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Lean Six Sigma Implementation on Reducing Incoming Processes Time in QA Department at Reckitt Benckiser Sdn Bhd

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ABSTRACT

The purpose of this project is to reduce the incoming process time in QA department and identify the non-value added. The main products of this company are producing household and health personal care products. This product have high demand customer from various country such as Singapore, Thailand and United State. This significant of this project is to overcome the delay at the Incoming QA unit, where huge of products need to be inspect simultaneously by visualize the process by using Value Stream Mapping. Lean Six Sigma is a method that depends on a cooperative team energy to improve performance by systematically removing waste and reducing variation. DMAIC were the constructive phases used in Lean Six Sigma methodology. Lean Six Sigma projects encompass features of Lean's waste elimination and process speed concentration and the Six Sigma emphasis on reducing defects and variation, based on critical to quality and process characteristics which comprises the Lean and Six Sigma tools.

Key words: Lean Six Sigma; Incoming Process; Improvement.

1. INTRODUCTION

Reckitt Benckiser is an enormously successful worldwide Fast-Moving Consumer (FMCG) company. The name behind many market-leading domestic, household, well-being and personal care product such as Dettol, Shieldtox, Vanish, Airwick, Strepsila, Veet, Clearasil and others. This company operates over 60 countries. Reckitt Benckiser Malaysia only produced an aerosol type of products.

Lean and Six Sigma are two systematic structures that have been comprehensively well-designed from manufacturing to transactional and service industries in different industries [1]-[2]. Nevertheless, the organizations that have applied Six Sigma or Lean Manufacturing or Management could discover that even after redeveloping their operating and supporting systems by solving major problems and resolving key inefficiencies, they eventually reached a point of decreasing return [3]. Subsequently this fact of decreasing returns, additional enhancements have stalled or are not at all longer easy to produce [4].

Lean Six Sigma is a concept tools whereby combines the lean principles of speediness and instantaneous accomplishment with the cultural, organization process in order to achieve the fastest degree of enhancement and improvement in customer satisfaction, cost, quality, process speed and invested capital whereby variations can be minimized [5]-[6]. Six Sigma methodologies is a proven tools which reduce product defect through improved work process whereby DMAIC philosophy is used for process improvement throughout the project [7]-[8].

2. PROBLEM STATEMENT

QC unit has a huge responsibility to inspect for every product that are produce by the production unit. Due to this situation, it contributes a tremendous delay of time in inspection unit. Thus, it will affect the time delivery to the respected customers, which may result a bad reputation for the company.

3. OBJEVTIVE

Following by the explanation in background and motivation, the following of three main objectives were set for this project:

- To analyze the waste of each processes in the QA department.
- To identify crucial problems at QA unit that contributes to late product delivery.
- To improve delay time of delivering the goods.

4. IV. DMAIC

George [9] mentioned that Motorola recognized that there was a design and pattern leading towards process improvement that could actually be divided into five transformational phases which are known simply as DMAIC.

4.1 Define

To identify and validate the opportunity (Figure 1-Figure 5) where improvement can have a significant impact on customer and business [10]. Figure 1 shown the project selection using Big Y Analysis. Then follow by the next step which translating voice of business (VOB) into critical to process (CTP) as reflected in Figure 2.

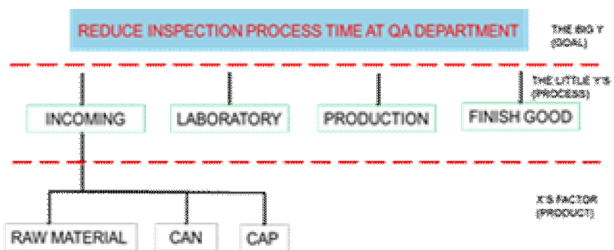

Figure 1: Big Y Analysis.

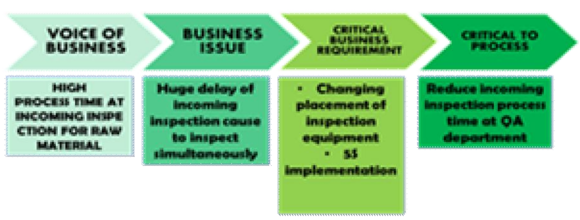

Figure 2: Translating VOB to CTP.

Table 1: Project Risk Assessment.

NO	Success Predictors	Rating (Yes=2, Partial=1, No=0)
1	Project is a strategic priority	2
2	Key stakeholders are willing to try new solution	2
3	There are sufficient reasons for change	2
4	There is a clear and measurable goal	2
5	A significant ROI expectation has been established	1
6	Right vertical and horizontal team members are available	2
7	Several team members are top talent and innovative thinkers	2
8	Management is willing to commit serious resources to solutions	1
9	Project is capable of completion within 3 to 6 months	1
10	Lean Six Sigma coach is assigned	2
	Total Success Probability Rating	17

Low= 0-14

Medium= 15-17

High= 18-20

Table 1 shows the success probability faced by this team is at medium level.

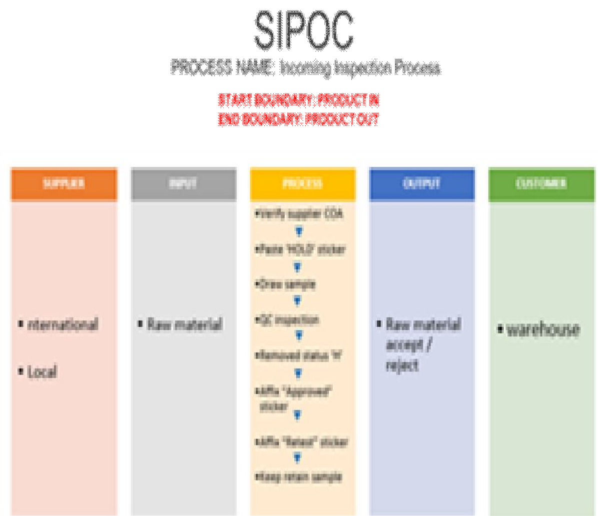

Figure 3: SIPOC.

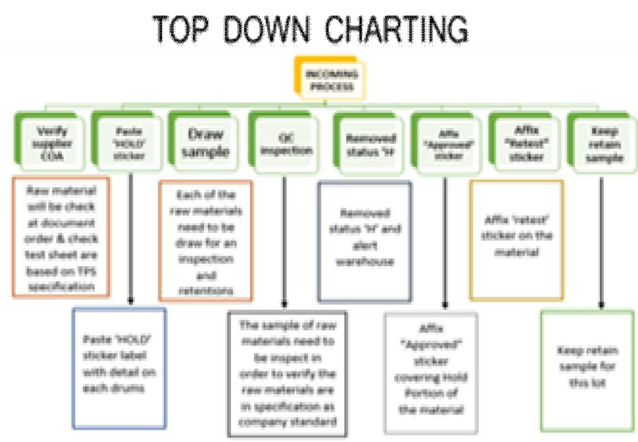

Figure 4: Top Down Charting.

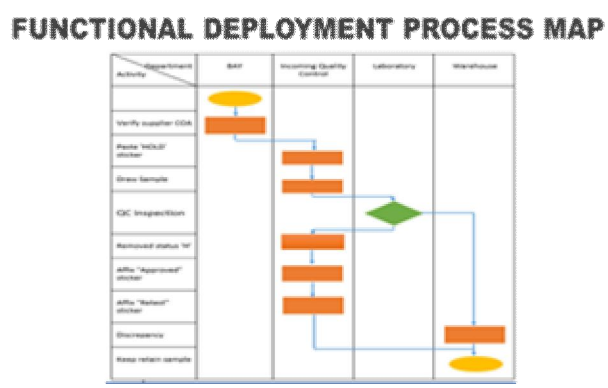

Figure 5: Functional Deployment Process Map.

Table 2: Value Analysis of Incoming Process.

VALUE ANALYSIS OF INCOMING PROCESS

No.	Process	Activity	Value Analysis: CVA	Value Analysis: OVA	Value Analysis: NVA
1	Verify Supplier COA	1. Raw Materials are received from suppliers			✓
		2. Verified the Raw Materials are in as stated Document Order (DO)	✓		
		3. Check test sheet that is based on TPS specification by company		✓	
2	Paste "HOLD" sticker	1. Raw Materials were placed at QA station for inspection			✓
		2. Raw Materials will be paste "Hold" sticker at all drums			✓
		3. The items that has "Hold" sticker will be queue for Draw sample		✓	
3	Draw sample	1. take bottle and dropper to fill the sample of raw materials		✓	
		2. open drum cap to take a sample		✓	
		3. fill in the sample into the bottle using dropper until 100ml		✓	
		4. placed the labels that had a sample name on the bottle		✓	
		5. close the drum cap		✓	
4	GC inspection	1. Send the sample to the laboratory			✓
		2. Prepared sample for run at GC machine		✓	
		3. Placed the sample at GC machine		✓	
		4. Calculated the result		✓	
		5. Verified the raw materials were in specification as standard in COA	✓		
		6. Approval from laboratory	✓		
5	Removed status "HOLD"	1. Removed the "HOLD" sticker from all drums		✓	
6	Affix "Approved" sticker	1. Placed an approval stickers to all drums			✓
7	Affix "Retest" sticker	1. The raw materials will be retest a month before an expiry date	✓		
		2. Placed the retest stickers to all drums	✓		
8	Keep retain sample	1. take bottle and dropper to fill the sample of raw materials		✓	
		2. open drum cap to take a sample		✓	
		3. fill in the sample into the bottle using dropper until 100ml		✓	
		4. placed the labels that had a sample name on the bottle		✓	
		5. close the drum cap		✓	

Table 2 shows the value analysis of each process. From that table the team can identify the non-value added that can be removed.

Table 3: Quick Win Opportunities.

QUICK WIN OPPORTUNITIES

POTENTIAL SOLUTIONS	EASY TO IMPLEMENT	FAST TO IMPLEMENT	CHEAP TO IMPLEMENT	WITHIN AUTHORITY	EASILY REVERSIBLE	QUICK WIN?
5S implementation at Laboratory	✓	✓	✓	✓	✓	YES
Operator Training on proper handling					✓	NO
Changing placement of inspection equipment	✓	✓	✓	✓	✓	YES
Assign more operator in incoming process	✓	✓		✓		NO

Table 3 shows the potential solutions that can be implement are 5S implementation at laboratory and changing placement of inspection equipment.

4.2 Measure

The improvement opportunity that was defined in the Team Charter needs to be measured to establish the baseline and measure the performance [11].

Table 4: Data Collection.

Process	Result Average (Min)				Mean Average (Min)
	Week 1	Week 2	Week 3	Week 4	
A	4.76	4.78	4.78	4.76	4.77
B	4.81	4.82	4.82	4.83	4.81
C	10.16	10.16	10.18	10.18	10.17
D	29.93	29.94	29.92	29.93	29.93
E	9.97	9.97	9.95	9.97	9.96
F	10.21	10.21	10.22	10.20	10.21
G	5.18	5.17	5.17	5.19	5.18
H	10.15	10.16	10.16	10.16	10.16

This data collection (Table 4) been used to develop the Value Stream Mapping (VSM) which served as blueprint and backbone for process mapping [12]. Mean Average is a cycle time for every process for one month working day.

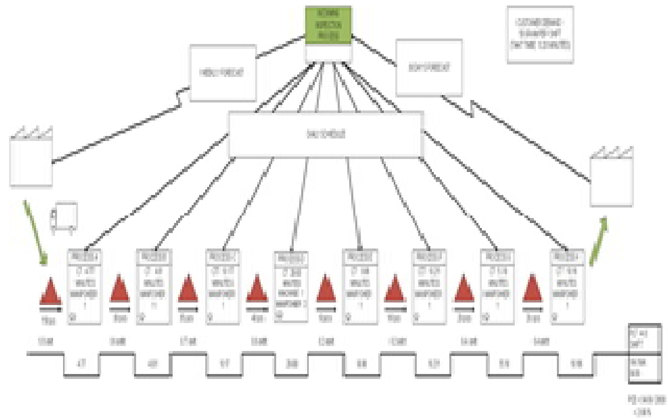

Figure 6: Value Stream Mapping.

In the VSM shown in Figure 6, the value added time is 85.19 minutes and the non-value added is 2838 minutes. The total process time is 2923.19 minutes shown as in Figure 7.

PROCESS CAPABILITY

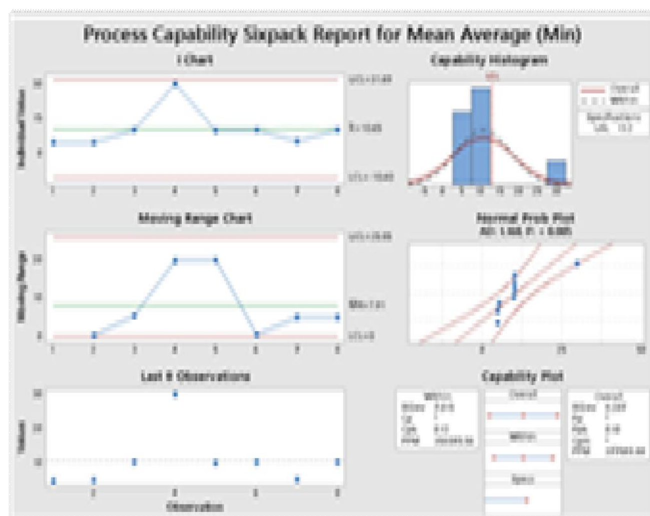

Figure 7: Process Capability

The sigma level (Table 5) is calculated by equation below:

Sigma level = 3(Cpk) + 1.5

Cpk value = 0.12

Sigma Level = 3(0.12) + 1.5 = 1.86

Table 5: Baseline Performance

Defects per 1,000,000	Success rate	Sigma Level	Defects per 1,000,000	Success rate	Sigma Level
933,000	7%	0.0	54,800	94.52%	3.1
919,000	8%	0.1	44,600	95.54%	3.2
903,000	10%	0.2	35,900	96.41%	3.3
885,000	12%	0.3	28,700	97.13%	3.4
864,000	14%	0.4	22,800	97.72%	3.5
841,000	16%	0.5	17,900	98.21%	3.6
816,000	18%	0.6	13,900	98.61%	3.7
788,000	21%	0.7	10,700	98.93%	3.8
758,000	24%	0.8	8,200	99.18%	3.9
726,000	27%	0.9	6,210	99.379%	4.0
691,000	31%	1.0	4,660	99.534%	4.1
655,000	34%	1.1	3,470	99.653%	4.2
618,000	38%	1.2	2,560	99.744%	4.3
579,000	42%	1.3	1,870	99.813%	4.4
540,000	46%	1.4	1,350	99.865%	4.5
500,000	50%	1.5	968	99.903%	4.6
460,000	54.0%	1.6	687	99.931%	4.7
421,000	57.9%	1.7	483	99.952%	4.8
382,000	61.8%	1.8	337	99.966%	4.9
345,000	65.5%	1.9	233	99.9767%	5.0
309,000	69.1%	2.0	159	99.9841%	5.1
274,000	72.6%	2.1	108	99.9892%	5.2
242,000	75.8%	2.2	72	99.9928%	5.3
212,000	78.8%	2.3	48	99.9952%	5.4
184,000	81.6%	2.4	32	99.9968%	5.5
159,000	84.1%	2.5	21	99.9979%	5.6
136,000	86.4%	2.6	13	99.9987%	5.7
115,000	88.5%	2.7	9	99.9991%	5.8
96,800	90.32%	2.8	5	99.9995%	5.9
80,800	91.92%	2.9	3.4	99.99966%	6.0
66,800	93.32%	3.0			

4.3 Analyze

The team needs to understand how constraints impact the process and how to identify and manage the bottleneck in all process [13].

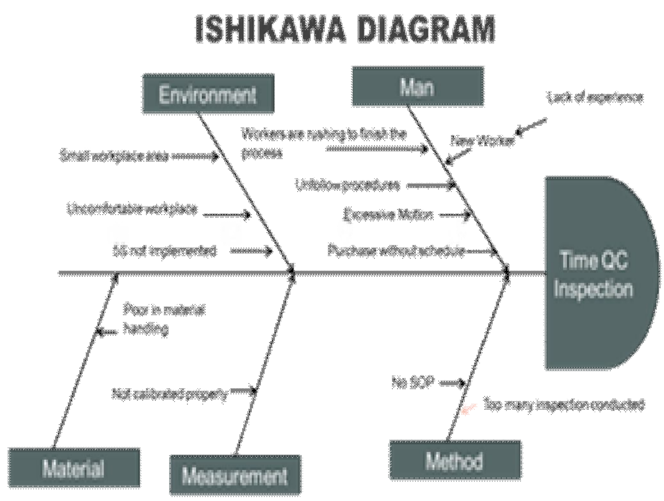

Figure 8: Ishikawa Diagram

Table 6: Cause and Effect Matrix

NO	INPUT/PROCESS INDICATORS	PURCHASING SCHEDULE	IMPLEMENT 5S ACTION	OUTPUT INDICATORS	RANK
		10	9	IMPORTANCE	
		CORRELATION OF INPUT TO OUTPUT		TOTAL	
1	Manpower follow procedure	0	3	27	6
2	List of products	0	5	45	5
3	Number of incoming raw materials	7	9	151	2
4	Excessive motion during inspection	9	8	162	1
5	Total numbers of workers	5	0	50	4
6	Total numbers of equipment	4	7	103	3

0: NO CORRELATION 1: LITTLE CORRELATION 3: MODERATE CORRELATION 9: STRONG CORRELATION

In the Ishikawa Diagram (Figure 8), there are five type of causes which is environment, man, material, measurement and method.

Based on the cause and effect matrix in Table 6, the excessive motion during inspection has high total number. It show that input have strong correlation with output indicator. So that process needs to do improvement.

The team develops the FMEA (Table 7 and Table 8) to get the root cause of the problem. The FMEA is proactive tool to organize possible process failure and the risk associated.

Table 7: FMEA with Initial RPN

Process Step	Potential Failure Mode	Potential Effects of Failure	Severity	Potential Causes of Failure	Occurrence	Current Controls	Detection	Initial RPN
Verify Supplier COA	Raw Materials not as per invoice	Difficult to process the material	[illegible]	[illegible]	[illegible]	Return back to supplier	[illegible]	175
	Raw Materials not as per specifications	Raw Materials rejected	[illegible]	[illegible]	[illegible]	Return back to supplier	[illegible]	150
	Raw Materials without identification and traceability	Difficult to process the material	[illegible]	[illegible]	[illegible]	Return back to supplier	[illegible]	210
	Raw Materials arrived too many at once	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	216
Paste "HOLD" sticker	Forgot to paste sticker	Work Delay	[illegible]	Workers are rushing to collect other raw materials	[illegible]	Rework	[illegible]	180
Draw sample	Bottles are not labelled	Work Delay	4	Workers are rushing to collect other raw materials	[illegible]	Rework	[illegible]	180
	Sample overfill more than 100ml	Difficult to process the material	4	[illegible]	[illegible]	Rework	[illegible]	150
QC inspection	Machine not perform well	Raw Materials rejected	[illegible]	Lack of maintenance	[illegible]	Monthly maintenance	[illegible]	75
	Miscalculation due to wrong procedure for testing	Damage output	[illegible]	Not following procedure	[illegible]	Rework	[illegible]	180
	Items to be inspect stocked in wrong location	Unable to locate the product	8	Correct location is full	8	None	8	512
	Excessive motion during inspection	Work Delay	8	Items need to be verified at different places	9	None	8	576
Removed status "HOLD"	Did not remove sticker	Work Delay	4	Not following procedure	[illegible]	Rework	[illegible]	80
Affix "Approved" sticker	Did not place an approved stickers	Work Delay	4	Not following procedure	[illegible]	Rework	[illegible]	80
Affix "Tested" sticker	Raw materials did not have tested stickers	Work Delay	[illegible]	Not following procedure	[illegible]	Rework	[illegible]	120
Keep retain sample	Forgot to take sample	[illegible]	[illegible]	Not following procedure	[illegible]	Rework	[illegible]	180

Table 8: FMEA with Revised RPN

Process Step	Potential Failure Mode	Initial RPN	Action Taken	Severity	Occurence	Detection	Revised RPN
Verify Supplier COA	Raw Materials not as per invoice	175	Customer complain	4	5	4	80
	Raw Materials not as per specifications	150	Customer complain	5	4	4	80
	Raw Materials without identification and traceability	210	Customer complain	4	5	6	120
	Raw Materials arrived too many at once	216	Changing layout	5	4	5	100
Paste "HOLD" sticker	Forgot to paste sticker	180	Revised SOP	4	5	4	80
Draw sample	Bottles are not labelled	180	Revised SOP	4	5	4	80
	Sample overfill more than 100ml	150	Revised SOP	5	4	5	1100
QC inspection	Machine not perform well	75	Weekly maintenance	4	4	3	48
	Miscalculation due to wrong procedure for testing	180	Revised SOP	4	5	5	100
	Items to be inspect stocked in wrong location	512	5S implementation	5	5	5	125
	Excessive motion during inspection	576	Changing layout	5	4	5	100
Removed status "HOLD"	Did not remove sticker	80	Revised SOP	3	4	4	48
Affix "Approved" Sticker	Did not place an approved stickers	80	Revised SOP	3	4	3	36
Affix "Tested" sticker	Raw materials did not have tested stickers	120	Revised SOP	4	5	4	80
Keep retain sample	Forgot to take sample	180	Revised SOP	4	5	5	100

4.4 Improve

The 'Improve' stage is wherever the group breakthroughs solutions, pilots process deviations, implements resolutions and lastly, gathers data to confirm to hand is quantifiable and measurable improvement. This project has implement 5S at laboratory (Figure 9 and Figure 10). The equipment at laboratory is very messy and difficult to find it. So it effected the time of inspection process.

Figure 9: Image of equipment at laboratory before 5S implementation.

Figure 10: Image of equipment at laboratory after 5S implementation.

Second improvement that this team do is changing layout or changing placement of equipment inspection. The old inspection at laboratory. So, the team change the placement of inspection to incoming process. So it better and can reduce motion of the manpower.

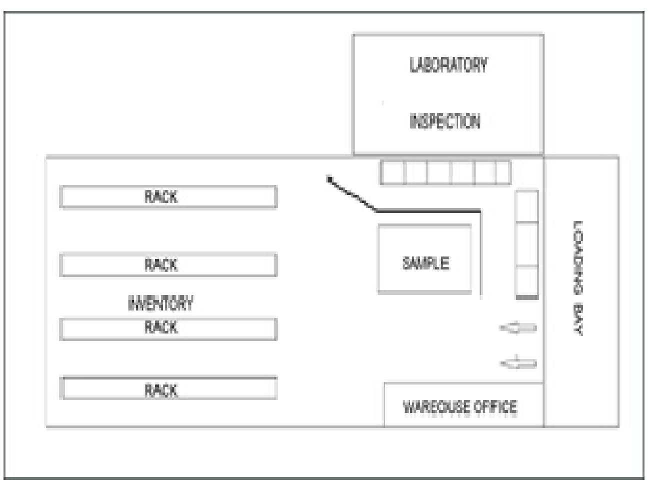

Figure 11: Layout before Improvement.

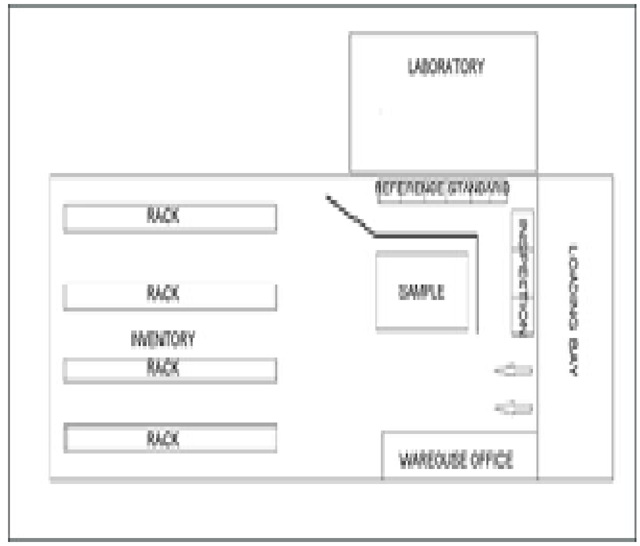

Figure 12: Layout after Improvement.

After all the improvement done (Figure 11, Figure 12 and Figure 13), the team collects the data of cycle time (Table 9). The team also calculates the sigma level.

Table 9: Data Collection after Improvement.

Process	Result Average (Min)				Mean Average (Min)
	Week 1	Week 2	Week 3	Week 4	
A	3.58	3.73	3.64	3.61	3.64
B	3.81	3.72	3.79	3.90	3.81
C	8.66	8.52	8.68	8.49	8.59
D	19.89	19.91	19.83	19.85	19.87
E	7.17	7.24	7.25	7.29	7.24
F	8.33	8.48	8.39	8.36	8.39
G	4.38	4.21	4.25	4.22	4.27
H	9.75	9.83	9.46	9.71	9.69

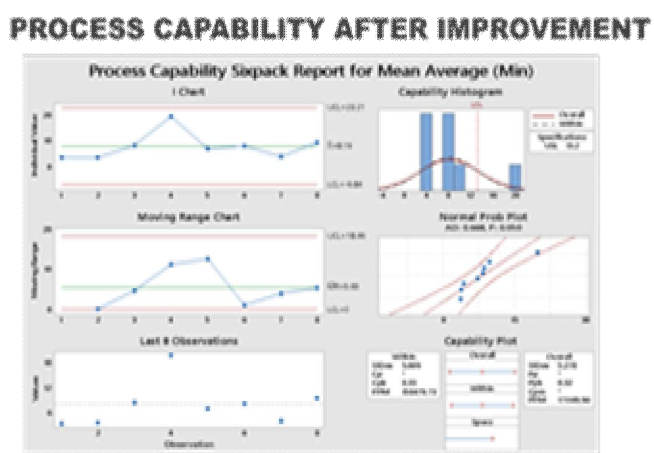

Figure 13: Process Capability after Improvement.

Table 10: Baseline Performance after Improvement.

Defects per 1,000,000	Success rate	Sigma Level	Defects per 1,000,000	Success rate	Sigma Level
933,000	7%	0.0	54,800	94.52%	3.1
919,000	8%	0.1	44,600	95.54%	3.2
903,000	10%	0.2	35,900	96.41%	3.3
885,000	12%	0.3	28,700	97.13%	3.4
864,000	14%	0.4	22,800	97.72%	3.5
841,000	16%	0.5	17,900	98.21%	3.6
816,000	18%	0.6	13,900	98.61%	3.7
788,000	21%	0.7	10,700	98.93%	3.8
758,000	24%	0.8	8,200	99.18%	3.9
726,000	27%	0.9	6,210	99.379%	4.0
691,000	31%	1.0	4,660	99.534%	4.1
655,000	34%	1.1	3,470	99.653%	4.2
618,000	38%	1.2	2,560	99.744%	4.3
579,000	42%	1.3	1,870	99.813%	4.4
540,000	46%	1.4	1,350	99.865%	4.5
500,000	50%	1.5	968	99.903%	4.6
460,000	54.0%	1.6	687	99.931%	4.7
421,000	57.9%	1.7	483	99.952%	4.8
382,000	61.8%	1.8	337	99.966%	4.9
345,000	65.5%	1.9	233	99.9767%	5.0
309,000	69.1%	2.0	159	99.9841%	5.1
274,000	72.6%	2.1	108	99.9892%	5.2
242,000	75.8%	2.2	72	99.9928%	5.3
212,000	78.8%	2.3	48	99.9952%	5.4
184,000	81.6%	2.4	32	99.9968%	5.5
159,000	84.1%	2.5	21	99.9979%	5.6
136,000	86.4%	2.6	13	99.9987%	5.7
115,000	88.5%	2.7	9	99.9991%	5.8
96,800	90.32%	2.8	5	99.9995%	5.9
80,800	91.92%	2.9	3.4	99.99966%	6.0
66,800	93.32%	3.0			

The sigma level is calculated by equation below:

Sigma level = 3(Cpk) + 1.5

Cpk value = 0.33

Sigma Level = 3(0.33) + 1.5 = 2.49

The sigma level of this project has been improved after the implementation of 5S and changing layout of inspection placement (Table 10). It show that the cycle time of each process has been reduced and improved.

4.5 Control

In the control section, the team showed the control and improve the company process by providing relevant and timely data about priorities and processes to the company. The information from the process control system serve as a basis for the team to make responsible improvement decisions based on the data.

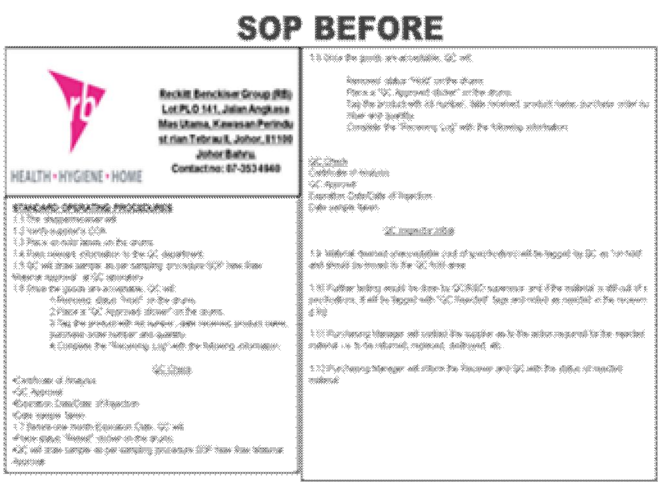

Figure 14: SOP before the Improvement.

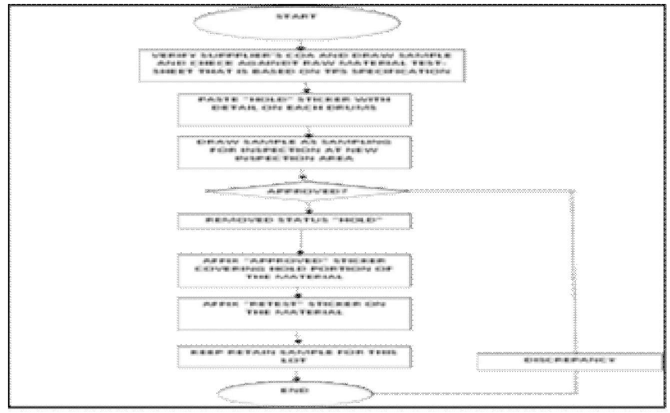

Figure 15: SOP after the Improvement.

The team has changed the SOP. The SOP before the improvement (Figure 14) has too many process to inspect the product. Team has simplified the SOP of the process and make it into flowchart (Figure 15). It easy to all worker and management to understand it. The respective I-MR charts are shown in Figure 16 and Figure 17.

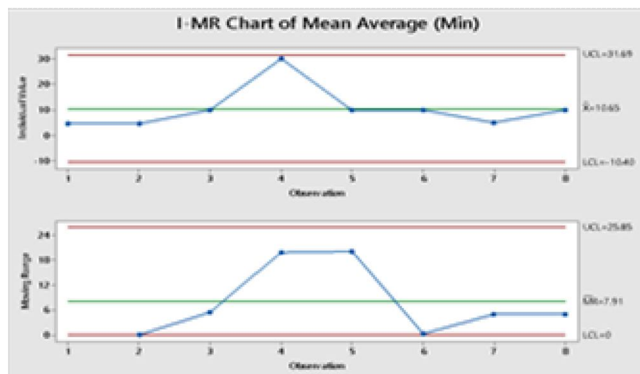

Figure 16: I-MR Chart before Improvement.

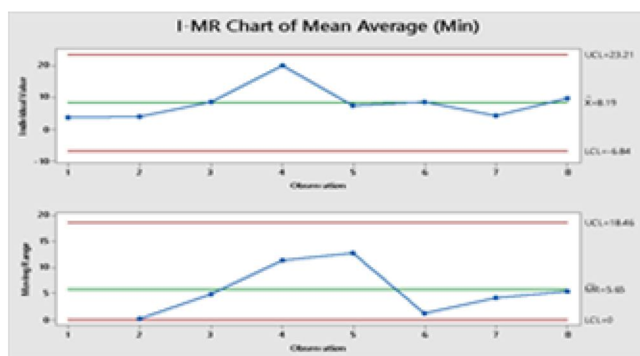

Figure 17: I-MR Chart after Improvement.

5. CONCLUSION

In a nutshell, Lean Six Sigma is a mixture of two methodologies that enables to decrease and enhance large organization in greater and continuous achievement. Lean six sigma operate tightly with variety that eliminates most of the waste and improves effectiveness. It basically relies on enhancing company development. From here, authors are prepared to comprehend the significance of management teams, the effect of company results on employees, and statistical assessment techniques. This project aims to reduce the incoming process time at QA department. Thus the objective of this project is achieved and aligned with learning outcomes of the subject. As an improvement and reduce the process time, Reckitt Benckiser able to maintain and make continuous improvement to cut the cost of the company. Alongside it gives a clear view of Lean Six Sigma importance and how it affects such an organization.

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