

Line Balancing in an Automobile Company using DMAIC

(Process Improvement)

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Abstract-- This paper is a case study of process improvement at a station in assembling line using DMAIC problem solving technique of six sigma methodology,

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I. INTRODUCTION

Six sigma is a data driven management system that focuses on process improvement and variation reduction using six sigma improvement projects based on two techniques which are DMAIC and DMADV. DMAIC has been chosen to improve the process in this case study.

II. LINE BALANCING

Line balancing is the process of calculating work cycles and making the workforce to do their job by improving their SOP, ergonomics, workload and many more aspects. DMAIC as a tool is very useful to identify the problem and providing root causes so that they can be eliminated.

III. WHAT IS DMAIC?

DMAIC is one of a problem solving technique of six sigma methodology which stands for **Define-Measure-Analyze-Improve-Control**. These five are the phases of DMAIC technique which are the stages to completed one after the other in order to achieve the process improvement.

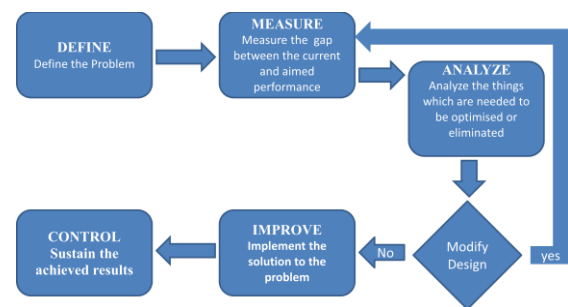
IV. LINE BALANCING USING DMAIC

Line balancing at any particular point can be done by following the five stages of DMAIC and steps involved in each stage one after another.

The five stages are:

- a) Define
- b) Measure

- c) Analyze
- d) Improve
- e) control



a) Define stage:

This is the First phase of DMAIC and here the major priority is given to identify the problem. By identifying the problem, making the goal statement and process flow maps which showcases the entire process helps in defining the problem.

Steps to be followed in define phase are:

- 1) Visual identification of problems faced at that particular station in assembling line and listing the down.
- 2) Calculating the severity of the problems based on its impact on productivity as well as workforce safety.
- 3) Creating a process flow diagram and highlight the places where the problems are being faced.
- 4) Analysing the process using 5WH technique or any other problem identification technique.
- 5) Creating a goal statement after identification of problems. This goal statement should address the exact or possible solution to that problems.

The above steps helps the team to identify the exact problems being faced and tools such as 5WH help getting to the exact problem which needs to be eradicated.

Where the problem is occurring?	The exact location of problem is to be given here
When is the problem happening?	The point of process in which the problem occurs should be given here
Who should be there?	The operator with optimum knowledge
What should be Improved?	things which need Improvisation are to be given here
How the method can be changed?	Feasible ideas are to be given here
Why following the same way?	Specify the reason for following the same way

Table 1 (process analysis using 5WH technique)

b) Measure stage:

This is the second phase in DMAIC in which the current conditions and process mapping is done to understand how the process is performing and how it should perform? The difference might also help in identifying the root causes. Steps to be followed in measure phase are:

- 1) Determine the current performance of the process.
- 2) Compare the current performance with desired and try to find what causing the problem.
- 3) Create a plan with the team to collect the data from the particular station.
- 4) Ensure the data is reliable.

The above process is very important and the data collection should not go wrong because if it does the entire following stages might get corrupted due to false data

What data should be collected?	The sort of data which is desired to solve the problem
Where the data should be collected?	Location of the problem
What should be taken from the data collected ?	Faults, issues faced, near misses
How much data is needed to analyse?	Sample size of 3 months
Additional data desired to collect:	Impacts and rework issues

Figure 1 (plan for collecting data)

FAULT	UQM	OCT	NOV	DEC	TOTAL	AVERAGE
Shroud moulting bolt loose	NOS	240	170	190	600	200
Bonnet mounting bolt loose	NOS	140	160	63	463	154.3
Bonnet holder one side N/F	NOS	10	110	35	155	51.67
Shroud mounting bolt N/F	NOS	40	80	5	125	41.67
Bonnet mounting bolt N/F	NOS	62	0	2	64	221.34
Radiator beading damage	NOS	11	140	0	151	50.34
Bonnet not fit	NOS	0	20	10	30	10
Bonnet lock bracket mounting nut loose	NOS	190	100	0	290	96.67
Bonnet lock bracket foul with lock	NOS	20	0	40	60	20
Bonnet gas strut mounting loose	NOS	14	53	1	68	22.67
Bonnet gas strut inside nut gap more	NOS	90	70	0	160	50.34
TOTAL FAULT	NOS	817	903	346	2066	689
Machines produced	NOS	2821	2298	1689	6808	2270
FAULT	%	28.96	39.29	20.48	30.34	30.3

Figure 2 (fault data)

c) Analyze stage:

this is the third phase and most important one in DMAIC, this phase is intertwined with the measure phase, Here the interpreted data is made into charts or graphs and then the probable and actual root causes are determined if there are any possible changes to be made to the design then this should go back to the measure phase.

Steps to be followed in analyze phase:

1. Examine the process closely by performing time analysis and other value added analysis based on the customer requirements and waste removal.
2. Plot graph or any quality control tool such as histogram, pareto charts. Based on the data collected from measure phase.
3. Brainstorm potential causes using any root cause analyses tool such as Fishbone diagram, 5whys, PFMEA etc.,
4. After finding root causes perform a process analysis, comparative analysis to verify whether the root causes are the real causes for the problems or not.
5. Tabulate the impacts of the causes and objectives of the team.

This is the stage in which the probable root causes are found and further analysis with tools like 5whys helps identifying actual root causes.

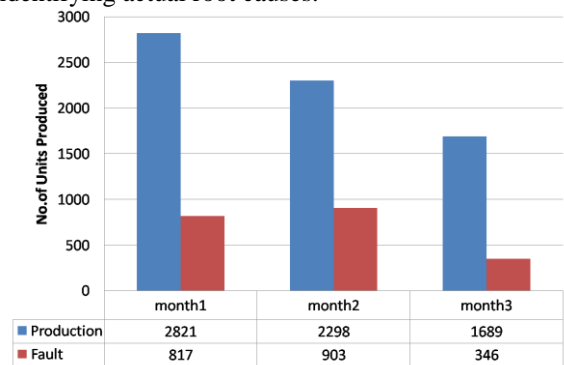


Figure 3 graph for faults vs production

The above graph is plotted between faults and production units which helps in identifying the month with more defects

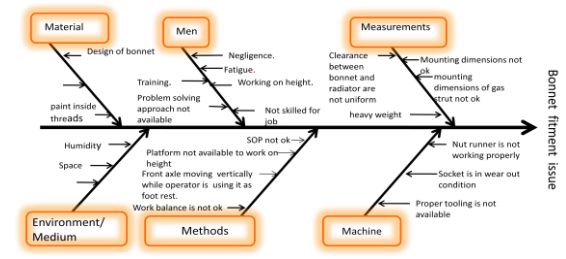


Figure 4 ishikawa diagram

d) Improve phase:

This is the fourth stage in DMAIC and it deals with implementation of new idea or improving the existing one, if it is sure that the data collected is appropriate then, it's time to move on to solution development. It is better to collect improvement ideas throughout the

project with effort so that it can lead to innovative and elegant solutions.

Steps to be followed in improve phase:

1. Brainstorm solutions that might fix the problem.
2. Select the practical solutions.
3. Develop maps based on different solutions to compare it with the present.
4. Select the best solution(s).
5. Implement the best solution.

The teams at this stage should concentrate on producing as many ideas as possible based on the idea, from Quantity, comes Quality.

in order to ensure the right decision is made, the team can use "PDCA cycle" or Plan Do Check Act, which can help refine the ideas

Control stage:

This the last stage of DMAIC, here the implemented ideas are sustained, This phase is a mini version of process management. The team has been building an idea of sustainability throughout the project, and during the Control Phase they begin to document exactly how they want to pass that idea of sustainability on to the employees who work in that particular process.

Steps to be followed in control stage:

1. Make sure the process is being monitored properly.
2. Expand the improved process throughout organization.
3. Apply new knowledge to other processes in your organization.

This stage has less steps to be followed but it has to be followed in order to sustain the implementation of ideas, control charts can be used in this stage.

V. CONTINUOUS IMPROVEMENT

Kaizen: kaizen is a continuous improvement technique which helps in sustaining the ideas implemented using DMAIC and it also helps improving them.

CONCLUSION:

Sharing of this six sigma problem solving methodology among the other areas in industry would bring up the positivity, if the entire methodology is not needed then a small concept or small parts of it which can be adopted and shared.

VI. REFERENCENCES:

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