Implementation of Lean Six Sigma in a Small Scale Mushroom Production Plant: At Basic Level

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Abstract – Lean Six Sigma is one of the most important and popular development in the field of quality. Lean Six Sigma is the combination of two different methodologies "Lean" focuses on elimination of wastes and "Six Sigma '' reduced the rate of defects. This research focuses on Mushroom production plant wastes. There are several wastes in Mushroom plant such as Compost waste, Poly propylene bags (compost bags), mushroom waste and water waste. In order to improve the production process in mushroom plant lean six sigma method is conducted. DMAIC (Define, Measure, Analyse, Improve, and Control) is used as a methodology, Ishikawa diagrams are also used to analyse the data. After implementation of lean six sigma there is reduction in wastes from 8-12% and increases the overall efficiency.

Index Terms – Lean Six Sigma; DMAIC Ishikawa diagram analysis; Mushroom Plant

1. INTRODUCTION

Lean Six Sigma is a synergized managerial concept of Lean and Six Sigma. Lean is a systematic approach to eliminate waste and change processes. This is done by identifying and reducing waste with continuous improvement. Lean seeks to create a production flow throughout the value stream by eliminating all forms of waste and improve value- added products to customers. There are seven wastes by Shigeo Shingo namely: overproduction, defects, unnecessary inventory, inappropriate processing, excessive transportation, waiting and unnecessary motion. Six Sigma is a process gives more value to customers and stakeholders with focused on improving product quality and company productivity. There are five stages DMAIC (define, measure, analyse, improve and control) method.

Mushroom cultivation in India began in the year 1962 in Himachal Pradesh at Solan. Since then mushroom production in India has increased from 7000 tons in the year 1983 to 70,000 tons in the year 2004. This production is quite low as compared to other mushroom growing countries of the world. Many factors such as seasonal growing by using long method of composts, poor hygiene and sanitation, attacks of pests and disease can be attributed to affect yield. Failures to provide optimum growing conditions also affect both quality and quantity. There are several wastes encounter in mushroom production plant which affects the overall production and cost. These wastes are compost waste, polypropylene bags (compost bags), mushroom waste, water waste and time consumption in mushroom crop harvest. To avoid all these problems Lean six sigma is implemented in mushroom plant in order to improve the productivity and quality.

2. RESEARCH METHODOLOY

The DMAIC approach and appropriate tools:

This method follows a conductive five- step necessary to obtain reliable results, contacted in the acronym DMAIC for: Define Measure, Analyse, Improve and Control. The DMAIC approach of six sigma is with his toolbox as a filter to pass from a complex problem with many uncontrolled variables to a situation where quality is controlled.

D for Define: This phase helps clarify the issues of the project, to identify customer expectations, to set goals and designated project stakeholders. In this first step, it is necessary to focus on the process that generates the product or service and the map in order to be familiar.

M for Measure: This is a step of collecting data on measurable parameters of the process. The objective is to determine what is able to provide the process in question namely its sigma. During this stage, it is important to focus on critical parameters for the quality, that is, those whose influence on the result is the largest.

A for Analyze: Data obtained during the previous step are analyzed to calculate performance gaps, that is to say the differences between what is done every day and what can be achieved. We must then study the origins of the variability of the process and determine the root cause. At this stage, improvement solutions to remove the root causes of process variability concerned are proposed to meet objectives.

I for Improve: The solutions to the dysfunctions proposed are validated by the project team and the ability of the optimized process is evaluated to ensure their impact. Finally, an action plan detailing the implementation of chosen solutions must be developed to best manage the changes induced by the solutions implemented.

C for Control: This last step is to control the process to ensure that the problem is solved and stay in quality level achieved. During this step, we must maintain the benefits gained by standardizing the process. Finally, the financial statement is prepared in order to quantify the made gains.

During a DMAIC improvement projects the initial process control charts are an opportunity to learn about process to make maximum benefits of this it is desirable to keep alongside the charts a log of everything which happened which might have an impact on the variability of the process.

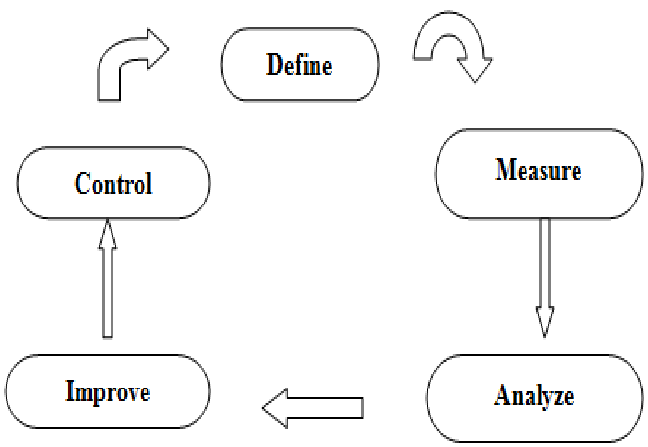


Figure 1: DMAIC

Why this Lean six sigma: this is study to:

Reduce all wastes from mushroom production plant.

Increased overall production of mushroom plant.

First phase: Define:

Definition of default: wastes problems In a mushroom production plant the main problem to run the plant efficiently is wastes, and non value added activity. On such conditions mushroom production plant owner should make a new innovation to minimize wastes and non value added activity. Type of waste identification during production process are shown in Table 1.

Table 1: Categorization of waste.

Type of waste	Description
Material	• Compost waste when not required • Compost bags • Lack of irrigation equipment
Labour	• Labour cost • Unskilled labour
Material handling	• Lack of material handling equipment
Transportation	• Lack of transportation
Unnecessary motion	• Lack of facilities while harvest of mushroom crop. •

Second phase: waste measurement

Based on the observations several types of waste that have identified are compost waste, polypropylene compost bags wastes, water waste, unnecessary motion, labour and transportation. The most common and influential waste shown in Table 2.

Table 2: summary of waste measurement

S.No	Type of waste	Description
1	Compost	7-8 kg/ bag
2	Polypropylene bags	200/ kg
3	Labour	10,500/ month
4	Unnecessary motion	hours

Third phase: Analyse

Ishikawa diagram also called a cause and effect diagram or fishbone diagram is a visualization tool for categorizing the potential cause of problems in order to identify its roots causes. Some points that leads to waste type is compost waste after being used, mushroom waste, and unloading of compost bags by workers sometimes gets break and loss of compost which ultimately affect the cost. Figure 2 show the potential waste which influence plant production.

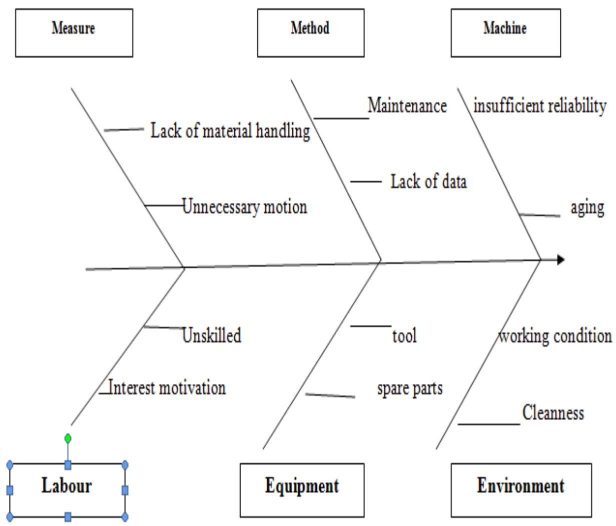


Figure 2 Ishikawa diagram

Fourth phase: Improvement

- Improvement in material handling system.
- Reduction in unnecessary motion.
- Improvement in scheduling.
- Reduction in wastes.
- Training programs for workers.
- Improvement in production.
- Improvement in working conditions.
- Reduction in faults step by step.
- Improvement in turnover.
- Increase efficiency

Fifth phase: controlled

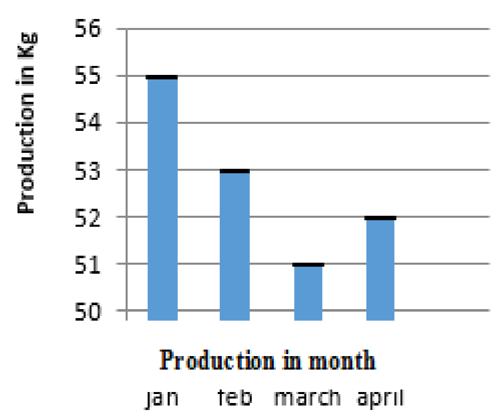
- Monitoring the implementation scheduled step by step
- Comparison between times of preventive works before and after using lean six sigma

3. RESULTS AND DISCUSSIONS

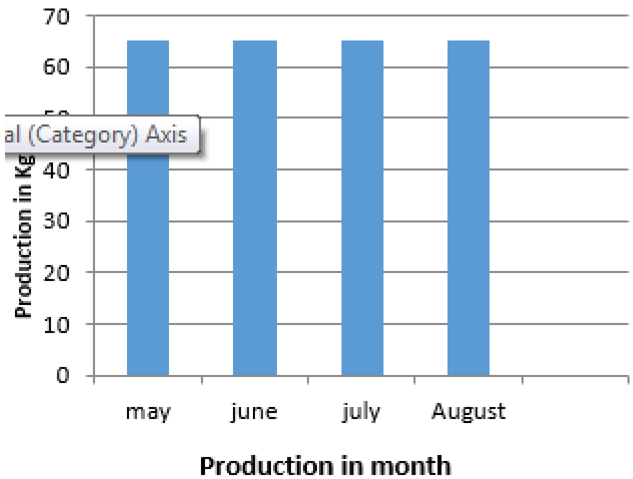
S/No.	Factors before implementation of lean six sigma	Factors after implementation of lean six sigma
1	Lack of material handling	Improvement in material handling
2	Unnecessary motion	Reduction in unwanted motion
3	Unskilled labour	Training programs for workers
4	Interest and motivation	Workers are more interested and motivated
5	Lack of data	Improvement in data source
6	Maintenance process	Reduction in faults step by step
7	Maintenance policy	Improvement in maintenance.
8	Insufficient reliability	More reliability
9	Production planning	Improvements in scheduling.
10	Working conditions	Improvements in cleanness.

Table 3

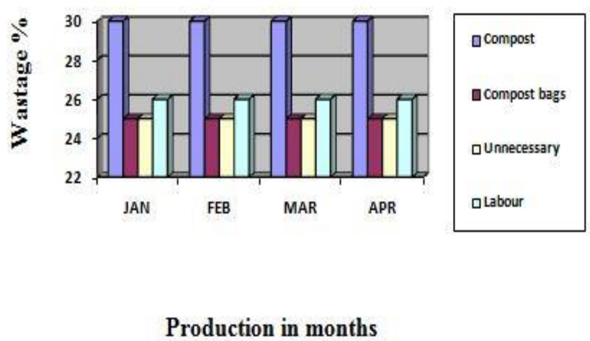
Rate of production before lean six sigma implementation



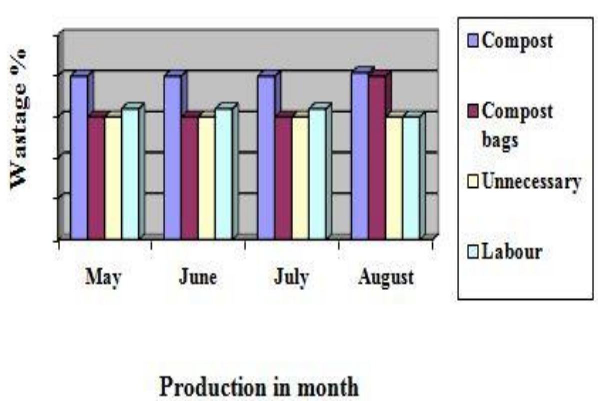
Rate of production after implementation of lean six sigma



Reduction in wastage Before implementation of lean six sigma



Reduction in wastage after implementation of lean six sigma



4. DISCUSSION AND CONCLUSION

From the above results it is very clear that after implementing lean six sigma there is reduction in the wastes and improvement in the quality process. The main wastes in mushroom production plant were compost , compost bags, material handling and unnecessary motion .The root causes of wastes were improper material handling system workers self unloading of compost bags which some time damages causes wastes. The main important waste is unwanted motion of workers during harvest of mushroom crop which leads to time consumption. Labour is some time not required which also affects the cost. The variation can be identifying by using the ishikawa diagrams analysis. After implementation of lean six sigma in mushroom production plant at basic level there is waste reduction from 8-12% and improvement in the productivity which leads to improvement in the turnover.

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