

Reducing the Vehicle Turnaround Time inside the Oil Industry using Six Sigma DMAIC Approach

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Abstract— There is a high pressure today on every industry of reduced cycle time. A very powerful and recent philosophy in this area is six sigma. Six sigma is becoming very popular and its advantage is being taken for improving productivity. In industry vehicle turnaround time is the time taken by the vehicle for completing all the operations. In oil industry vehicle turnaround time inside the plant determines the productivity of the system. The more the number of processes involved higher will be the complexity and hence the vehicle turnaround time will be higher. This vehicle turnaround time is the loss for the plant as it is the waiting time for the vehicles in the product loading lines. Six sigma DMAIC tool is a process improvement tool. A case study has been conducted at a heavy oil industry to reduce vehicle turnaround time by using six sigma DMAIC tool which focuses on improving the existing processes and the productivity of the plant. Implementation of six sigma DMAIC tool in an oil industry resulted in reduction of vehicle turnaround time by 20%.

Key words: Six Sigma, Vehicle Turnaround Time

I. INTRODUCTION

Six Sigma is a quality tool and it is based on eliminating the defects in any process. It can be used in service industries and manufacturing products. In terms of statistical representation it can be said that Six Sigma process must not produce more than 3.4 defects per million opportunities. Six Sigma is a flexible and comprehensive system for sustaining, achieving and maximizing business success [4]. Six Sigma is uniquely driven by close understanding of Disciplined use of facts, customer needs, data, and statistical analysis, and diligent attention to Improving, managing and reinventing business processes [1].

The implementation of a strategy based on measurement focuses on process improvement and variation reduction which is the Fundamental objective of the Six Sigma methodology. This can be achieved by systematically using Six Sigma methodology which is DMAIC (Define-Measure-Analyze-improve-Control).

Vehicle turnaround time is the time taken by the vehicle to complete all the operations of loading the product starting from the entry to exist from the industry [6]. Higher Vehicle turnaround time increases traffic inside plant which causes delays and results in decreased efficiency of the plant. It also increases the number of vehicles present in the plant which raises the safety issues especially in oil industries [5]. In a heavy oil industry where number of vehicles delivered are huge on the daily basis vehicle turnaround time plays a vital role in ensuring high productivity of the plant. Vehicle turnaround is calculated by considering the mean time taken by the vehicle from its arrival to the departure from the plant.

II. OBJECTIVE

The objective of the study were as follows:

- 1) To study all the operations of a vehicle starting from loading to dispatch.
- 2) To Identify and eliminate non value added activities.
- 3) To reduce vehicle turnaround time inside oil industry.
- 4) In order of doing this number of tools are available this paper discusses the application of ‘Define-measure-analyze-improve-control tool.

III. METHODOLOGY

The following steps were taken to reduce the vehicle turnaround time inside the heavy oil industry.

A. Steps taken

- 1) Selection of appropriate department of the oil industry for analysis which has greater impact on entire organization.
- 2) Define the system and the project charter which includes project goals, scope and timeline.
- 3) Collection of data to describe the current situation. Further this data can be used as a baseline for the improvement in the process capability.
- 4) Determine the root causes of the process problems and confirming the potential root causes for improvisation.
- 5) Identifying solutions to implement for optimizing or reducing the impact of root causes.
- 6) Gather data after improvements are in place.
- 7) Maintain and standardize the improved processes.

B. Six Sigma DMAIC tool

Six sigma is set of tools and techniques for the purpose of process improvement [2]. DMAIC is an acronym for Define-measure-analyze-improve-control. DMAIC is suitable tool for the studies which are aimed at improving existing business processes [3].

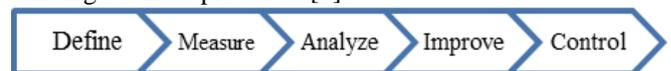


Fig. 1: DMAIC Tool

Define: Define the problem.

Measure: Measure gap between current and required performance.

Analyze: Analyze factors that need to be adjusted or eliminated.

Improve: Implement best solutions to the problems.

Control: Sustain the achieved results [7].

IV. PROCESS IMPROVEMENT PHASES

A. Define

Process flowchart of vehicle from entry to exit from plant is shown below:

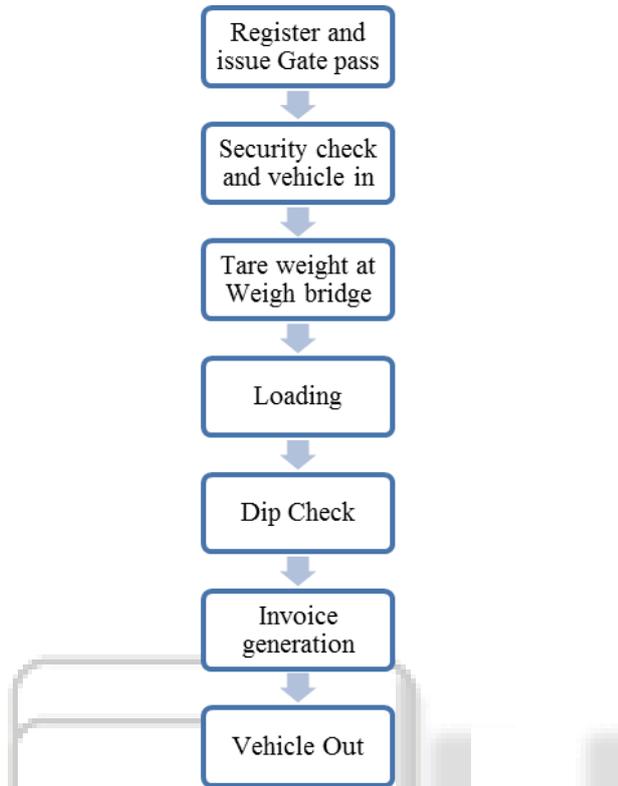


Fig. 2: Process Flowchart of Vehicle

B. Measure

Data is collected to describe the current situation. It will help to understand how the process is working. The readings of hundred tank vehicles are taken to fully understand the current working conditions. Process sigma is calculated with the help of mean of Turnaround times of all the vehicle, USL (upper specific limit), LSL (lower specific limit), standard deviation, and Cpk (process capability).

Sr.No.	Parameters	Time (Minute)
1	Mean	209
2	USL	280
3	LSL	127
4	Standard deviation	41.04
5	Cpk	0.5766
6	Sigma Level	1.73

Table 1: Calculation of Process Sigma before Improvisation
Calculation of sigma level-

Process capability (Cpk) = [(USL-Mean) / (3*Standard Deviation)]

Sigma level= Cpk*3

Process sigma for the current situation is 1.73.

C. Analyze

Analyze phase focuses on identifying the root causes for high vehicle turnaround time and confirming the selection of specific causes for the elimination or optimization. With the help of cause and effect diagram all the causes for high turnaround time are listed[v]. Causes related to people such as less staff availability, lack of experience to tanker drivers. Some cause related to traffic congestion due to less space

availability and weighing of dip checked vehicles. Some of them are non-value activities which adds to the turnaround time of vehicles. Departmental issues regarding measurement and accuracy.

D. Improve

This phase identifies the solutions to the problems that project aims to address. After identifying the potential solutions specific ones which has the higher impact on productivity needs to be implemented. The same data which was collected during measure phase is again obtained after improvements are in place.

Sr.No.	Parameters	Time (Minute)
1	Mean	168
2	USL	229
3	LSL	106
4	Standard deviation	27.84
5	Cpk	0.7303
6	Sigma Level	2.1910

Table 2: Calculation of Process Sigma after Improvisation
Sigma level after improvisation is 2.19.

E. Control

Control chart is a graphical tool that helps determine whether a process is 'in control or not'. Below control chart shows process is in control.

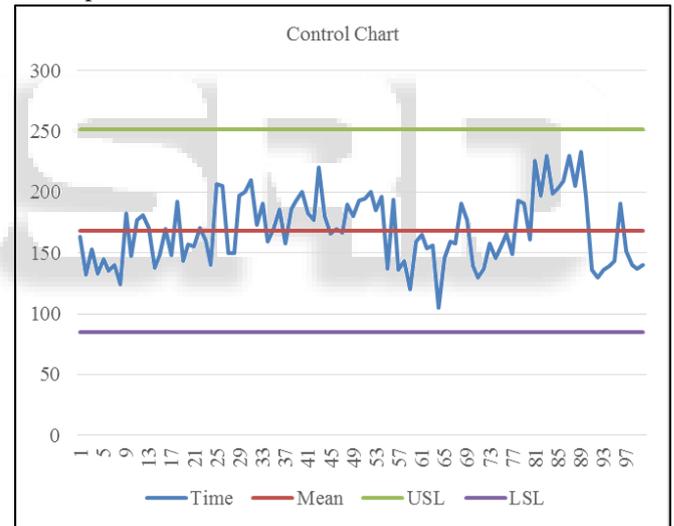


Fig. 3: Control Chart

In the control phase steps need to be taken to ensure results obtained during improve are maintained. New improved processes needs to be standardized. Officers of the plant does monitoring of bulk department on monthly basis and check whether all the implemented solutions are running smoothly.

V. RESULTS

The implementation of Six Sigma DMAIC tool resulted in improving Sigma level from 1.73 to 2.19. Which helped the industry to reduce vehicle turnaround time by 20%.

VI. CONCLUSION

Industries have to deal with issues related to process improvement. Low productivity directly affects the company targets. Organizations undergo huge losses due to substandard productivity which are difficult to cope up with.

Hence for the process improvement six sigma DMAIC tool can be effectively applied on the existing business processes. Six sigma DMAIC tool provides statistical support to each and every action thus helping making decisions more efficient. Thus Six Sigma DMAIC is completely an industry oriented methodology of process improvement. Implementation of six sigma DMAIC tool in an oil industry resulted in reduction of vehicle turnaround time by 20%.

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