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Reduction of Oil Consumption by Using Six Sigma (A Case Study)

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ABSTRACT: To attain maximum profit, we must minimize our 'wastage' that which we permanently throw away into the environment that will not be naturally recycled for reuse. Manufacturing process must be organized as closed systems. So we can not easily find out the problem which is minimize or reduce our consumption as well as cost. Increasing competition and increasing customer expectations make it imperative that cost at each head is to be reduced at the earliest. The hydraulic / lubrication cost is also an important head of total machining cost. In industry generally, We are not getting more profit due to tight margin from customer side, by attempting this project we are aiming to "reduce our oil consumption" and improve profit. This paper present the successful application of Six Sigma. Define-Measure-Analyze-Improve-Control (DMAIC) methodology in an manufacturing industry minimize the oil consumption during a machining process. And effective use of men, machine, material, money (4M) Hence, Six Sigma, DMAIC methodology was applied to this process for reducing the oil consumption. The potential causes of high oil consumption were identified through a brainstorming session.

KEYWORDS: Productivity Improvement, Six sigma (DMAIC), Cause and effect, Control, (4M)

I INTRODUCTION

Reduction of Oil consumption Starts With issuing from store Ends With consumption in machine. In industry we analyze the process of manufacturing at each station. And I have decided how to reduce waste in industry without affecting its quality and productivity. We want to minimize waste like oil consumption in each manufacturing machine this oil is used as a terms of cutting oil, lubrication oil. Our main aim to effective use of Men, Machine, Material, Money (4M) in manufacturing industry. Many organizations lack the proper data analysis skills and as a result, the solutions for complex problems are too heavily based on intuition alone. For this purpose we define our goal and measure all the aspect in industry afterthat analyze the each workstation where product is manufactured and passes one machine to another machine and also analyze how to worker and machine operator handle the issue task which is given by the senior team members. And find out the way of handelling operating task through the employee who are worked at industry. afterthat we control our task and improve the overall task efficiency by using six sigma operation. Finally we achieve our goal. Basically in six sigma process we studied five step which are following in diagram.

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DMAIC Roadmap

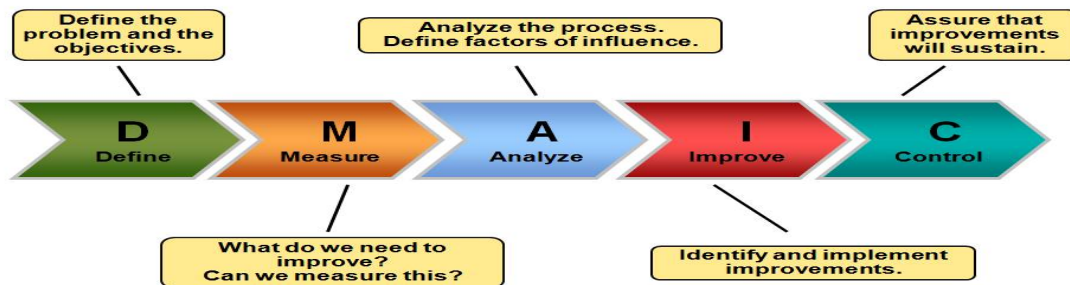


Figure 1.1

II. LITERATURE REVIEW

Many research had been done in implementing DMAIC technique in different process and manufacturing industry. ¹Kumar et al.(2011) presented some facts and benefits of using DMAIC Approach in improving the efficiency and performance level of the manufacturing process with lowest possible cost. ²Jiju Antony Ricardo Banvelas, Ashok Kumar demonstrated on how Six Sigma could be applied or has been applied in a real industry setting, and it also provides a systematic approach in contemporary organizations both for assessment and application purpose .The purpose of this book is to clearly explain how Six Sigma methodology can be applied to a particular manufacturing, service or transactional problem and also the calculations of estimated cost savings from the project and the benefits of Six Sigma, effective management decisions and improved internal communications. ³Thomas Pyzdek in the book “The Six Sigma Hand Book” explained the guidelines and directions to find a complete overview of management and organization of Six Sigma and its philosophy which underlines those problems solving techniques and and statistical tools most often used in six sigma. ⁴H.E. Cook explained the design for Six Sigma as strategic experimentation. It is a practical science based methodology for guiding the product realization process for highly competitive markets. ⁵Debhasis Sarkar enumerated that the Six Sigma is probably one of the best methodologies to pervade the world of improvement. ⁶Terence T Borton and Jeff L Sams explained in their book which provides a detailed implementation road map and frame work for Six Sigma. It also includes methodologies, models hands on techniques case studies, implementation tools.

III. RESEARCH METHODOLOGY

1 DEFINE PHASE

TYPE OF OIL	QTY USED PER MONTH(ML)
Hydraulic 68	4900
Spin 12	500
Spin 2	500
Mobile velocity 6	100

Table 1.1

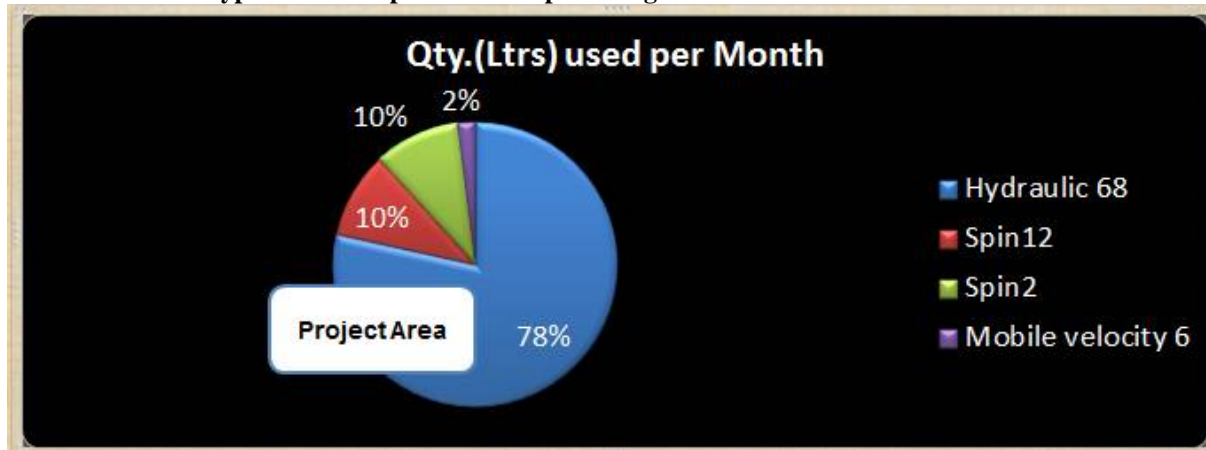
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Pie chart of different type of oil used per month in percentage



Pie Chart 1.1

1.1 Potential saving calculation.

	Current Oil consumption	Target consumption	Saving	Price per Ltr	Saving per month	Saving annum(approx)
MI/Pic	8	7	1	Rs. 90	0.45 lacs	5.4 lacs
Ltrs	3992	3500	492			

Table 1.2

1.2 OIL CONSUMPTION TREND BEFORE

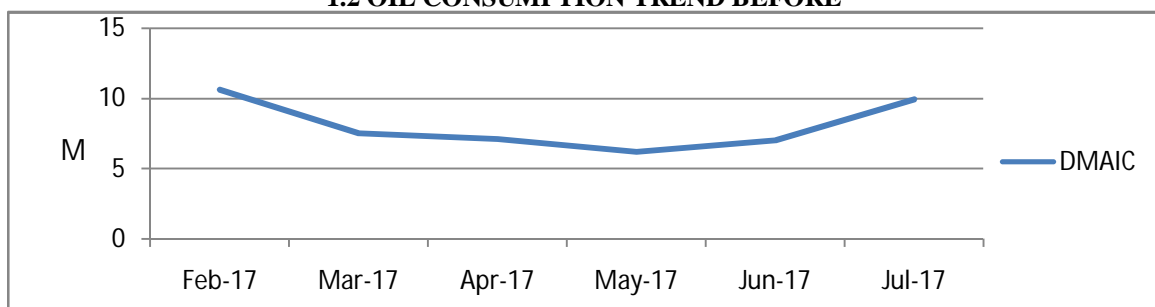


Figure 1.2

Average oil Consumption in last six month is 8 ml/Part.

2 MEASURE

S NO.	ACTIVITIES
1	Identified All Possible Causes of more Oil consumption
2	Implemented all identified quick wins
3	Data Collection for oil consumption in each line/machine started

Table 1.2

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The main objective in this phase is to collect data pertinent to the scope of the problem. And identified all possible causes of more oil consumption and implemented following steps after identified causes of more oil consumption.

- 1 Trolley for handling oil,
- 2 Provided funnel for top up
- 3 Shade for storage of oil
- 4 On job training for pressure setting
- 5 Provide tray to avoid spillage

3 ANALYSIS

S NO.	Key Process Input Variables (x's)	Line	Statistical tools for validation
1	Hose pipe and Slide lubrication return line condition verification	CS2	Bar chart 2P Test
2	Hose pipe and Slide lubrication return line condition verification	HUB	Bar chart 2P Test
3	Hose pipe and Slide lubrication return line condition verification	CS1	Bar chart 2P Test
4	Hose pipe condition verification	HMSI	Bar chart 2P Test

Table 1.3

3.1 Analysis of oil consumption in CS2 line in month of june 2017

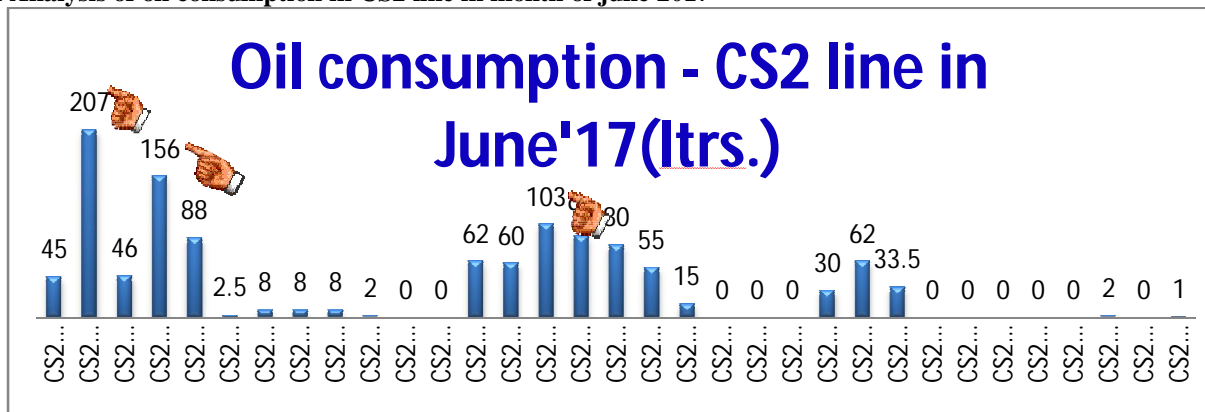


Figure 1.3

3.2 Top machines having high oil consumption are ,

- 1 Turning(CS2-120)
- 2 Pin Milling(CS2-123)
- 3 Pin Grinder(CS2-130)

1 Investigation of Turning (CS2-120)

Observation: Hose pipe wear out resulting into leakage of oil

Action taken: Hose pipe replaced

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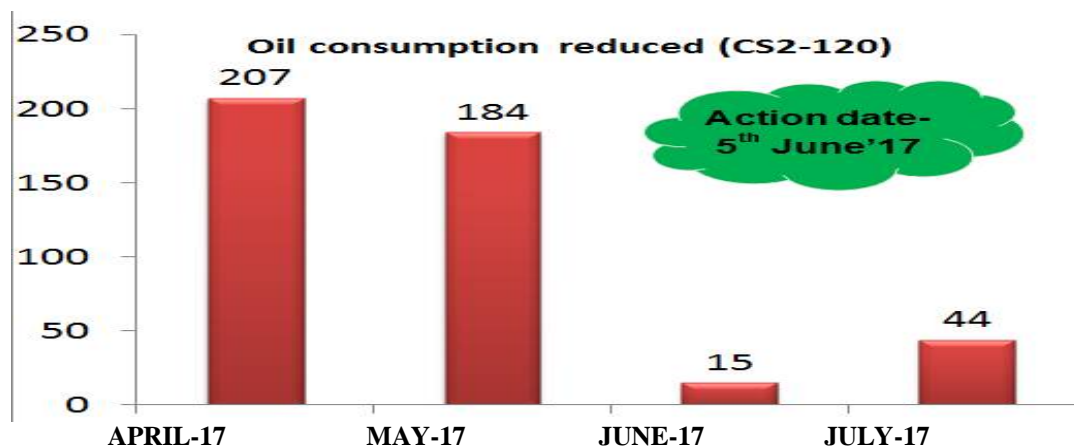


Figure 1.4

2 Investigation of pin milling (CS2-123)

Observation: Lubrication cartridge & hose pipe wear out resulting into leakage of oil

Action taken: Lubrication cartridge & Hose pipe replaced.

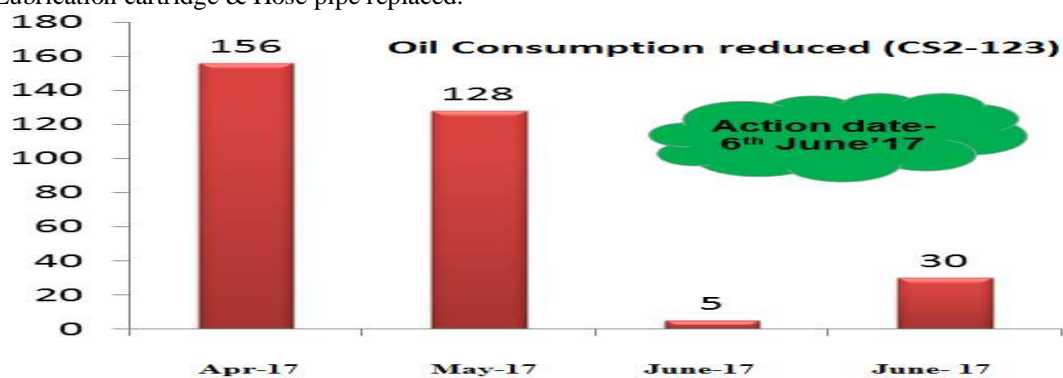


Figure 1.5

3 Investigation of pin grinder (CS2-130)

Observation: Slide lubrication return line choked resulting into leakage of oil

Action taken: Slide lubrication return line cleaned.

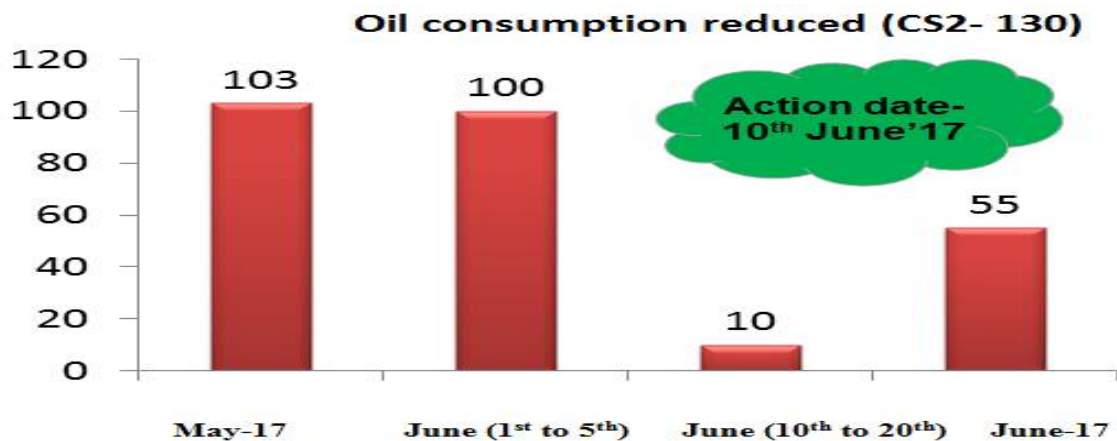


Figure 1.6

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Test and CI for Two Proportions (2P test)

Sample	X	N	Sample p
1 0 May ~ ,5 june 17	2864	10163	0.281807
06 june ~ 30 june,17	2025	8850	0.228814
Difference = p (1) - p (2)			
Estimate for difference 0.0529930			
95% CI for difference: (0.0406198, 0.0653661)			
Test for difference = 0 (vs not = 0): Z = 8.39 P-Value =0.000			

Conclusion: There is significant reduction of oil consumption in CS2 line

May ~ Jun,2017 = 281 ml/part

July 2017 = 228 ml/part

NOTE: we have analyzed oil consumption of each line like hub line, cs1 line, hmsi line, and used statistical tools for validation of each line by using bar chart and 2p test. but here in this research report we provide details of only one line which is CS2 line.

4 IMPROVE

Improve Phase Plan

S NO.	Activities
1	Verification of Hose pipe condition and to be replaced where ever required.
2	Cleaning of Slide lubrication return line
3	AMC to be given for oil chiller to maintain their viscosity.
4	Daily Monitoring of oil consumption of each line.

Table 1.4

OIL CONSUMPTION FROM DECEMBER 2016 TO JULY 2017

ACIL LTD,MANESAR,GURUGRAM HARYANA						
LSS Green Belt Project: Reduction of oil consumption						
MONTH	OIL CONSUMPTION (LTRS)	PRODUCTION	OIL/PART (ML)	Project Stages	OIL/PART (ML)	OIL COMSUMPTION / MONTH
Dec-2016	4900	463761	10.6	Project selection	8.0	3992.5
Jan-2017	4000	534694	7.5			
Feb-2017	3500	489949	7.1			
Mar-2017	3155	510007	6.2			
Apr-2017	3200	455304	7.0			
May-2017	4200	423740	8.9	During project	6.7	3218.0
(10-15)-May-2017	3725	491292	7.6			
(16-20)-May-2017	3050	414763	7.4			
(21-25)-May-	3500	504777	6.9			

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2017						
(25-30)-May-2017	3089	458704	6.7			
(31May-4 June)-2017	2838	474577	6.0			
(5June-8 June)-2017	3106	519001	6.0			
(9June-12 June)-2017	2584	513963	5.0	Project Completion	5.8	2839.0
(13June-17 June)-2017	2609	487722	5.3			
(17June-25 June)-2017	3025	426025	7.1			
(26June-30 June)-2017	2916	547439	5.3			
(30June-5 July)-17	2935	478794	6.1			
(5July-10 July)-2017	2965	491780	6.0			

Table 1.5

IMPROVE PHASE SUMMARY

S.No	Line	At the start of project (ml/part)	Actions taken	At completion of project (ml)
1	CS1	315	1. Monitoring of oil consumption of each line/machine. 2. Hose pipe condition verified and replaced where ever required. 3. Slide lubrication return line cleaned. 4. AMC given for oil chiller to maintain their viscosity.	166
2	CS3	227		78
3	CR1	15		7
4	SK1	109		26
5	CS2	324		241
6	HMSI	2.2		1.6
7	HUB	14		7
8	Overall Average	8		

Table 1.6

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5 CONTROL Control Phase Plan

S. No.	Activities
1	Preventive maintenance (Turning center)check list revised to Monitor hose pipe condition
2	Preventive maintenance (Pin Milling)check list revised to Monitor hose pipe condition
3	Given AMC for spindle oil chiller to ensure viscosity of oil
4	Monitoring of daily oil consumption in each line/machine

Table 1.7

DATA SUMMERY ON PROJECT

Parameter	Before Project	Target	Actual
MI/Pic	8	7	5.8
Ltrs	3992.5	3500	2839
Cost	325040	280000	227120

Table 1.8

Oil saving per month (Ltrs) : 1153.5
Saving in Rs. (Per Annum) = 12.5 Lacs

IV. CONCLUSION

The goal of this research was to improve the target company's reduction of oil consumption. In addition, the goal was to demonstrate how this type of project can be executed using the Six Sigma methodology. To better understand the Six Sigma concept, both Lean and Six Sigma methodologies were studied. The Thesis described in this work is one of those projects that benefited greatly from the use of Lean Six Sigma. Lean offered some of the basic principles behind optimal production flow where as Six Sigma enabled the scientific analysis of the data and accurate estimations of process improvement potential. These together with the structure of DMAIC ensured that the project stayed on track and that no shortcuts were taken. Six Sigma projects are systematically executed processes that have the goal of reducing unwanted variation in processes to ensure better quality for processes and products. Six Sigma projects have a basic team structure. In the project described in this work, the researcher acted in the role of black belt. Black belt does most of the data analyzes and acts as the project manager and leader. In addition to a basic team structure, Six Sigma also has a basic predefined process for project execution.

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