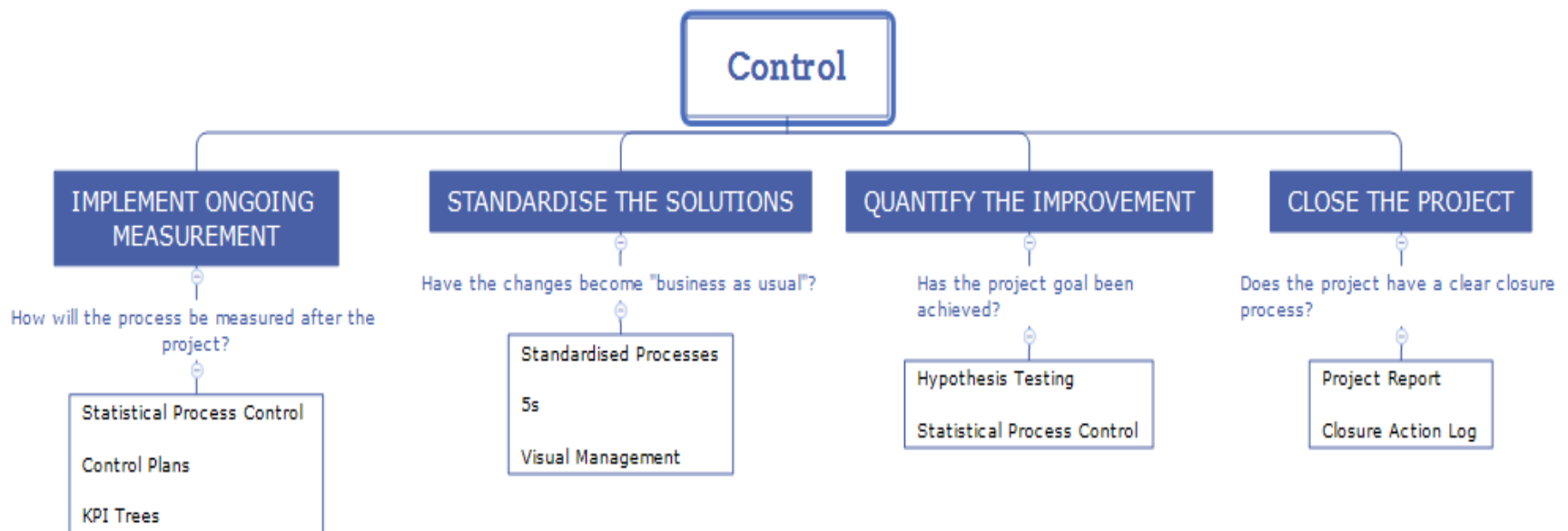


Implemented 5S



Se definió un área de prioridades para el proceso de Inspeccion.





Before and after

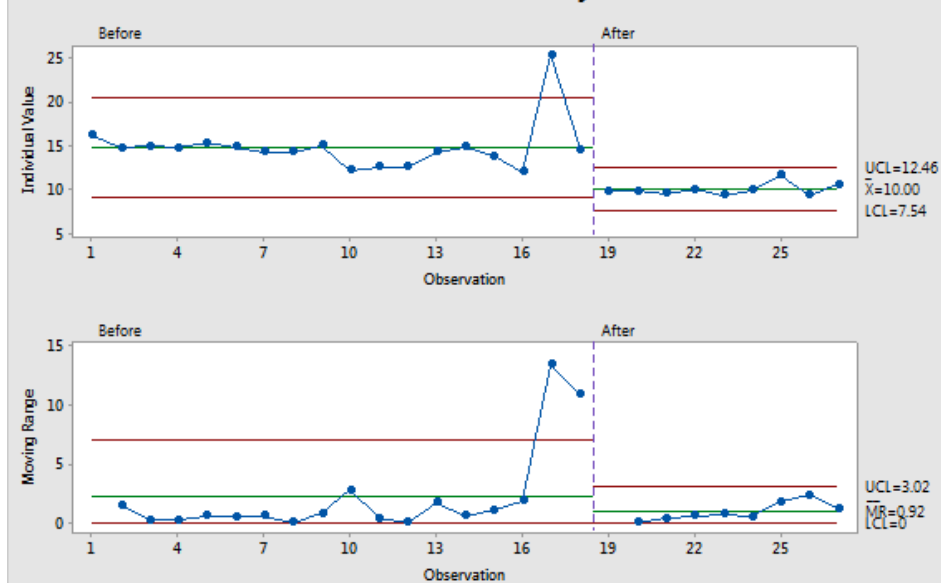
- Before and after implementation

KPOV1:

KPOV2:

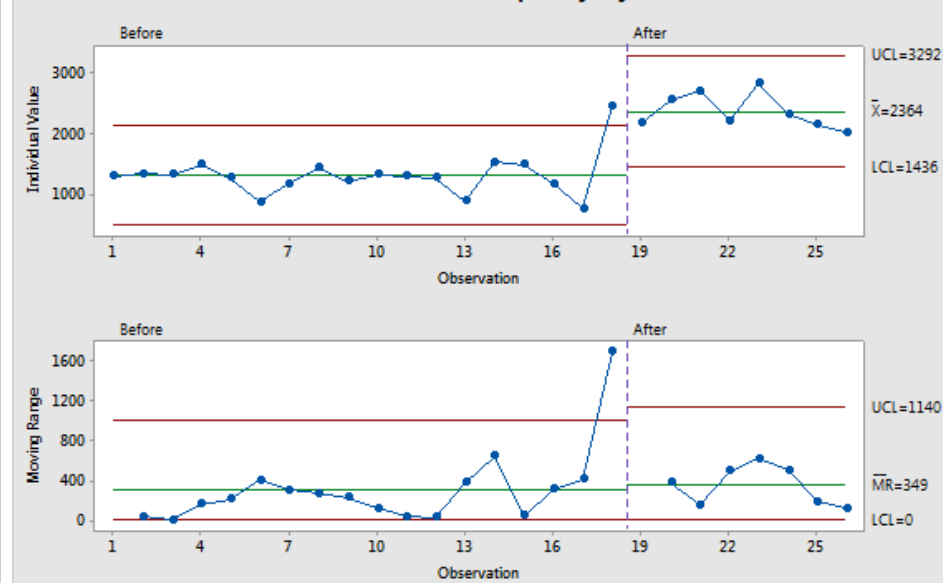
**OTD
Impacted**

I-MR Chart of T/Piece by Status1



The inspection time was reduced by 33% and the variability was reduced

I-MR Chart of Real capacity by Status2



Capacity increased by 37% with one person less



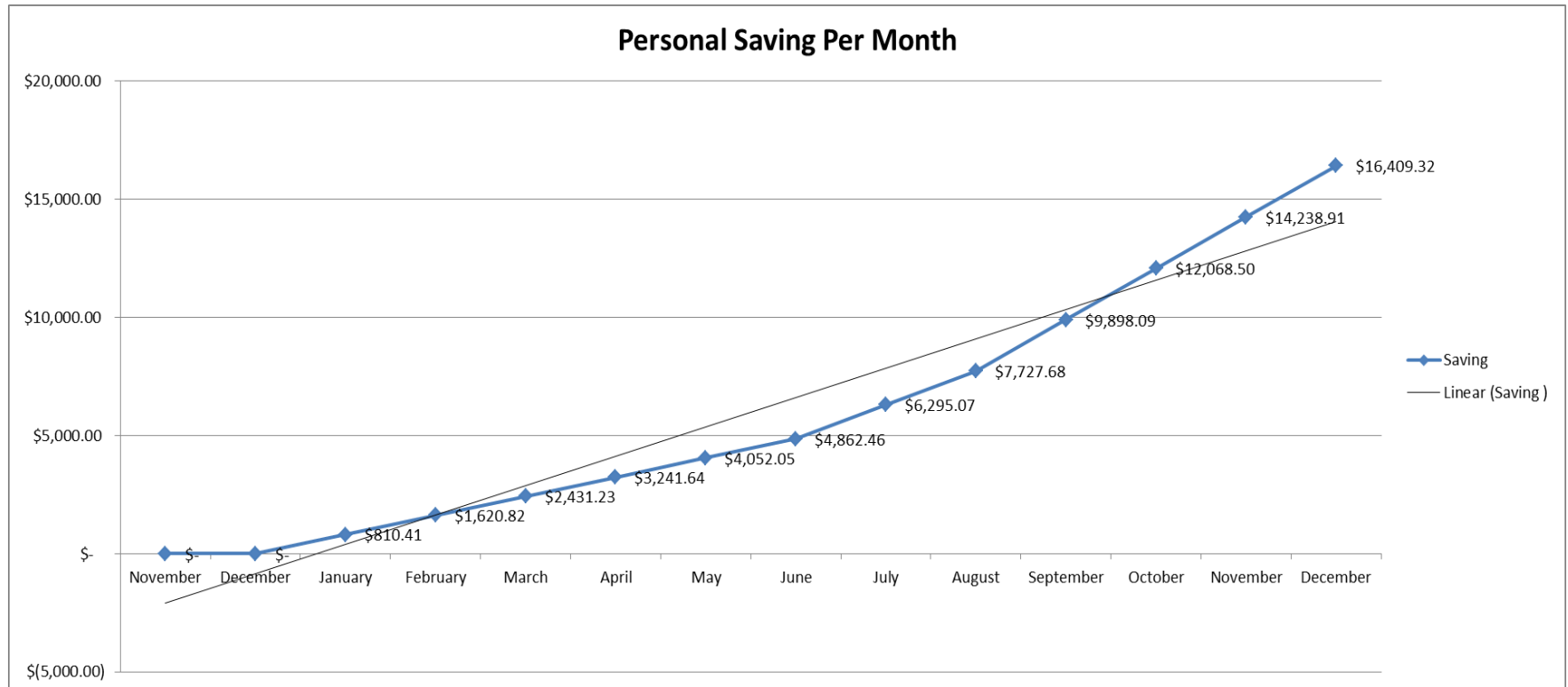
Saving in personal Cost

Calculating the personal cost by month, using the actual salary statements and the capability analysis using the tool implemented we can reorganize the resources of the quality inspector team.

- 1 Adjustment (December 2018)
- 2 Adjustment (July 2019)
- 3 Adjustment (September 2019)

Savings in the personal cost.

Impact on the EBITDA





Gracias por su interés en el grupo de empresas de Zollner Electronics

SOLUTIONS FOR YOUR IDEAS

