

Analysis of Productivity Improvement and Safety Measures by using Six-Sigma Technique

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Abstract— In this paper an analysis is made of the relation between the general and specific topics of management and the six-sigma approach. a typical process of quality improvement has six phases: Define, Measure, Analyze, Improve, Control and Technology Transfer. DMAIC (T) is a well-known and highly utilized process for design for six-sigma. Product design is a process of creating new product by an organization or business entity for its customer. Six-sigma utilizes quality tools in the design process in order to avoid future problem in the product. The six-sigma methodology was applied through the implementation of DMAIC. The analysis of the problem an identification of areas for improvement was carried out developing different tools. Six-sigma provides an effective mechanism to focus on customer requirements through improvement of process quality. Six-sigma projects are being carried out with the objective of improving on time delivery, product quality and in-process quality. Six-sigma must after how people actually behave at work and, to this end, various behavioral and work process are key to achieving these aspirations. Implications are discussed with regard to performance management processes in organizations.

Key words: Quality, defects reduction, DMAIC, design for six-sigma

I. INTRODUCTION

The aim of this paper is to explain the use of six-sigma in a simplified manner. Six sigma's aim is to eliminate waste and inefficiency, thereby increasing customer satisfaction by delivering what the customer is expecting. Six is a highly disciplined process that helps us focus on developing and delivering near perfect product and services.

Design for six sigma is a data driven, decision making approach to analyze the root causes of problems and improve the process capability to the six sigma level. It utilizes a systematic six-phase problem solving process called 'DMAIC'. The process of DMAIC stays on track by establishing deliverable per each phase, by creating engineering models overtime to reduce the process variation and continuously improving the predictability of system performance.

In today's worlds, business as become more and more competitive. As well as the rubber gloves manufacturing industry, the organization studied in this paper itself has to maintain the quality of products so as to able to delight customers and thus effectively compete in the market. In general, one of the most vital concerns for the rubber gloves manufacturing industry is the reduction of common quality defects such as holes and stain in gloves.

Dealing with one process output in quality improvement is not enough in today's complex business environment. In most cases we deal with more than one

requirement needed to be satisfied. In this paper we present the proposed methodology which improves the six-sigma methodology based on the multi-objective techniques and design of experiment.

II. CONCEPT

SIX-SIGMA is a highly disciplined process that enables organization deliver nearly perfect products and services. It is a quality philosophy and the way of improving performance by knowing where you are and where you could be Methodology to measure and improve company's performance, practices and systems.

SIX-SIGMA emerged as a natural evolution in business to increase profit by eliminating defects. The current business environment now demands and rewards innovation more than ever before due to:

- Customer expectations.
- Technological change.
- Global competition.
- Mark-fragmentation.

One of the SIX-SIGMA'S distinctive approach process and quality improvement is DMAIC. The DMAIC model refers to 5 interconnected stages.

A. Define:

These stages within the DMAIC process involve defining team's role; project scope and boundary; customer requirement and expectations and the goals of selected projects.

B. Measure:

These stages include selecting the measurement factor to be improved and providing a structure to evaluate current performance. As well as assessing, comparing and monitoring subsequent improvements and their capability.

C. Analyze:

This stage centers is determining the root cause of problem, understanding why defects have taken place as well as comparing and prioritizing opportunities for advance betterment.

D. Improve:

This step focuses on the use of experimentations and statical techniques. To generate possible improvements to reduce the amount of quality problems or defects.

E. Control:

Finally, this last stage within the DMAIC process ensures that the improvements are sustained and that on-going performance is monitored. Process improvement are also documented and institutionalized.

III. IDENTIFICATION OF PROBLEMS

In many manufacturing industry there are so many problems related to productivity. It is major problem in industry because it affects industrial growth. In this industry there are so many problems which affect their productivity and production. The following are the problems found in that industry:-

- 1) No Painting shop: - There is no separate paint shop. Thus painting is done in free space. The paint particles get spread in all over the shop.
- 2) Improper handling of material: - In this industry improper material handling by workers take place, due to which chances of accident increases.
- 3) Improper inventory of materials: - There is no specific space for raw materials and finished products. Due to this workers face much problem to find proper material. It increases production time.
- 4) Less safety measures: - In this industry, the proper safety equipments are not available. So that it increases accidents to them.
- 5) Environmental hazardous: - In the industry some machining operation is done in open space like grinding, painting etc. Due to this particles get spread in environment because of it environment get hazard.

IV. SIX-SIGMA METHODOLOGY

Manufacturing process produces well that have physical characteristics that can be measured. The quality of the goods produced is based on their usefulness to the end user or customer of the products. The definition of quality has evolved to include the utility of that which is produced to the end customer. The measure of these characteristics become the first concern of a manufacturing organization that employees a six-sigma quality system. The first act in utilizing a six-sigma approach to a problem is to analyze the ability to measure the characteristics that need to be optimized.

Six-sigma projects follow two project methodologies inspired by PDCA.

- DMAIC
- DMADV

These methodology, composed of

- DMAIC
- DMADV

DMAIC is used for projects aimed at improving an existing business process. DMADV is used for projects aimed at creating new product or process design.

The DMAIC project methodology as 5 phases:-

- Define the system, the voice and customer and their requirements, and the project goals.
- Analyze the data to investigate and verify cause and affect relationship.
- Improve or optimize the current process based upon data analysis using techniques such as design of experiments and standard work to create a new, future state process.
- Control the future state process to ensure that any deviations from the target are corrected before they result in defects.

The DMADV project methodology as 5 phases:

- Define design goals that are consistent with customer demands and the enterprises strategy.
- Measure and identify CTQs (characteristics that are critical to quality), product capability production process capability, and risks.
- Analyze to develop and design alternatives.
- Design improved alternatives, best suited per analysis in the previous step.
- Verify the design, set up pilot runs, implement the production process and hand it over to the process owner.

V. PRINCIPLES OF SIX-SIGMA

- Describe the problems in operational term.
- Focus on why defects, errors and excessive variation occur.
- Evaluation and selection.
- Implementation planning.
- Standard operating procedures.
- Maintain improvements.

VI. IMPLEMENTATION ON PROBLEMS

A. *Grinding Operation On Raw Material Creates Smoke And Spark:*

1) *Solution:*

- Workers now uses smoke control mask.
- Opening of side sheet for better ventilation & Smoke exhaust.
- Workers now use full size aprons for avoiding Spark contact.



Fig. 1:

B. *Unloading Of Material from Trucks to Storage Place:*

1) *Solution:*

- Now uses small cranes for lifting materials.
- Uses hand gloves during handling.
- Direct truck parking in storage place which effects in minimum manual handling of materials.



Fig. 2:

C. Improper Storage of Material:

1) Solution:

Materials are now properly planned and kept by using appropriate space on the floor and also avoiding further congestion in the path.



After Improvement

Before Improvement

Fig. 3:



Fig. 4:

D. Environmental Effect like Dust & Smoke:

1) Solution:

- Quantity of exhaust fans are increased now
- More openings are provided for ventilation & Lightning.
- Fan for workers to provide comfort working conditions.

E. Improper Location For Painting The Machine Parts In Between Other Shops Causes Breathing Problem:

1) Solution:

Suggesting to place the painting shop separately from the shop floor.

VII. CONCLUSION

The six-sigma process improvement methodology viz. DMAIC project shows that the performance of the company is increased to a better level as regards to: enhancement in customer satisfaction, development of specific methods to redesign and reorganize a process with a view to reduce or eliminate errors, defects, development of more efficient, capable, reliable and consistent manufacturing process and more better overall process performance and creation of continuous improvement.

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