Scrap reduction in Pizzamania

Nirbhay Kumar Dubey

Agenda

Overview

Define

Measure

Analyze

Improve

Control

Overview

Define

Measure

Analyze

Improve

Control

Background

Pizzamania, a busy pizza center in Abu Dhabi, expanded operations in 2019 with modern automated machines targeting 600 pizzas per day. However, process issues emerged, and by early 2021 the internal scrap rate had risen to around 17% and customer returns averaged 3%. Customer complaints—mainly about burnt or uncooked pizzas—intensified. Scrap and rework reduced effective capacity, and revenue fell from $2M to $1.5M in six months.

The management set a target of reducing internal scrap to below 5% and minimizing customer returns while maintaining output. Achieving this would save $200,000 annually from reduced scrap/rework and generate an additional $175,000 from improved margins, totaling $375,000 in tangible benefits. Intangible benefits include improved customer satisfaction, delivery reliability, and quality

Overview

Context

- Internal scrap is high @17%, customer return @ 3% and reduced revenue by 500 K USD

GOAL

- To reduce scrap (internal & external) from 20% to 5% Benefit – 200,000 USD on savings because of reduced rejections+ 175,000 USD improvement in margin = 3,75,000 USD

PROJECT TEAM

- Leader – Mr.Nirbhay
- Champion / Sponsor – Mr. Ali
- Master Black Belt / Coach – Nirbhay
- Team – Nirbhay & Team

APPROACH

Follow DMAIC METHODOLOGY

SCOPE

The Scope of this project is limited to pizza manufactured in 'Pizzamania Pizza Centre' Abu Dhabi.

DURATION

- Start Date - 01/01/2022
- End Date - 30/06/2022
- Duration - 6 month

Project Phase

Overview

Define

Measure

Analyze

Improve

Control

VOC & CTQ

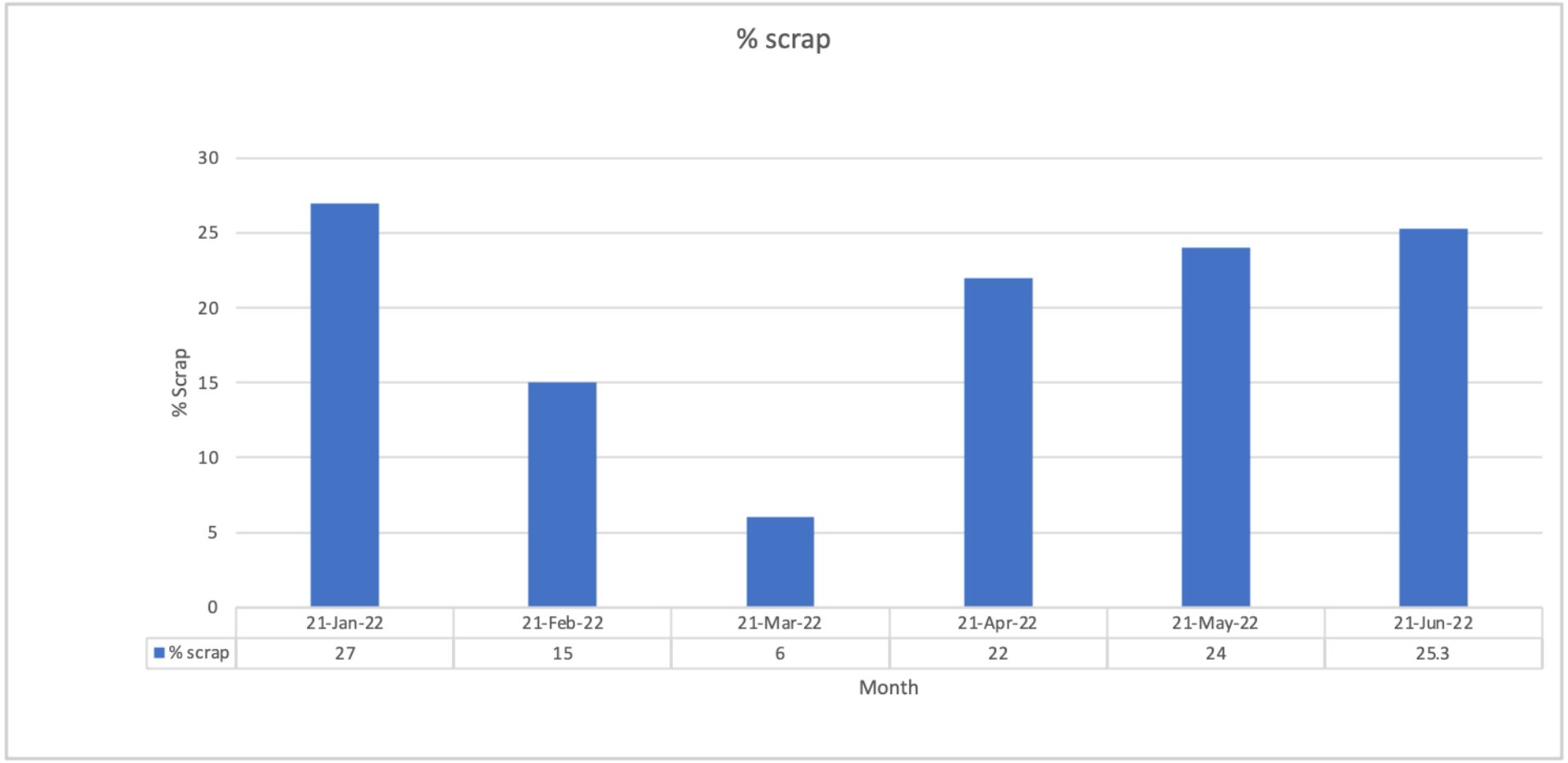
Voice of Customer:

- Quality is bad, customers are getting uncooked and burnt pizzas

CTQ Tree :

Voice of customer	Critical to X	Primary Metric for improvement
Bad Pizza Quality Uncooked & burnt	CTQ – Quality – % Scrap – Internal and External	**Primary Metric -** Y = % Scrap = No of bad quality / total pizza cooked Target – 5 % (internal + external) Defect – Any pizza not meeting specification **Secondary Metric -** Output pizzas per day (600)

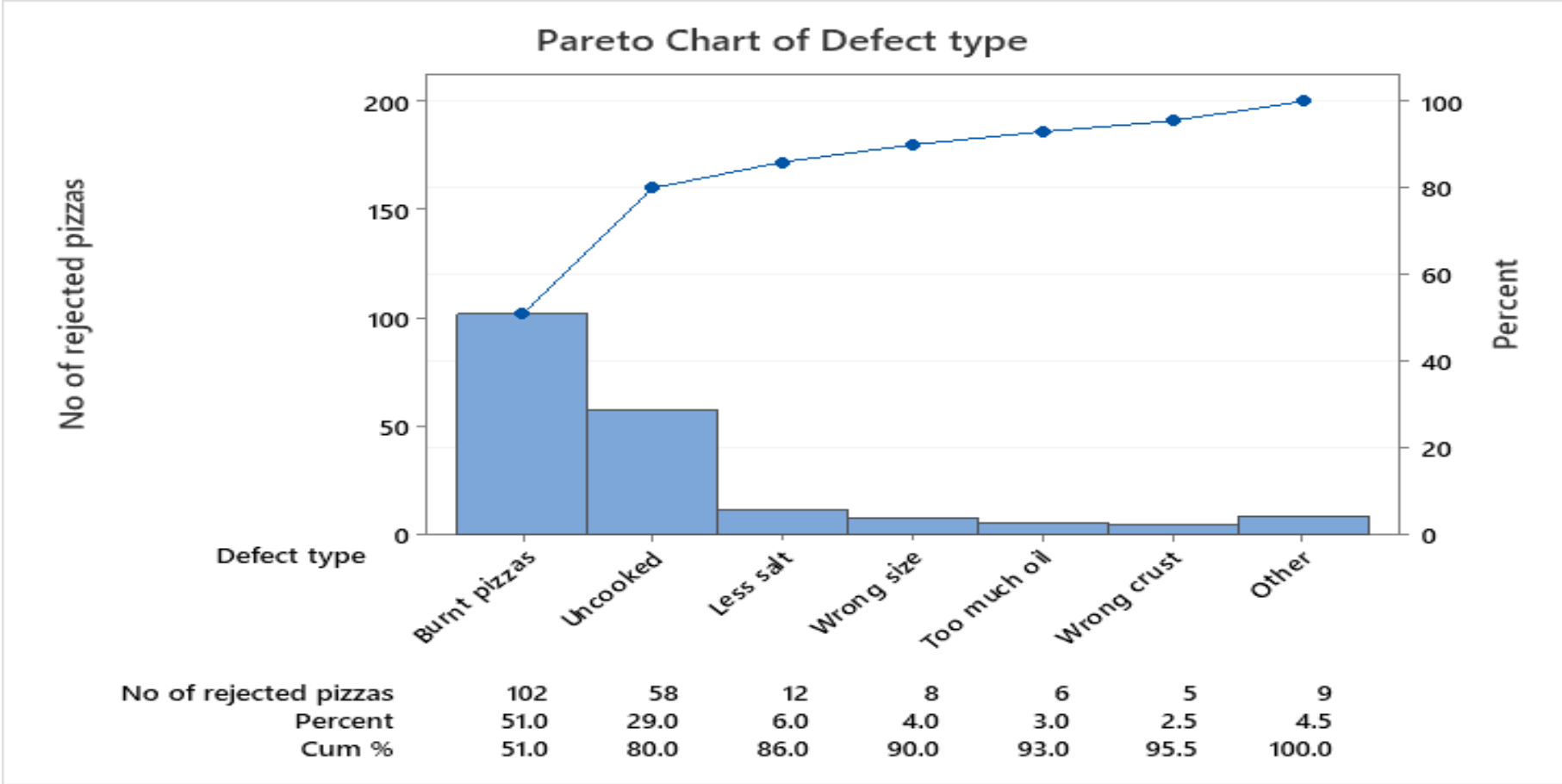
Baseline Performance of Primary Metric (6 months data as Bar chart)



Inference :

- Last 6 months scrap percentage data shows a significant variation and hence ideal problem to be taken up as a Six Sigma Project.

Pareto chart

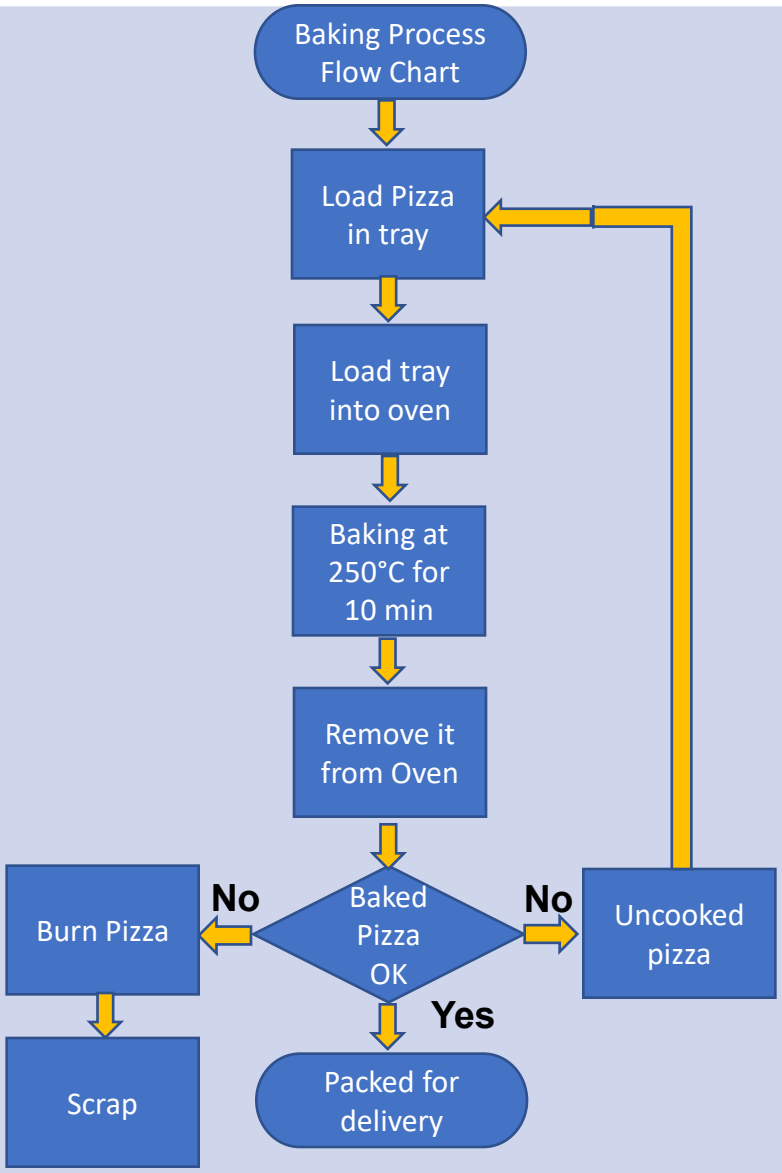


No of rejected pizzas	102	58	12	8	6	5	9
Percent	51.0	29.0	6.0	4.0	3.0	2.5	4.5
Cum %	51.0	80.0	86.0	90.0	93.0	95.5	100.0

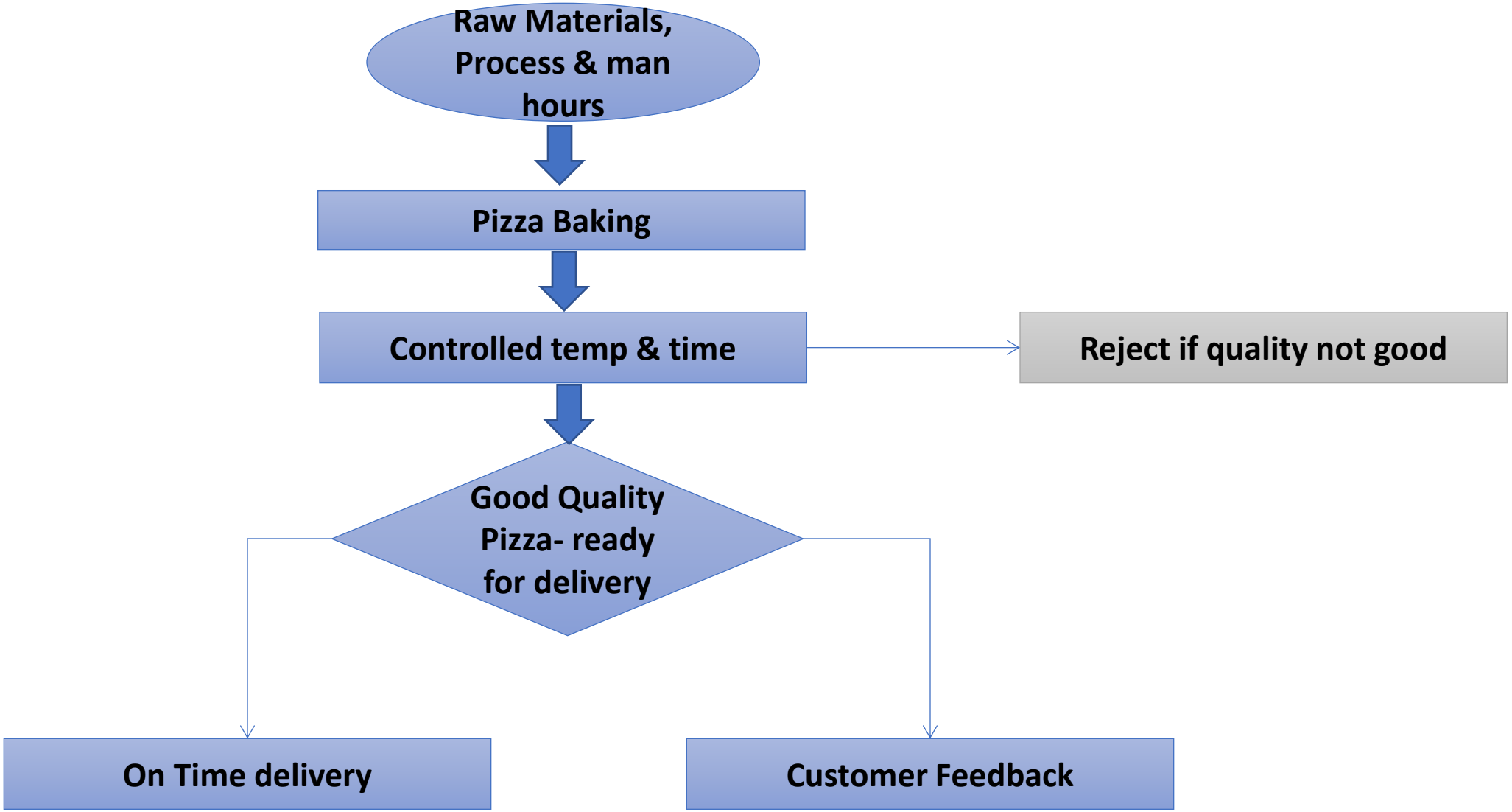
Inference :

- Burnt and Uncooked pizza scrap in Baking process contributes to 80% of total scrap.
- Scope of project can be limited to Baking process
- By reducing Baking process scrap from 16% to 1 % , Pizzamania can achieve overall scrap reduction from 20 % to 5 %.

SIPOC – For Baking Process

Suppliers	Input	Process	Output	Customers
• Rolling • Topping	• Rolled Pizzas with toppings • Baking trays • Heating elements • Air • Thermocouples • Temperature controllers		• Baked Pizza	• Dine in customers • Take out customers • Home delivery customers

High Level Process Mapping



Project Charter

Project Title:	Reduction of Scrap% in Baking process from 16 to 1%

Project Leader:	**Project Team Members:**
Name: Nirbhay Business Unit: Abu Dhabi Branch Email: Pizzamaniaabudhabi@pizzamania.com Contact No: 00971 000 000 000	1 Adi 2 Sunil 3 Ali 4 Hamid
Champion/Sponsors:	**Master Black Belt:**
Mr. Ali	1. Annamalai
Problem Statement:	**Goal Statement:**
Scrap from backing process is very high (@ 16 %) based on the data January 2021 to June 2021.	Reduce the scrap from backing process from 16% to 1% by June 2022.
Secondary Metric	**Assumptions Made:**
Number of pizza output per day	80 % scrap from the baking process is determined based on samples

Project Charter

Tangible and Intangible Benefits:

Estimated saving =

- $ 200,000 + $ 175,000 = $ 375,000

Other benefits –

- Customer Satisfaction
- Accuracy on delivery time

Risk to Success:

In Scope:

Baking process of pizza

Out of Scope:

All other process and other product

Signatories:

Project Leader : Nirbhay

Sponsor : Ali

Master Black Belt : Annamalai

Finance Representative : Pizzamania

Project Timeline:

Jan 2022 to June 2022
(6 Months)

Stages	Start	End
Define	1st January 2022	31st January 2022
Measure	1st February 2022	28th February 2022
Analyze	1st March 2022	15th April 2022
Improve	16th April 2022	31st May 2022
Control	1st June 2022	30th June 2022

Project Phase

Overview

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Operational Definition (Primary Metric)

Quantifiable. Measurable Y Metric	**% Scrap In baking process**
In What units is the Y measured?	percentage
What underlying raw data elements are required to calculate the Y metric?	Input – Total number of pizza Total number of scrap due to baking process over period of time
What is the formula to calculate Y?	$\frac{Number\ of\ Scrap}{Total\ Number\ of\ pizza}$ x 100
How do you define each underlying data element used to calculate Y? (In this case: definition of START a END)	Business is running for 12 Hours everyday Start - Morning 09:00 AM End - Evening 09:00 PM
What gages (instruments) were used?	Scrap rate during quality check
Who collects the underlying raw data? How?	Quality team by random sampling
Does the data represent the entire population or only a sample?	Samples
If sampled, what is the sample size? What is the sampling strategy?	Every 50th pizza from continuous oven 1 to oven 4
What period of time does the data represent? (From ____ To ____)	Past 6 month from Jan – 2021 to June 2021

Data collection – Descriptive statistics (Before improvement)

Statistics

Variable	N	N*	Mean	StDev	Variance	Minimum	Q1	Median	Q3	Maximum	Range
Oven1	40	0	5.9772	0.2146	0.0461	5.5900	5.8200	5.9900	6.1100	6.4800	0.8900
oven2	40	0	5.9918	0.0976	0.0095	5.8300	5.9100	6.0050	6.0575	6.1700	0.3400
oven3	40	0	6.3048	0.0883	0.0078	6.1100	6.2500	6.2950	6.3575	6.5500	0.4400
oven4	40	0	6.2780	0.0920	0.0085	6.1000	6.2150	6.2850	6.3275	6.5500	0.4500

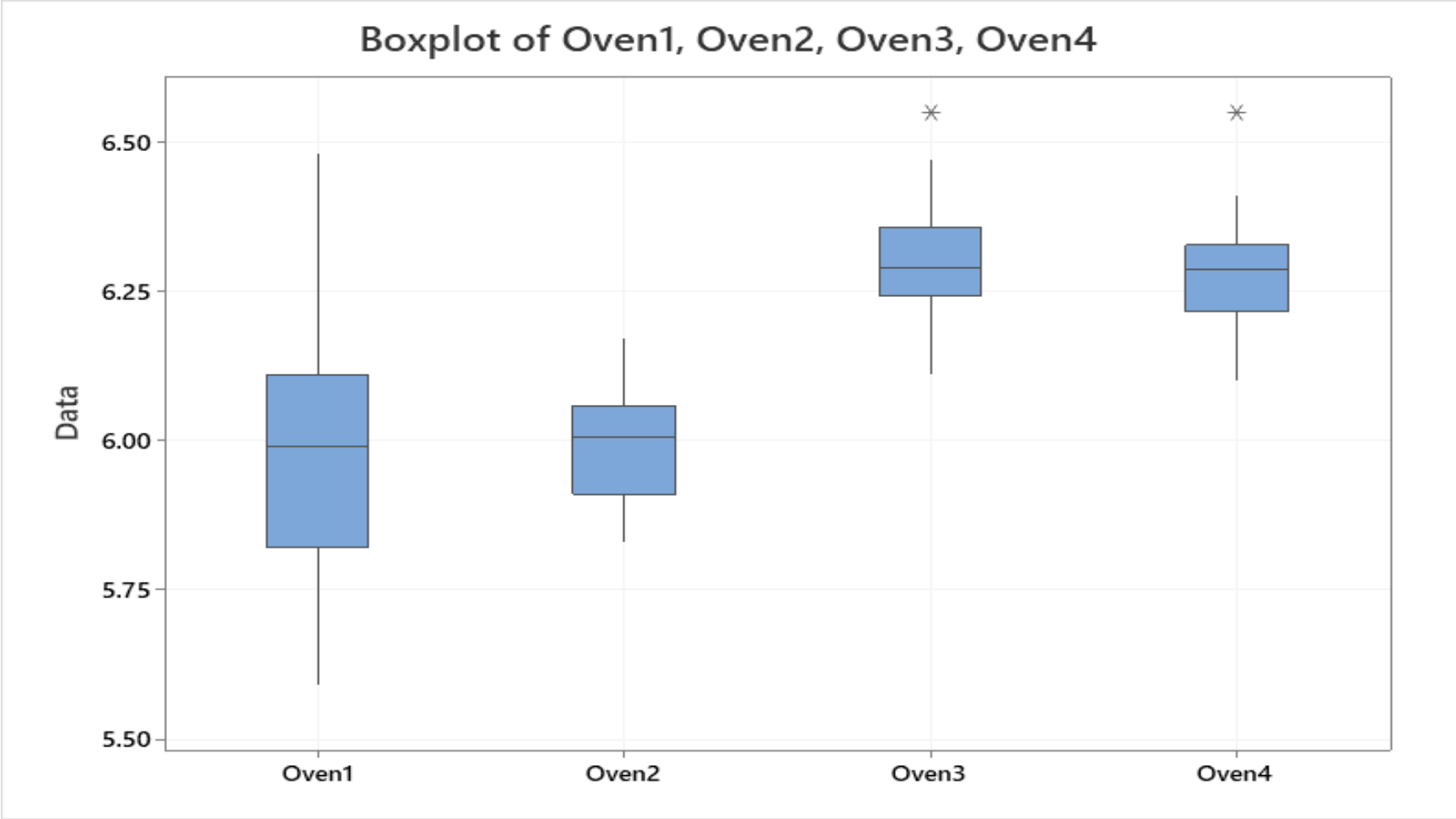
Variable	IQR	Mode	N for Mode
Oven1	0.2900	6.1	3
oven2	0.1475	6.04	4
oven3	0.1075	6.27, 6.28, 6.29, 6.32	3
oven4	0.1125	6.29, 6.32	4

The data contain at least five mode values. Only the smallest four are shown.

Inference :

- Oven 1 and Oven 2 having mean near to required thickness but the variation is more in oven 1
- Oven 3 and Oven 4 is having mean above 6.04 mm near to USL.
- Even having at higher thickness the variation in oven 3 is less.

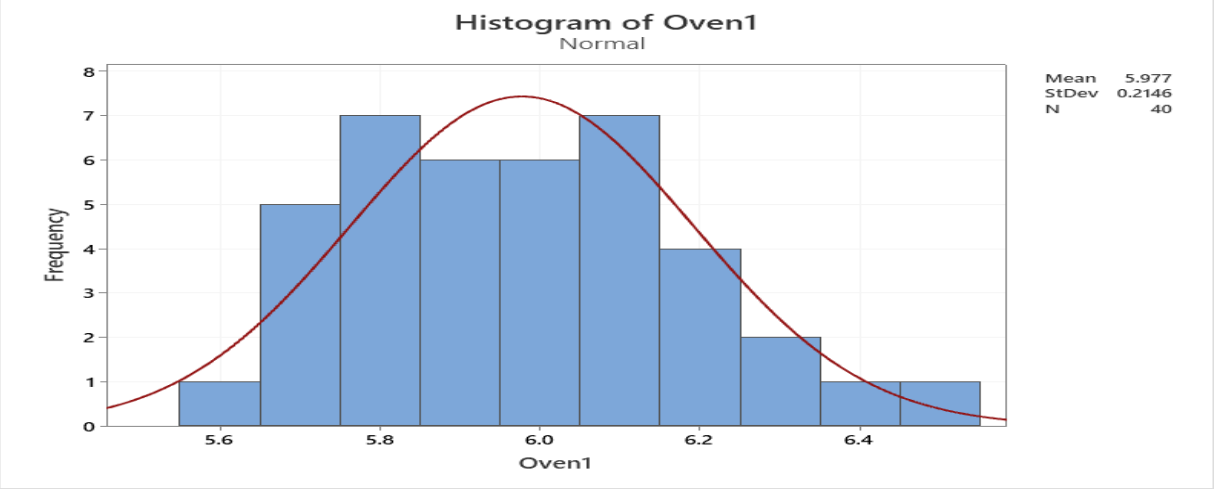
Data collection – Box Plot (Before improvement)

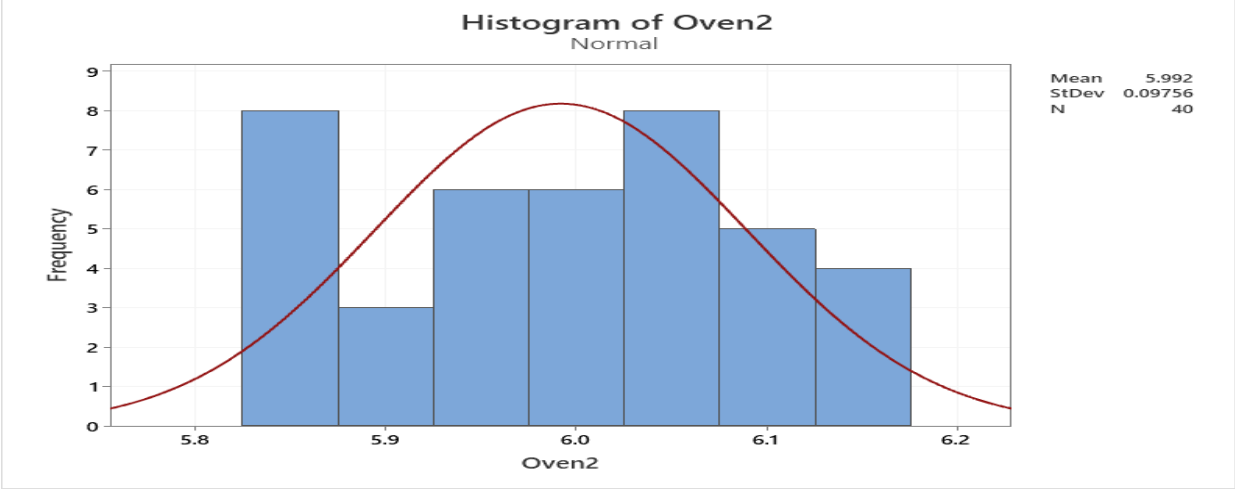


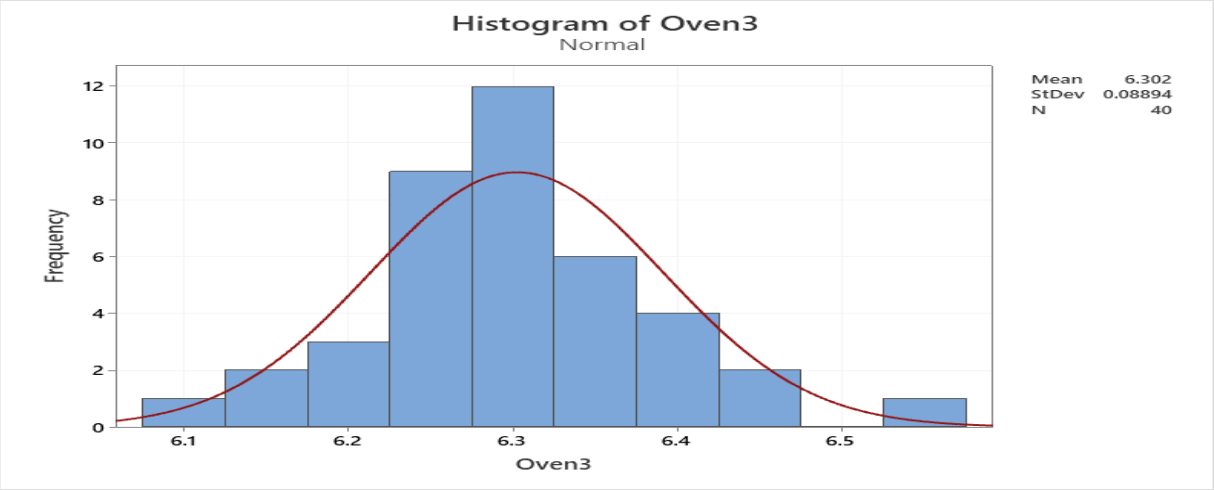
Inference :

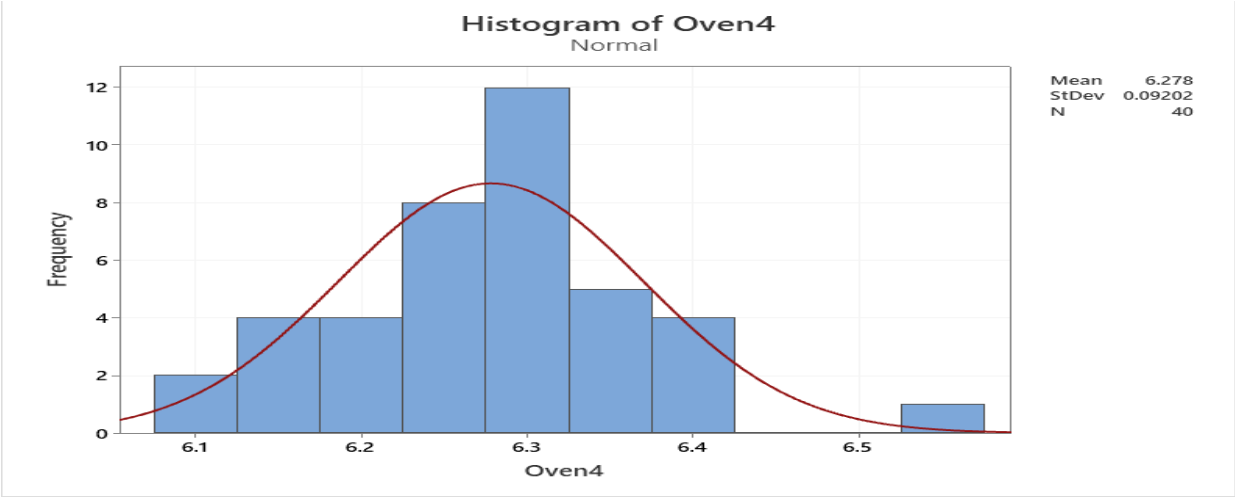
- Thickness of Oven 1 and Oven 2 is near to desirable thickness 6.04 mm and on other hand thickness of Oven 3 and Oven 4 is having above from the expected thickness even some of outliers also present.

Data collection – Histogram (Before improvement)





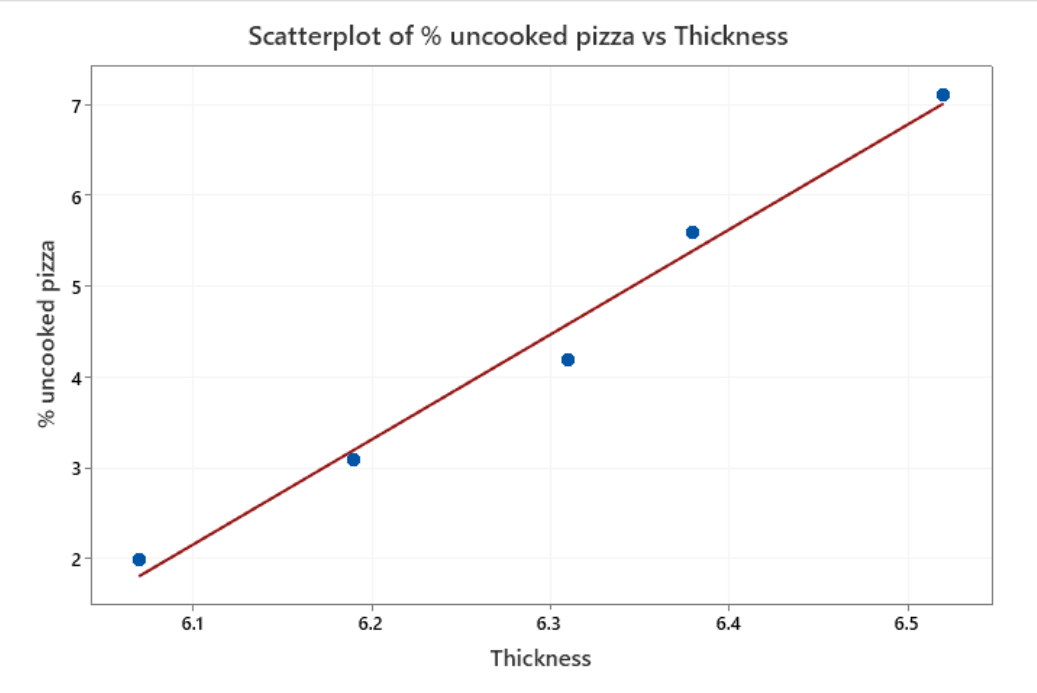


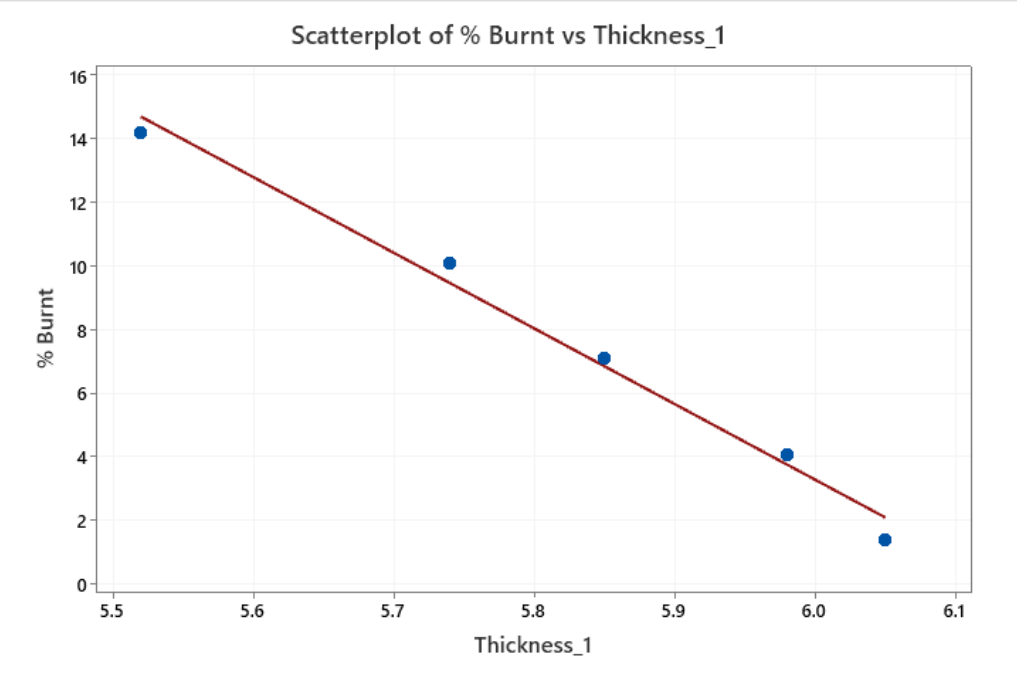


Inference :

- Data is normally distributed over the mean for all oven

Data collection

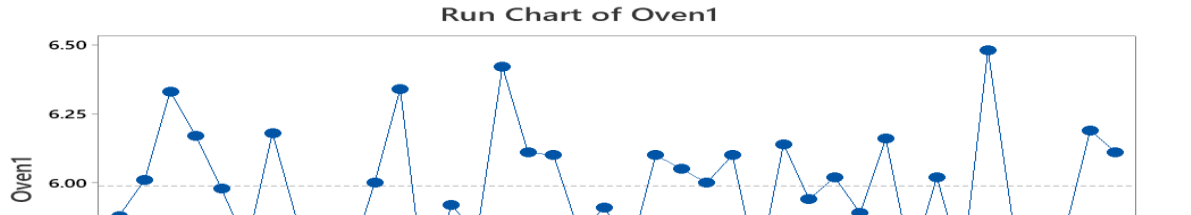




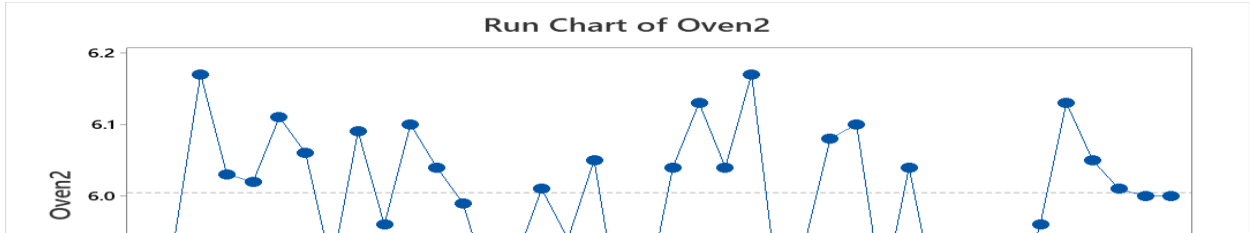
Inference :

- % Rejections in uncooked with thickness is having strong positive relationship and % rejection in burnt pizzas is having strong negative relationship with thickness.
- Focus of the project will be to control the thickness in narrow range to reduce baking rejections

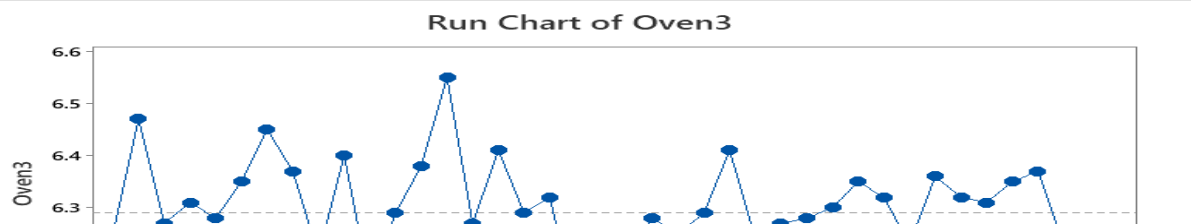
Data collection – Run Chart (Before improvement)



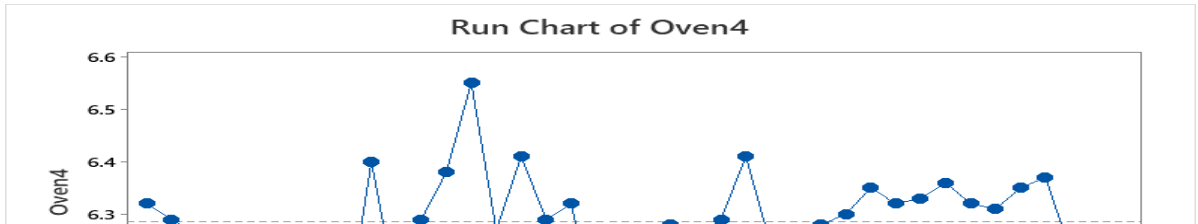
Number of runs about median:	22	Number of runs up or down:	28
Expected number of runs:	21.0	Expected number of runs:	26.3
Longest run about median:	4	Longest run up or down:	3
Approx P-Value for Clustering:	0.626	Approx P-Value for Trends:	0.739
Approx P-Value for Mixtures:	0.374	Approx P-Value for Oscillation:	0.261



Number of runs about median:	19	Number of runs up or down:	24
Expected number of runs:	21.0	Expected number of runs:	26.3
Longest run about median:	5	Longest run up or down:	4
Approx P-Value for Clustering:	0.261	Approx P-Value for Trends:	0.185
Approx P-Value for Mixtures:	0.739	Approx P-Value for Oscillation:	0.815



Number of runs about median:	21	Number of runs up or down:	27
Expected number of runs:	20.9	Expected number of runs:	26.3
Longest run about median:	6	Longest run up or down:	4
Approx P-Value for Clustering:	0.506	Approx P-Value for Trends:	0.601
Approx P-Value for Mixtures:	0.494	Approx P-Value for Oscillation:	0.399

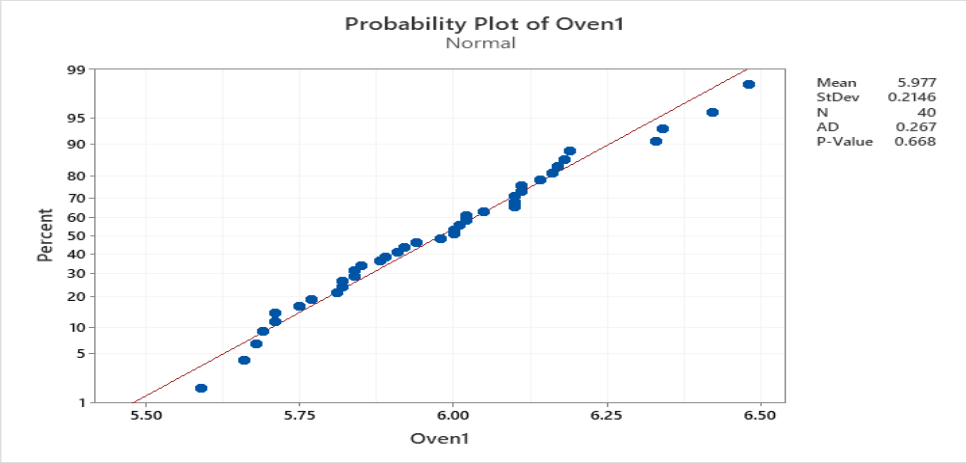


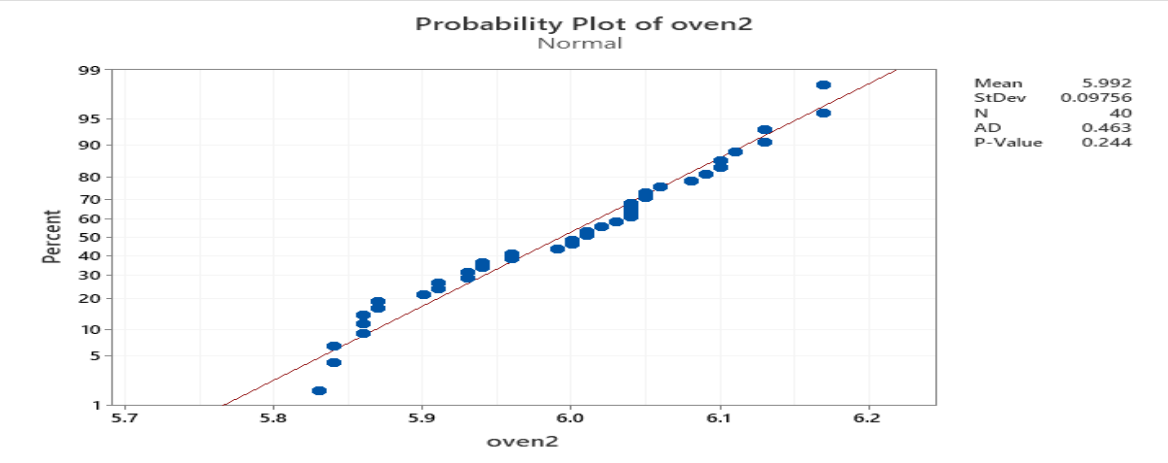
Number of runs about median:	12	Number of runs up or down:	22
Expected number of runs:	21.0	Expected number of runs:	26.3
Longest run about median:	9	Longest run up or down:	8
Approx P-Value for Clustering:	0.002	Approx P-Value for Trends:	0.048
Approx P-Value for Mixtures:	0.998	Approx P-Value for Oscillation:	0.952

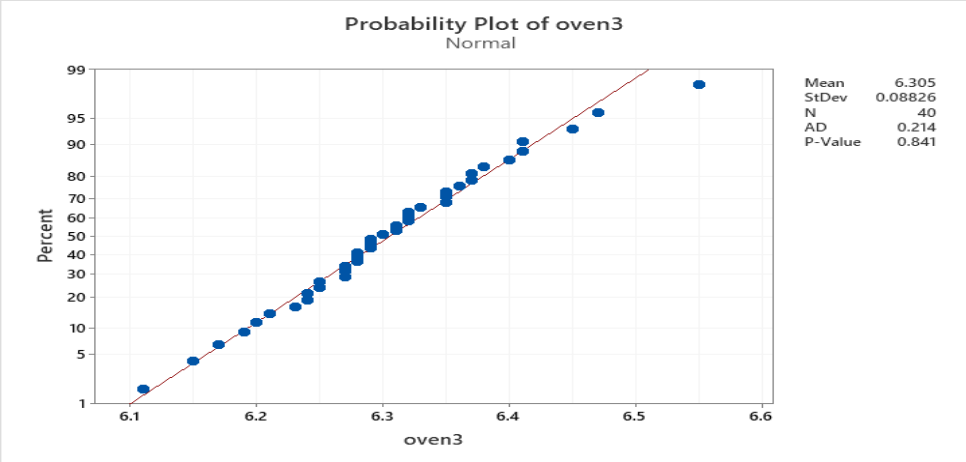
Inference :

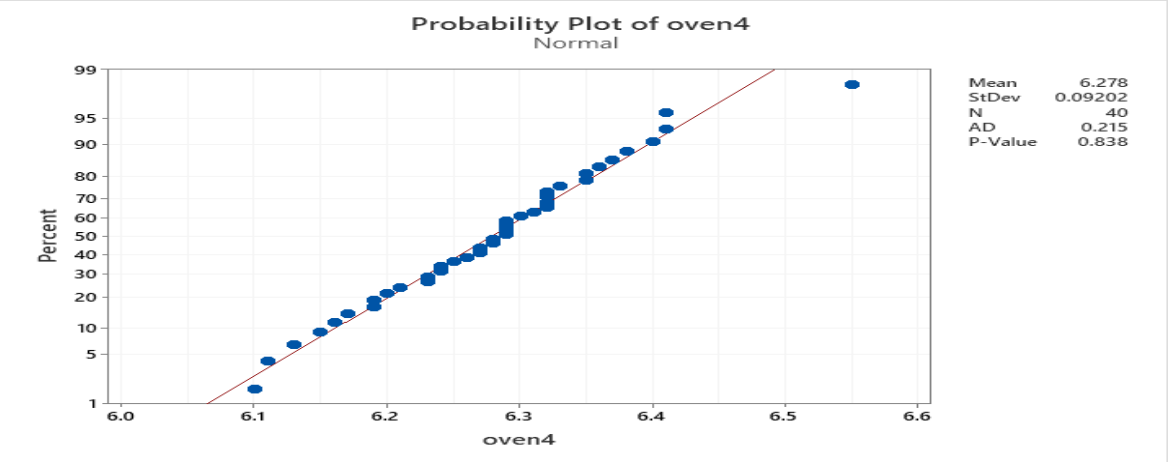
- Oven 1, Oven 2 & Oven 3 - P > 0.05 – No special causes in the process
- Oven 4 – P < 0.05 and having visible pattern and special causes thus data cannot be used for further analysis

Data collection – Normality plot (Before improvement)







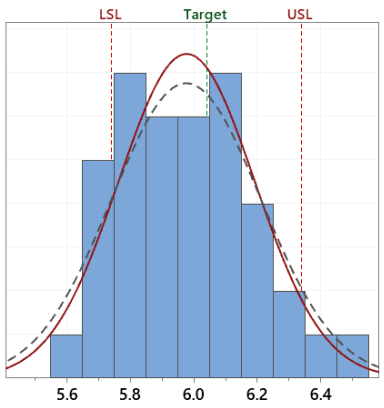


Inference :

- P > 0.05 in all oven thus all the data is normally distributed

Data collection – Process capability (Before improvement)

Process Capability Report for Oven 1



Process Data	
LSL	5.74
Target	6.04
USL	6.34
Sample Mean	5.97725
Sample N	40
StDev(Overall)	0.214607
StDev(Within)	0.235725

Overall
Within

Overall Capability	
Pp	0.47
PPL	0.37
PPU	0.56
Ppk	0.37
Cpm	0.45

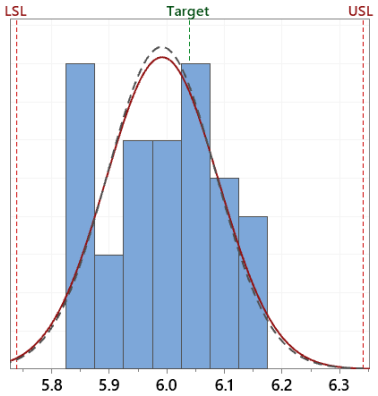
Potential (Within) Capability	
Cp	0.42
CPL	0.34
CPU	0.51
Cpk	0.34

Performance

	Observed	Expected Overall	Expected Within
PPM < LSL	150000.00	134469.99	157094.58
PPM > USL	50000.00	45485.70	61917.83
PPM Total	200000.00	179955.69	219012.41

The actual process spread is represented by 6 sigma.

Process Capability Report for Oven 2



Process Data	
LSL	5.74
Target	6.04
USL	6.34
Sample Mean	5.99175
Sample N	40
StDev(Overall)	0.097557
StDev(Within)	0.0943353

Overall
Within

Overall Capability	
Pp	1.03
PPL	0.86
PPU	1.19
Ppk	0.86
Cpm	0.93

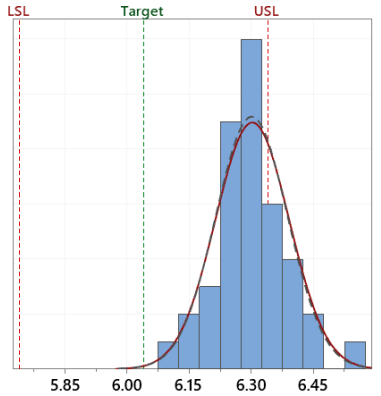
Potential (Within) Capability	
Cp	1.06
CPL	0.89
CPU	1.23
Cpk	0.89

Performance

	Observed	Expected Overall	Expected Within
PPM < LSL	0.00	4932.27	3807.60
PPM > USL	0.00	178.69	111.42
PPM Total	0.00	5110.96	3919.01

The actual process spread is represented by 6 sigma.

Process Capability Report for Oven3



Process Data	
LSL	5.74
Target	6.04
USL	6.34
Sample Mean	6.30225
Sample N	40
StDev(Overall)	0.0889393
StDev(Within)	0.086834

Overall
Within

Overall Capability	
Pp	1.12
PPL	2.11
PPU	0.14
Ppk	0.14
Cpm	0.36

Potential (Within) Capability	
Cp	1.15
CPL	2.16
CPU	0.14
Cpk	0.14

Performance

	Observed	Expected Overall	Expected Within
PPM < LSL	0.00	0.00	0.00
PPM > USL	325000.00	335619.94	331876.42
PPM Total	325000.00	335619.94	331876.42

The actual process spread is represented by 6 sigma.

Inference –

- Oven 1 & 2 – CpK is < 1.33, hence processes are not capable. Since Mean is nearer to target, variation need to be reduced
- Oven 3 – Cpk value is very less in comparison to other oven and most of the collected data is near to upper specified limit, which indicates oven 3 needs improvement.

Project Phase

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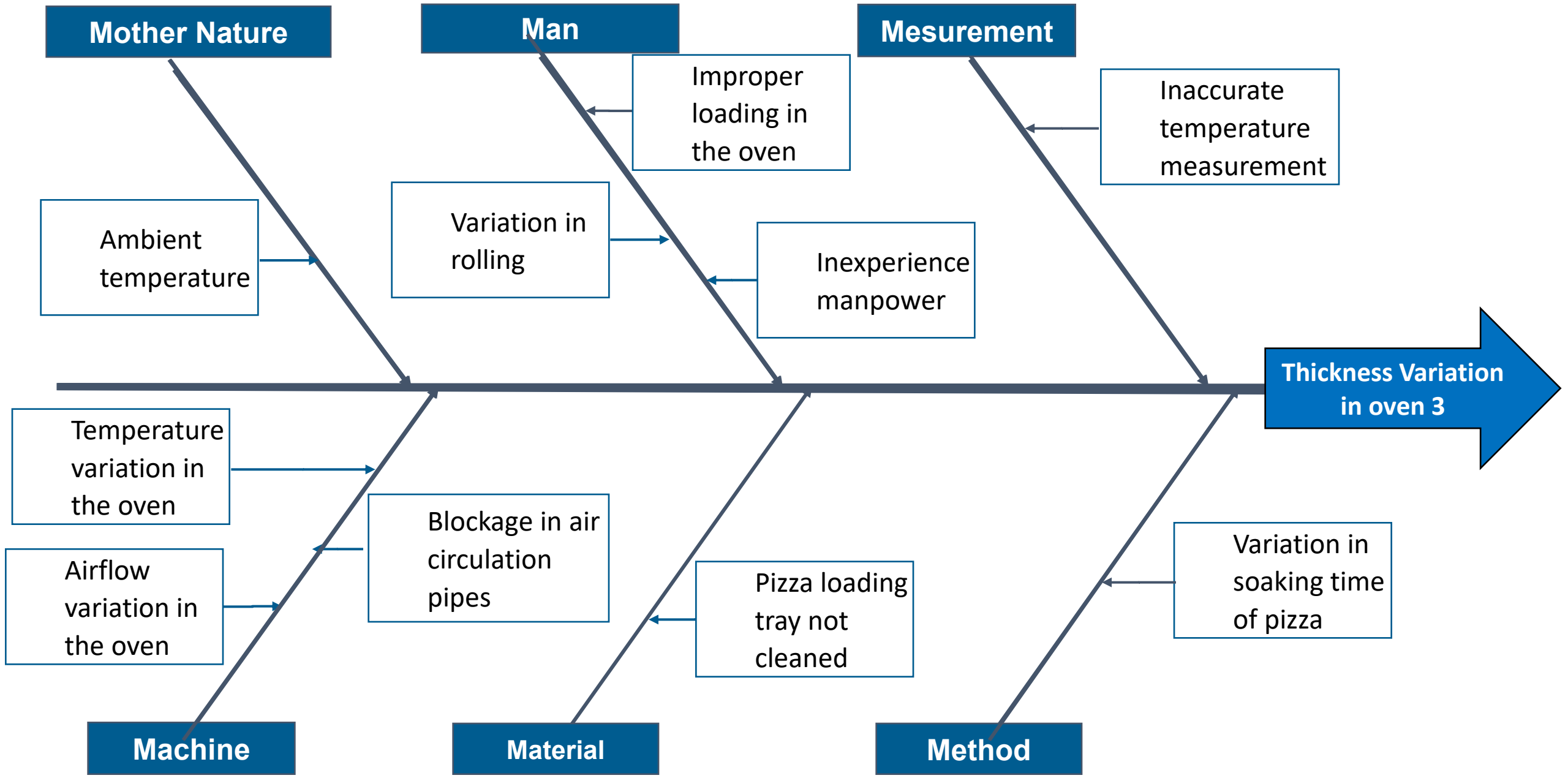
Analysis – Fish Bone Diagram



Data Collection – (X-Y diagram)

Output variable	Taste	Delivery time	Uncooked pizza	Burnt pizza	Price	Size of pizza	Net score
Priority (output rating)	9	8	9	9	5	9	
Input variables							
Temperature variation in the oven	9	3	9	9	1	9	353
Airflow variation in the oven	3	3	9	9	1	9	299
Variation in thickness of rolled pizzas	3	1	9	9	1	3	229
Inexperienced manpower loading the oven	3	3	3	3	3	1	129
Improper loading in oven	3	3	3	3	1	1	119
Ambient temperature	1	1	3	3	1	3	103
Inaccurate Temperature measurement	1	3	0	0	0	3	60

Inference :

- Temperature variation, Airflow variation and Variation in thickness of the pizzas were prioritized for data collection

Analyse – Hypothesis testing for thickness mean for all oven

One-way ANOVA: Oven 1, Oven 2, Oven 3

Method

Null hypothesis	All means are equal
Alternative hypothesis	Not all means are equal
Significance level	α = 0.05

Equal variances were not assumed for the analysis.

Factor Information

Factor	Levels	Values
Factor	3	Oven 1, Oven 2, Oven 3

Welch's Test

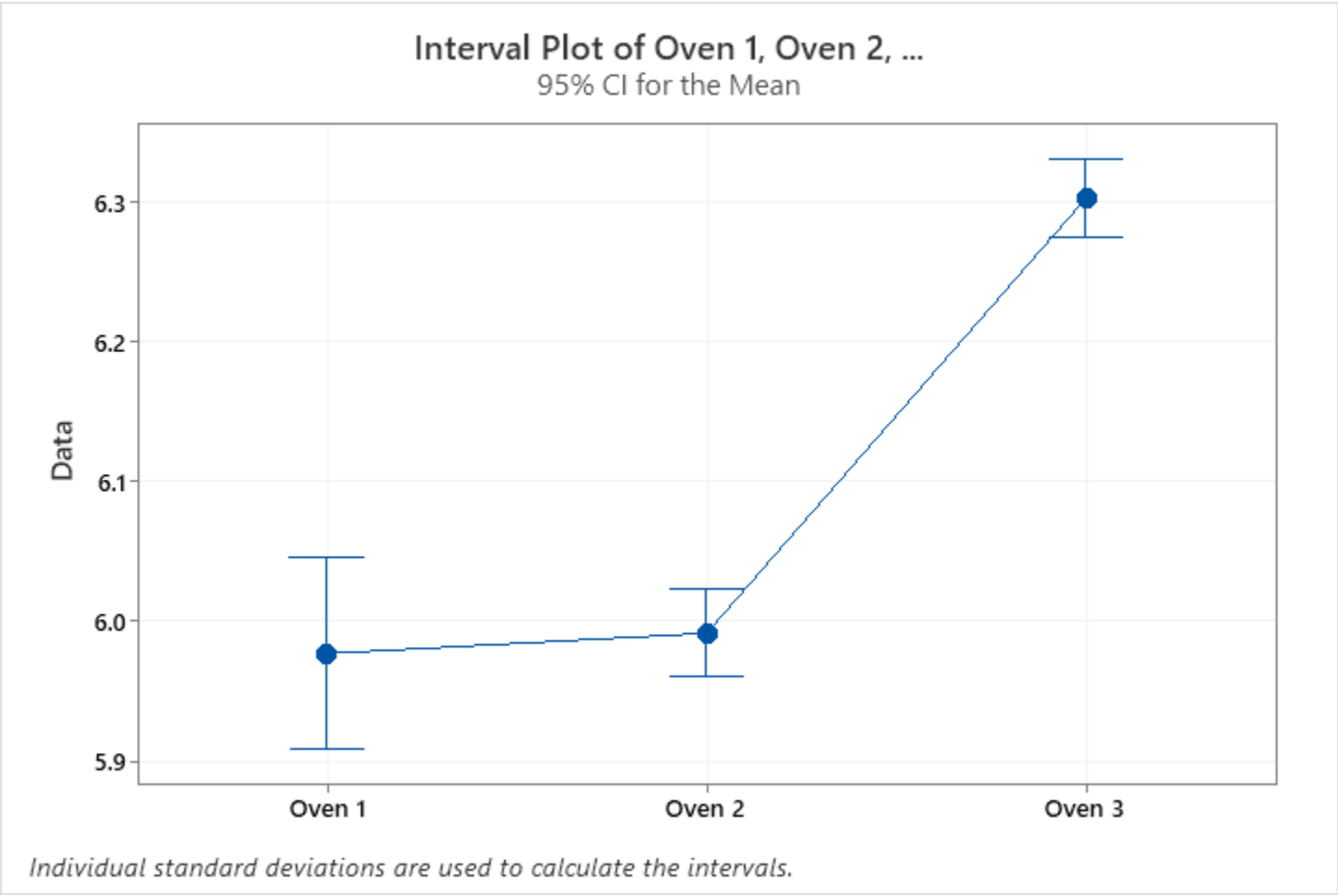
Source	DF Num	DF Den	F-Value	P-Value
Factor	2	72.7867	122.97	0.000

Model Summary

R-sq	R-sq(adj)	R-sq(pred)
52.13%	51.32%	49.65%

Means

Factor	N	Mean	StDev	95% CI
Oven 1	40	5.9772	0.2146	(5.9086, 6.0459)
Oven 2	40	5.9918	0.0976	(5.9605, 6.0230)
Oven 3	40	6.3022	0.0889	(6.2738, 6.3307)



Inference :

- Since p < 0.05, thus not all means are equal
- There is significate difference between oven 1, oven 2 and oven 3
- Oven 3 pizza thickness is much higher than other oven

Analyse – Regression analysis

Regression Analysis: Thickness_1 versus Temp, Rolling thickness, airflow

Backward Elimination of Terms

α to remove = 0.05

Regression Equation

Thickness_1 = 6.8584 - 0.003449 Temp + 0.03252 airflow

Coefficients

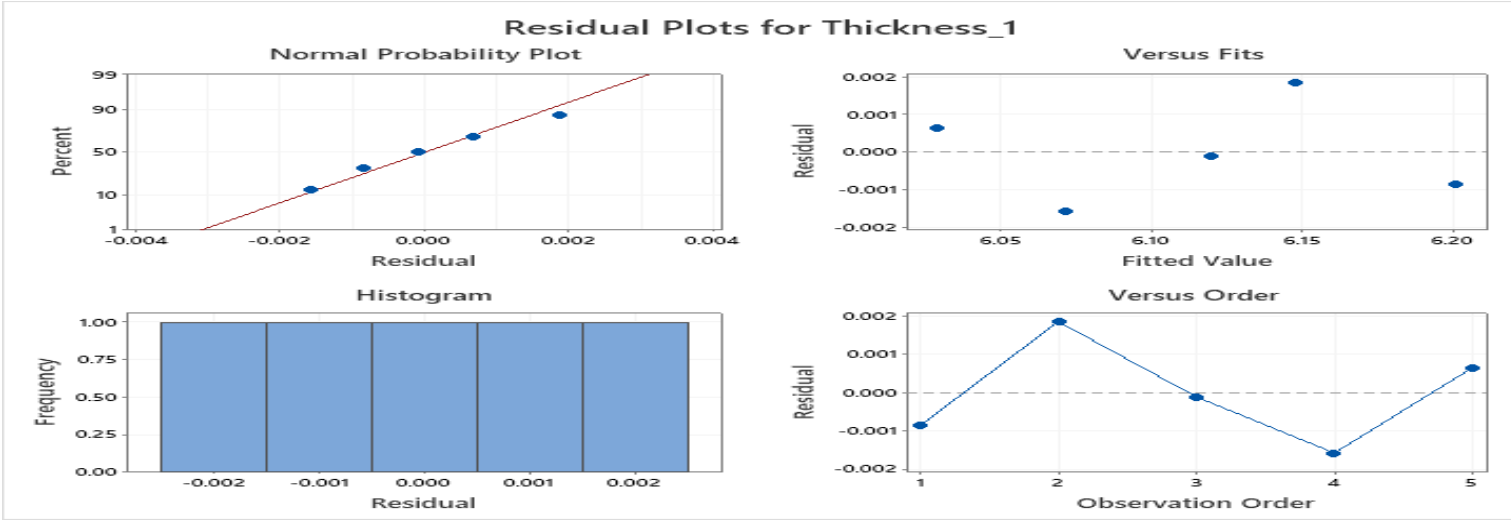
Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	6.8584	0.0609	112.71	0.000	
Temp	-0.003449	0.000127	-27.06	0.001	4.95
airflow	0.03252	0.00618	5.26	0.034	4.95

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.0018781	99.96%	99.92%	98.96%

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	2	0.017713	0.008856	2510.74	0.000
Temp	1	0.002584	0.002584	732.45	0.001
airflow	1	0.000098	0.000098	27.70	0.034
Error	2	0.000007	0.000004		
Total	4	0.017720			



Inference :

- All input data (X) are continuous and Output data (Y) is also continuous thus Multiple Linear Regression used
- 8 step validation
  - Overall Regression and individual p value is less than 0.05 in ANOVA Table
  - VIF is also less than 5
  - R-Sq Adj is above 85 %
  - Residual analysis - Normality plot shows data is normally distributed, equal variance shows the random behaviour, Residual observation order run chart is OK and Histogram does not shows any outlies
- Since it is passing all the step regression equation is valid and Temperature and Airflow are critical input.

Summary of Statistically validated Root causes

- Temperature and air flow variation in oven is critically important

Project Phase

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Improve

Design of Experiment

StdOrder	RunOrder	CenterPt	Blocks	Temperature	Airflow	Thickness
3	1	1	1	-1	1	6.19
5	2	0	1	0	0	6.10
6	3	0	1	0	0	6.11
4	4	1	1	1	1	6.06
1	5	1	1	-1	-1	6.17
2	6	1	1	1	-1	6.03

Factorial Regression: Thickness versus Temperature, Airflow, CenterPt

Coded Coefficients

Term	Effect	Coef	SE Coef	T-Value	P-Value	VIF
Constant		6.11000	0.00289	2116.57	0.000	
Temperature	-0.13500	-0.06750	0.00354	-19.09	0.000	1.00
Airflow	0.02500	0.01250	0.00354	3.54	0.038	1.00

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.0070711	99.21%	98.68%	96.87%

Improve

Design of Experiment

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Model	2	0.018850	0.009425	188.50	0.001
Linear	2	0.018850	0.009425	188.50	0.001
Temperature	1	0.018225	0.018225	364.50	0.000
Airflow	1	0.000625	0.000625	12.50	0.038
Error	3	0.000150	0.000050		
Curvature	1	0.000075	0.000075	2.00	0.293
Lack-of-Fit	1	0.000025	0.000025	0.50	0.608
Pure Error	1	0.000050	0.000050		
Total	5	0.019000			

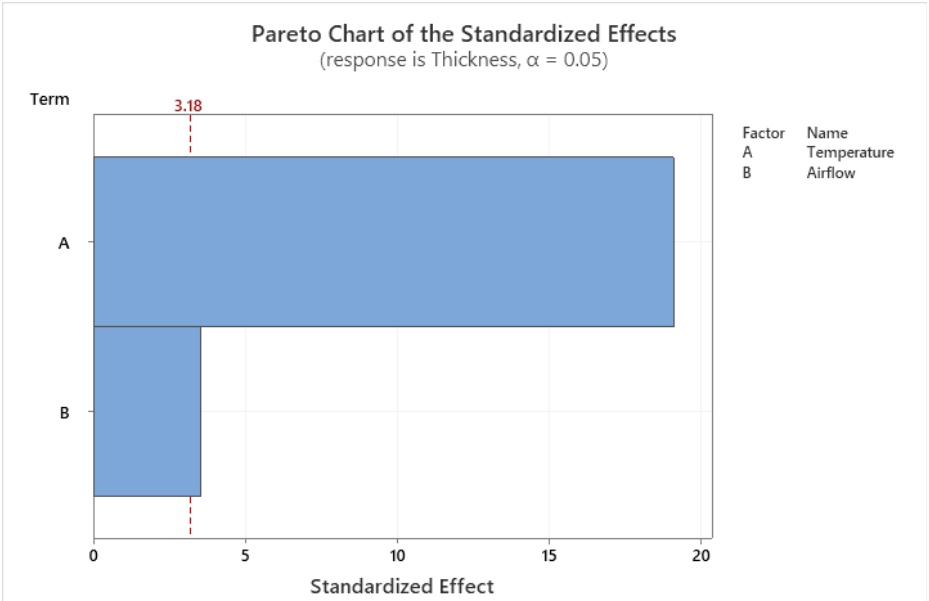
Regression Equation in Uncoded Units

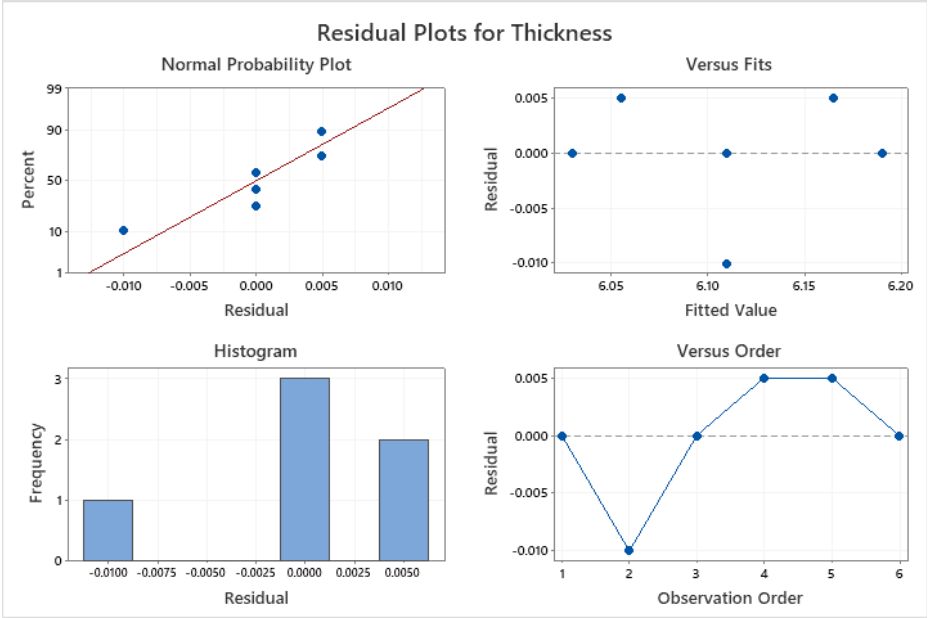
Thickness = 6.11000 - 0.06750 Temperature + 0.01250 Airflow

Inference :

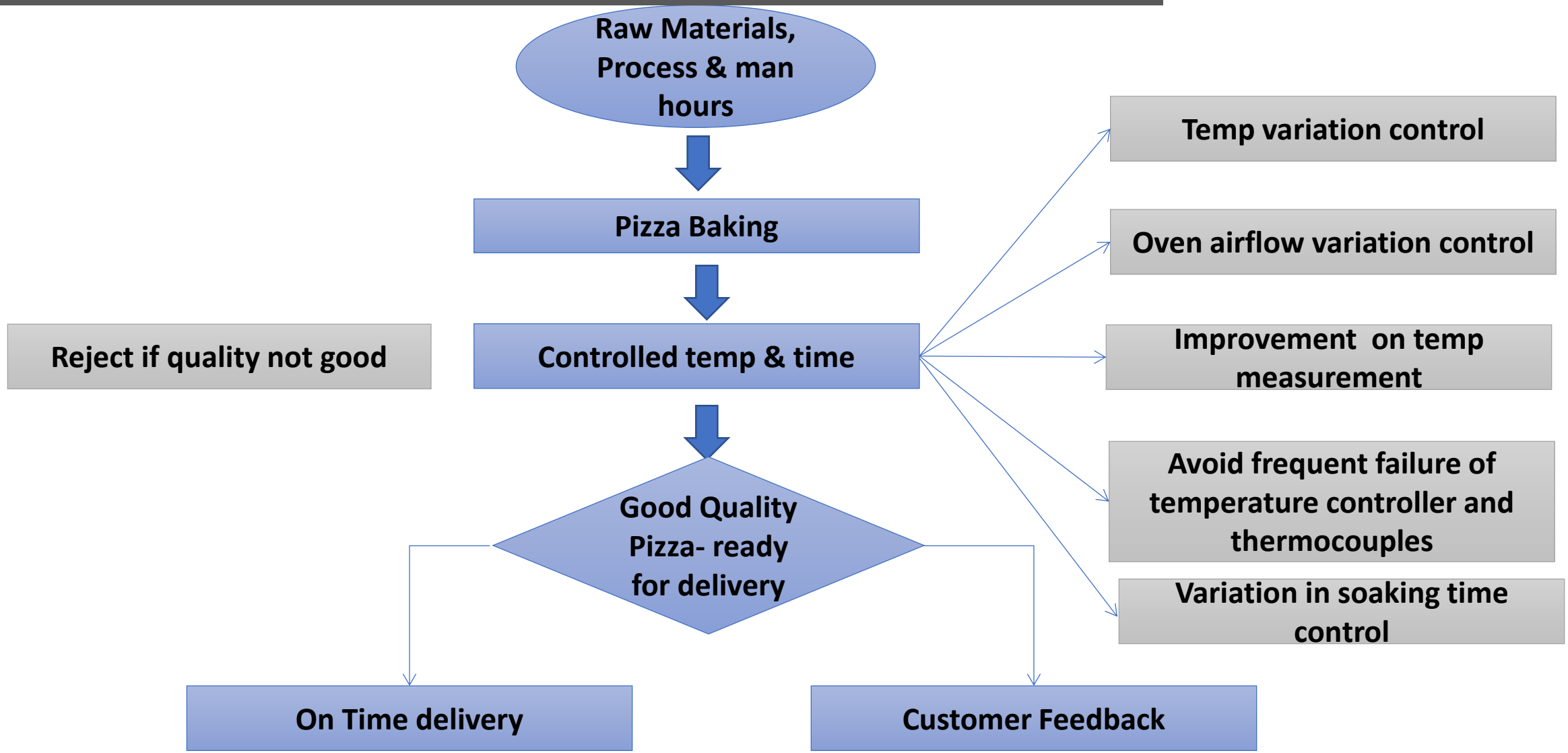
8 step validation

- **Overall Model and individual p value is less than 0.05**
- **VIF is also less than 5**
- **R-Sq Adj is above 85 %**
- **Residual analysis - Normality plot shows data is normally distributed, equal variance shows the random behaviour, Residual observation order run chart is OK and Histogram does not shows any outlies**
- **Since it is passing all the step regression equation is valid and Temperature and Airflow are critical input.**



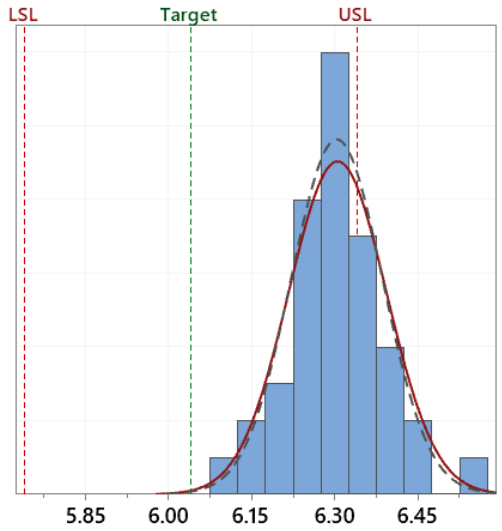


Improve – Process Mapping (After Improvement)



Improve – Process capability – Before & After Improvement

Process Capability Report for Oven 3 Before



Process Data	
LSL	5.74
Target	6.04
USL	6.34
Sample Mean	6.30475
Sample N	40
StDev(Overall)	0.0882592
StDev(Within)	0.0827423

Overall
Within

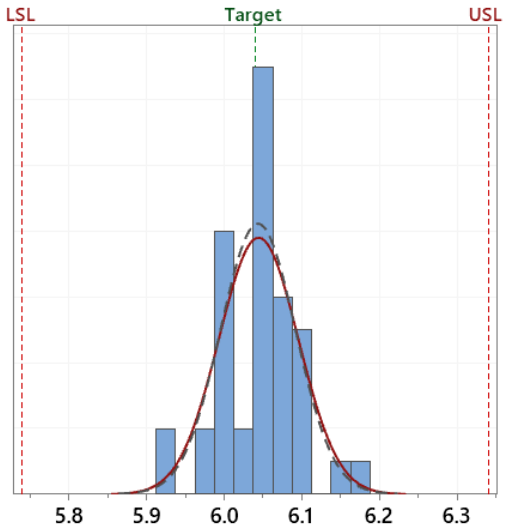
Overall Capability	
Pp	1.13
PPL	2.13
PPU	0.13
Ppk	0.13
Cpm	0.36
Potential (Within) Capability	
Cp	1.21
CPL	2.28
CPU	0.14
Cpk	0.14

Performance

	Observed	Expected Overall	Expected Within
PPM < LSL	0.00	0.00	0.00
PPM > USL	325000.00	344802.21	335046.12
PPM Total	325000.00	344802.21	335046.12

The actual process spread is represented by 6 sigma.

Process Capability Report for Oven 3 After



Process Data	
LSL	5.74
Target	6.04
USL	6.34
Sample Mean	6.04425
Sample N	40
StDev(Overall)	0.051085
StDev(Within)	0.0484179

Overall
Within

Overall Capability	
Pp	1.96
PPL	1.99
PPU	1.93
Ppk	1.93
Cpm	1.98
Potential (Within) Capability	
Cp	2.07
CPL	2.09
CPU	2.04
Cpk	2.04

Performance

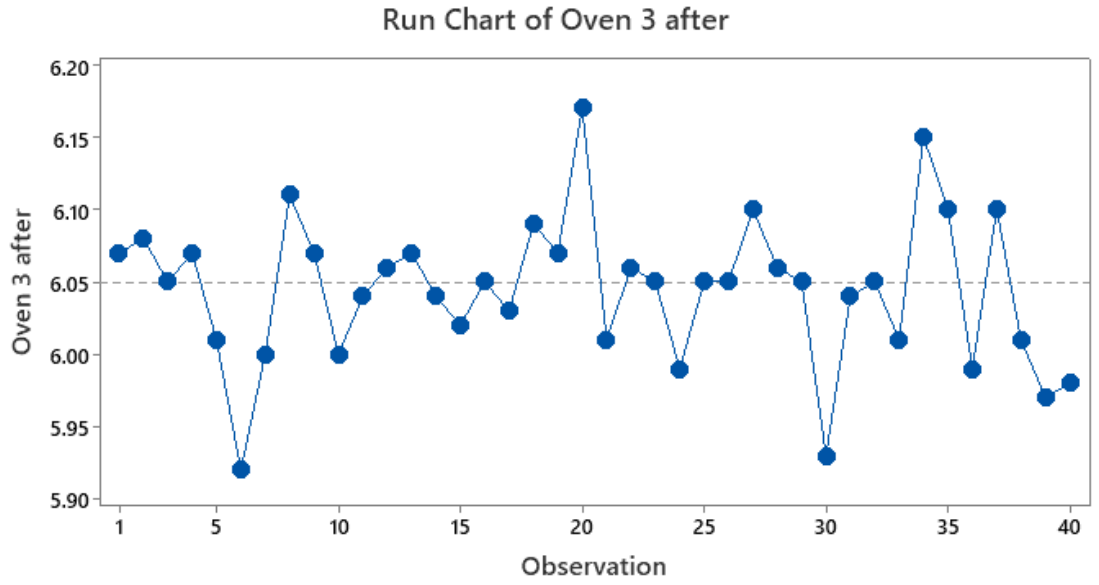
	Observed	Expected Overall	Expected Within
PPM < LSL	0.00	0.00	0.00
PPM > USL	0.00	0.00	0.00
PPM Total	0.00	0.00	0.00

The actual process spread is represented by 6 sigma.

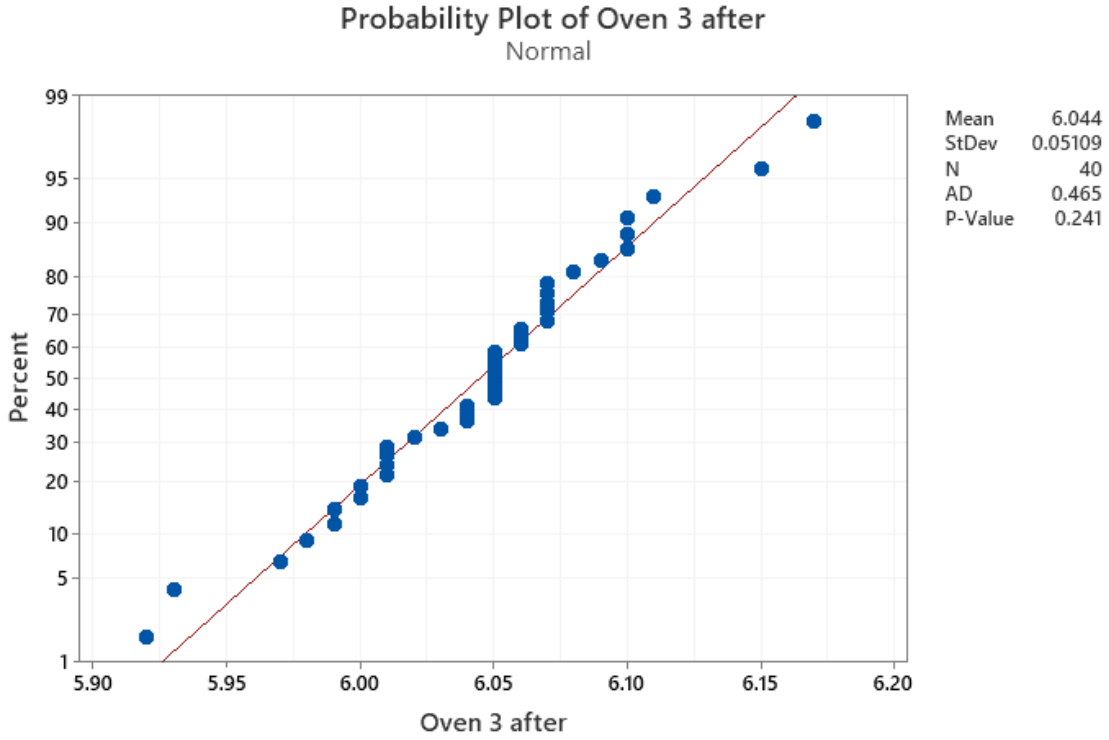
Inference :

- Before Cpk < After Cpk, which shows process is much more capable after improvement
- There is less variability in system since stdev reduced after improvement
- After improvement the data are normally distributed near the target within specified limit

Improve – Run chart and Normality Test (After Improvement)



Number of runs about median:	18	Number of runs up or down:	27
Expected number of runs:	20.2	Expected number of runs:	26.3
Longest run about median:	5	Longest run up or down:	3
Approx P-Value for Clustering:	0.231	Approx P-Value for Trends:	0.601
Approx P-Value for Mixtures:	0.769	Approx P-Value for Oscillation:	0.399



Inference:

- Run chart – process is stable there is no special causes in the process (p value > 0.05)

Inference:

- Normality test – Data are normally distributed

Improve –After Improvement (Statistical validation for Improvement – Hypothesis Testing)

Two-Sample T-Test and CI: Oven 3 Before, Oven 3 after

Method

μ₁: population mean of Oven 3 Before
μ₂: population mean of Oven 3 after
Difference: μ₁ - μ₂

Equal variances are not assumed for this analysis.

Descriptive Statistics

Sample	N	Mean	StDev	SE Mean
Oven 3 Before	40	6.3048	0.0883	0.014
Oven 3 after	40	6.0443	0.0511	0.0081

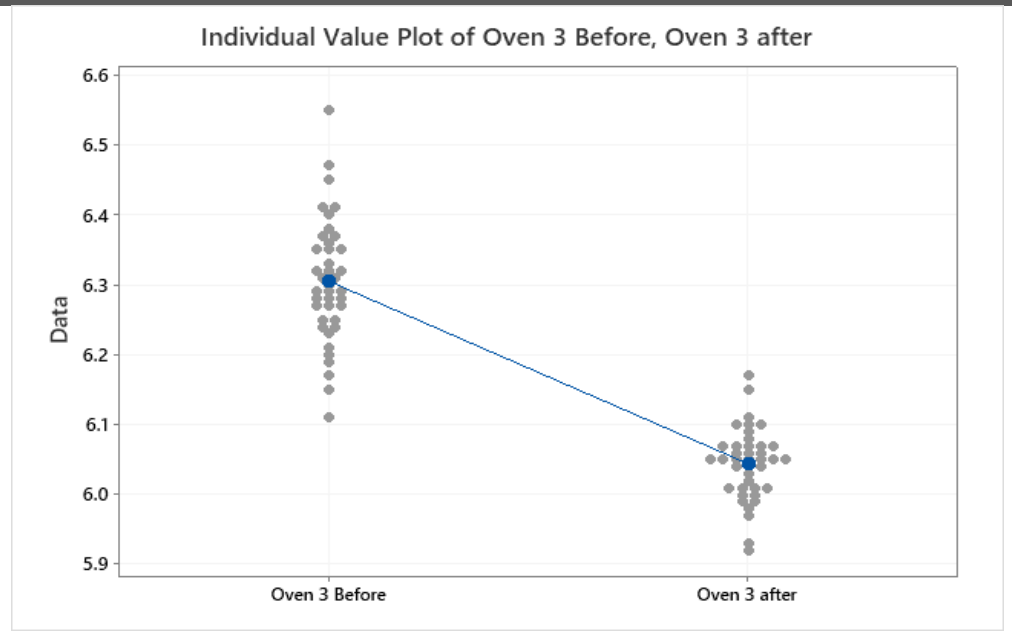
Estimation for Difference

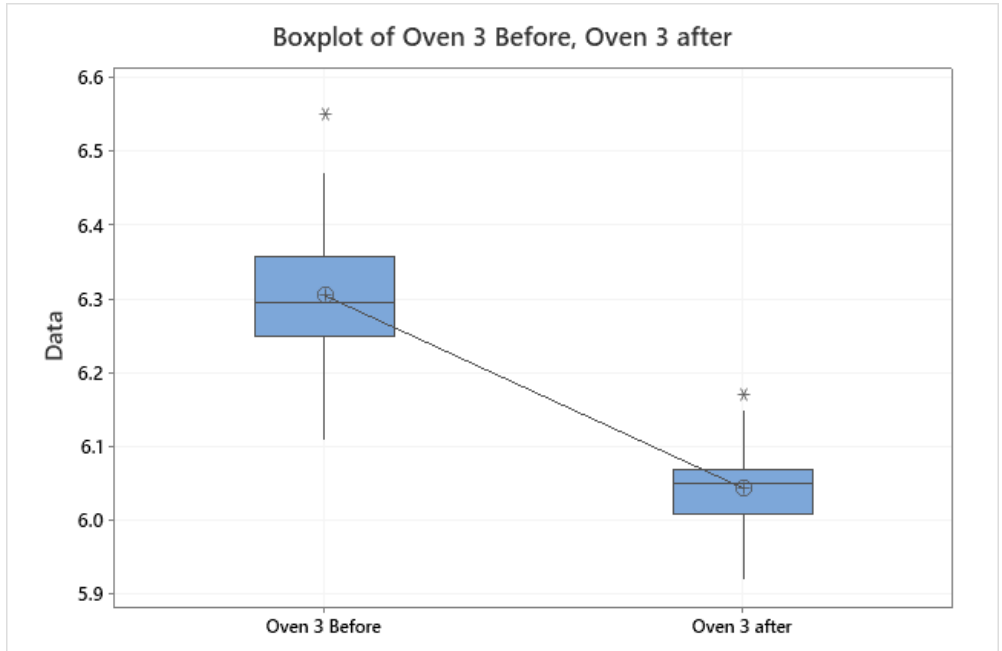
Difference	95% CI for Difference
0.2605	(0.2283, 0.2927)

Test

Null hypothesis H₀: μ₁ - μ₂ = 0
Alternative hypothesis H₁: μ₁ - μ₂ ≠ 0

T-Value	DF	P-Value
16.16	62	0.000



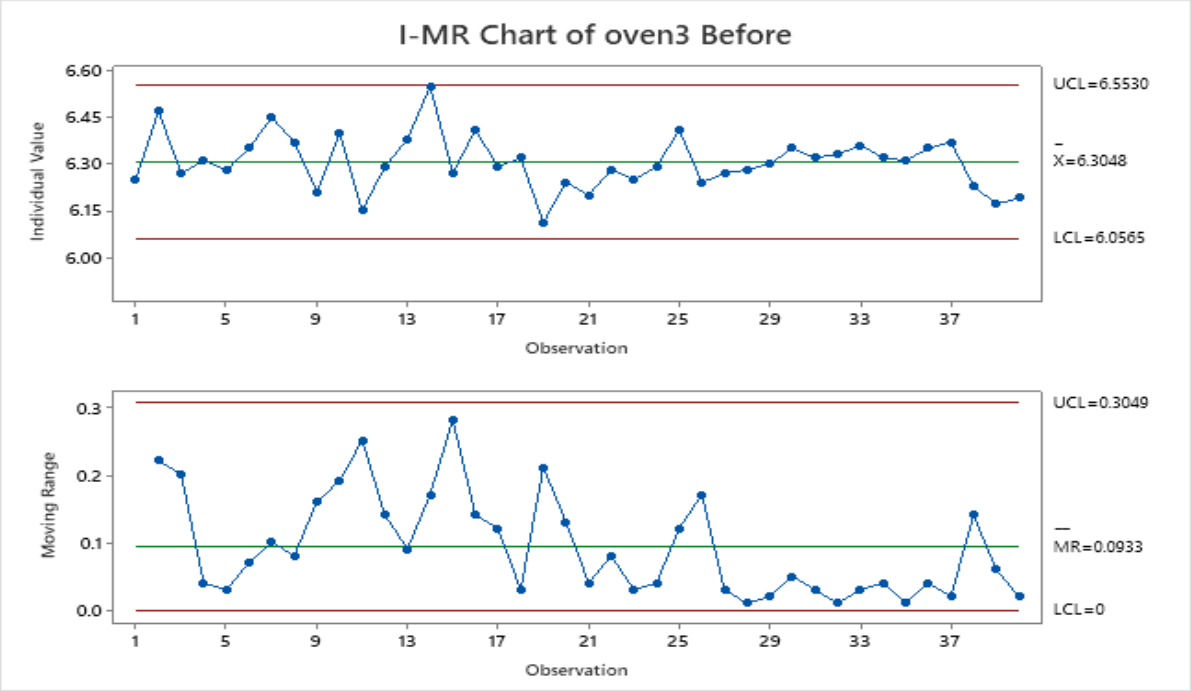


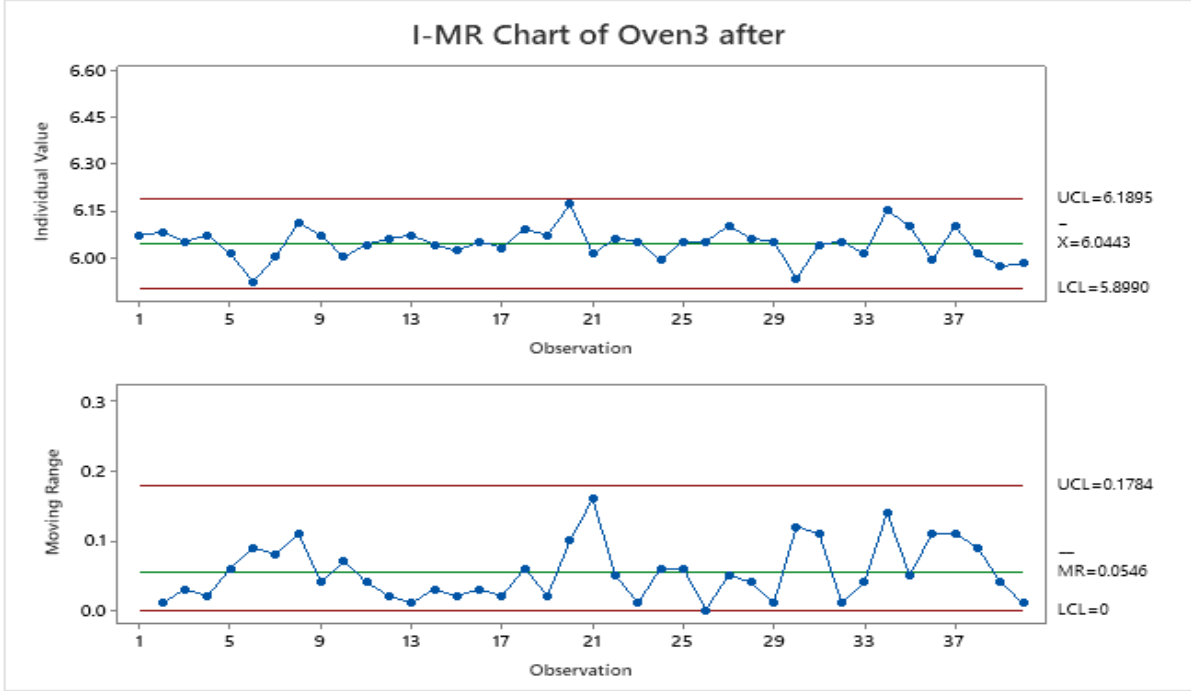
Inference:

- **Since P value is less than 0.05, there is enough evidence to reject the null hypothesis and we can conclude that the difference between the population means is statistically significant.**
- **It is also visible from the individual value plot & box plot, there is clear difference in mean after improvement which is closer to required thickness**

Improve (Statistical validation for Improvement – I-MR Chart)

I-MR Chart of oven3 Before, Oven3 after





Inference:

- As seen in control chart, before improvement mean was high and there was high variability in the thickness and after improvement, it has achieved to target thickness and less variability
- There is a significant reduction in variation in thickness

FMEA

FAILURE MODE AND EFFECTS ANALYSIS

Item:	Oven	Responsibility:	Mr. Ali	FMEA number:	Oven1234
Model:	Current	Prepared by:	Mr. Ali	Page :	1 of 1
Core Team:	Ali (Engineering), XX (Production), YY (Quality)			FMEA Date (Orig):	12/06/2022 Rev: 1

Process Function	Potential Failure Mode	Potential Effect (s) of Failure	Sev	Class	Potential Cause(s) / Mechanism (s) of Failure	Occur	Current Process Controls	Detect	RPN	Recommended Action (s)	Responsibility and Target Completion Date	Action Results				
												Actions Taken	Sev	Occ	Det	RPN
Pizza Baking process	Oven Temp too high	Short cooking time	3	N/A	Incorrectly set temp and inaccurate thermostat	3	Temp controlled by thermostat	5	45	1. Train staff to set correct temp 2. Calibration of thermostat 3. Add alarm, if temp is not as per specified limit.	Ali / 12/07/2022	Control measure in place	1	1	5	5
		Cooking burn	5	N/A		2		5	50				1	1	5	5
	Oven Temp too low	Longer cooking time	3	N/A	Incorrectly set temp and inaccurate thermostat	3		5	45				1	1	5	5
		Undercooked	5	N/A		2		5	50				1	1	5	5

Overview

Overview

Define

Measure

Analyze

Improve

Control

Control – 2 sample t-test after improvement for % Scrap

WORKSHEET 10

Two-Sample T-Test and CI: Oven 3 Before Improvement, Oven 3 After improvement

Method

μ_1: population mean of Oven 3 Before Improvement
μ_2: population mean of Oven 3 After improvement
Difference: $\mu_1 - \mu_2$

Equal variances are not assumed for this analysis.

Descriptive Statistics

Sample	N	Mean	StDev	SE Mean
Oven 3 Before Improvement	6	19.88	7.98	3.3
Oven 3 After improvement	6	4.883	0.376	0.15

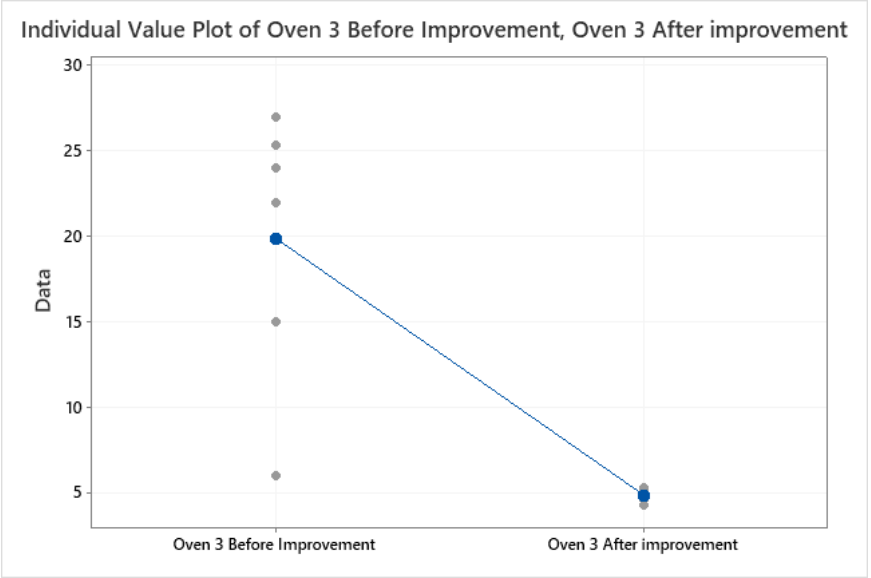
Estimation for Difference

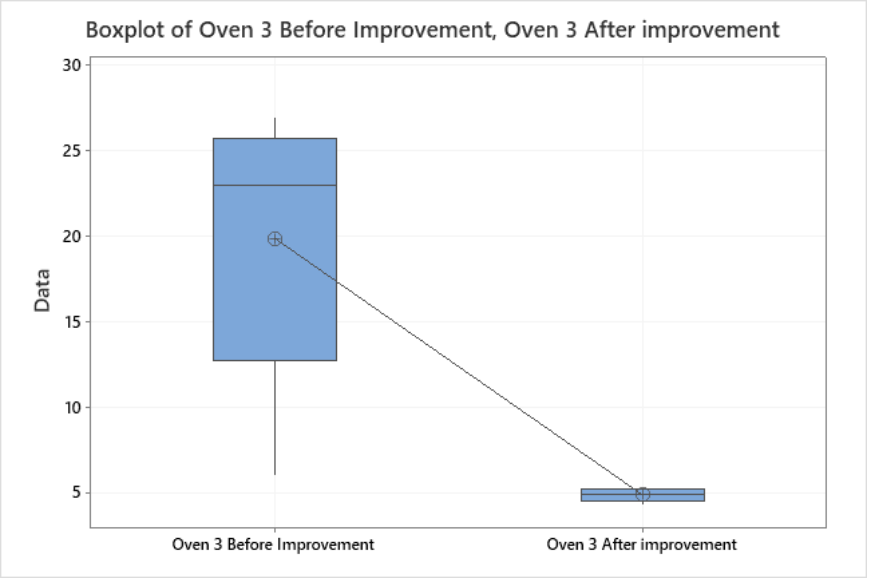
Difference	95% CI for Difference
15.00	(6.62, 23.38)

Test

Null hypothesis $H_0: \mu_1 - \mu_2 = 0$
Alternative hypothesis $H_1: \mu_1 - \mu_2 \neq 0$

T-Value	DF	P-Value
4.60	5	0.006

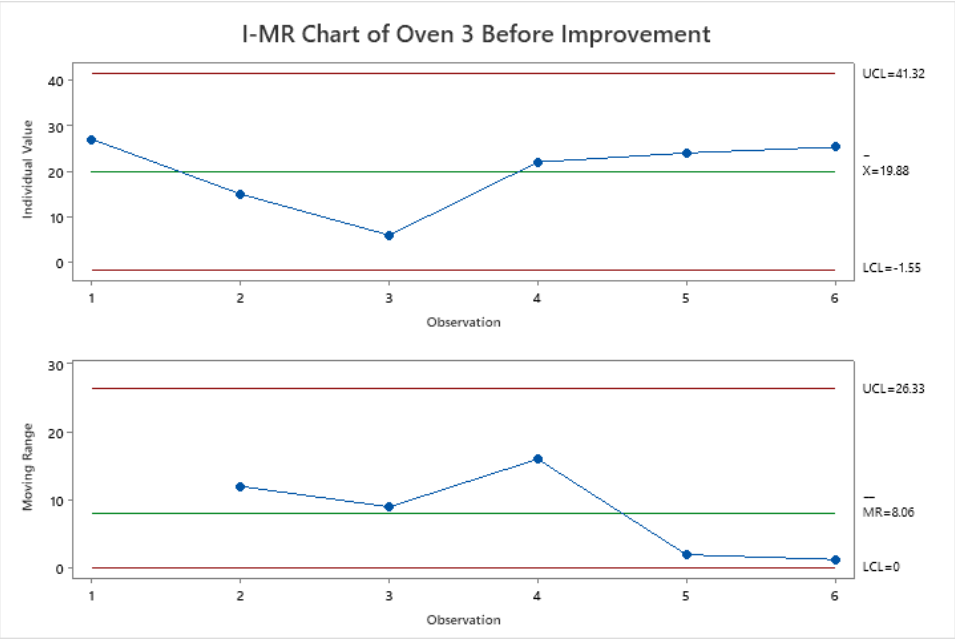




Inference:

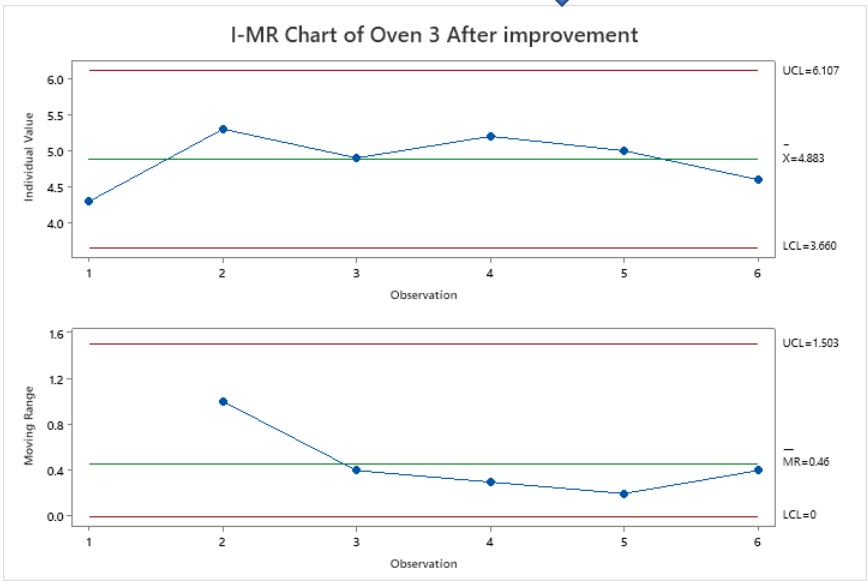
- **Since P value is less than 0.05, there is enough evidence to reject the null hypothesis and we can conclude that the difference between the population means is statistically significant.**
- **It is also visible from the individual value plot & box plot, there is clear difference in mean after improvement.**

Control – Control Chart for % scrap Before & after improvement



Inference:

- There is significant improvement on scrap reduction after improvement



Control Plan

CONTROL PLAN

☐ Prototype ☑ Prelaunch ☐ Production

Control Plan Number - **PizzaMania-001-2022**		Key Contact/Phone - **Mr. Ali / Owner of Pizzamania/ 00971 XXXX XXXX**	Date(Orig) - **12/06/2022** / Date (Rev.)
Part Number/Latest Change Level - **Oven**		Core Team - **Mr. Ali & Team**	Customer Eng. Approval/Date - **N/A**
Part Name/Description - **Thermocouple, Heating Element, Bricks & Temperature Controller**		Organization/Plant Approval/Date - **12/06/2022**	Customer Quality Approval/Date (if Req'd) - **NA**
Organization/Plant - **Pizzamania, Abu Dhabi, UAE**	Organization Code - **PizzaMania001**	Other Approval/Date (If Req'd) - **N/A**	Other Approval/Date (If Req'd) - **N/A**

Part / Process Number	Process Name / Operation Description	Machine, Device, Jig, Tools, for Mfg.	Characteristics			CTQ ?	Methods					Reaction Plan
			No.	Product	Process		Product / Process Specification / Tolerance	Evaluation / Measurement Technique	Sample Size	Sample Freq.	Control Method	
1	Thermocouple	Calibration unit	1a	Fixed in proper place for measurement	Temperature Measurement	Y	Measuring temperature	Calibration	NA	Twice in a day	Temp Stability study	Conduct the detailed study before replacing the thermocouple
2	Heating element	Coil	1b	Located in furnace	Temperature inside furnaces	Y	Heating up to define limit	NA	NA	During AMC	Life cycle study	If life cycle not as per required timeline , seek the better quality product
3	Furnace bricks	Bricks	2a	-	-	N	good in shape	visible check for any broken bricks	NA	Daily before starting Furnace	Visible Monitoring	None
4	Temp Controller	Regulator	3	Regulator knob to adjust the temp	Controlling the temp inside the furnace	Y	Controlling temperature at given tolerance	Alarming if temperature controller not working	NA	Automatic alarm system	Calibrating the controller	Replace the controller

Conclusion

Results after improvement

- **Project has achieved its intended results after improving thickness by identifying the variation cause and reducing scrap rate.**