

Role of Total Productive Maintenance in Implementation of Lean

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Abstract

Total productive maintenance (TPM) is a lean manufacturing concept in which it is believed that the maintenance activities are not only restricted to maintenance personnel but it is the responsibility of all the facilities of the organization to participate in such activities which in turn will improve the efficiency of the organization significantly. It uses the skill of the facility to incorporate the maintenance related activities in daily routine activities. This approach results in a safer workplace, lesser breakdowns, and improved efficiency of the organization. This paper discusses the main aspects of the total productive maintenance technique which will help the authors in the implementation process.

Keywords Total productive maintenance, Lean manufacturing, Waste minimization, Productivity improvement

1 Introduction

The breakdown of the plant, machinery, and equipment directly affects the efficiency of the organization. The breakdowns result in increased lead times which affects the deadlines and thus customer satisfaction. In the competitive world, no organization can afford frequent and long breakdowns in its production system otherwise it will result in customer loss. TPM is a maintenance program which involves all the facility of the organization to maintain the plant and the equipment. The aim is to improve the production time of the organization through fewer breakdowns and a safer environment. TPM makes everyone realize the importance of maintenance activities and their vital role in a successful business. The unscheduled and emergency breakdowns are considered evil for the business and the aim of the TPM is to keep these to a minimum. It considers the maintenance activities are part of the daily manufacturing activities and try to integrate the maintenance activities with the manufacturing process activities. It helps in reducing waste or defects, improving quality, reducing cost, and improving lead times.

It is thus, very important for organizations to incorporate TPM in its manufacturing environment in order to improve overall efficiency and customer satisfaction.

2 Literature review

In order to understand the concept of TPM, one must have knowledge of different types of maintenance first. The various types of maintenance are given below:

- a) Breakdown maintenance: It means that maintenance of the equipment will be done only when it fails to operate or breakdown. This is preferred only in the case when the failure of the equipment or its breakdown does not affect the production significantly and thus does not incur any significant loss.

- b) Preventive maintenance: It includes the daily maintenance activities done in order to prevent the breakdown of the equipment and maintaining a sound condition to ensure the proper functioning for the future without any failure. It includes activities like cleaning, lubricating, and inspection, etc. In this type, it is ensured that all the parts are in healthy condition and must be replaced before their deterioration so that their condition should not affect the whole system. It is further of two types:
- Periodic maintenance: It is also known as time-based maintenance. It includes activities like timely or periodic checking of all the important parts of the equipment and ensuring that all parts used are in a healthy state and working properly. It includes the inspection, cleaning, replacement and servicing activities of the parts to prevent sudden failures or breakdowns.
 - Predictive maintenance: It includes the prediction of the service life of the important parts through inspection and decision related to their replacement is taken based on the condition of the part in use.
- c) Corrective maintenance: It is carried out during other work orders when an extra problem is diagnosed which demands maintenance in order to prevent the system from another breakdown in the future. For example, during preventive maintenance or breakdown maintenance, maintenance personnel has identified another faulty part of the system for which maintenance was not planned but during the maintenance that additional work has been identified which needs repair in order to prevent another possible breakdown in the future.
- d) Maintenance prevention: It is the use of improved technology to reduce or eliminate various types of maintenance activities. In this, the information related to weakness of certain parts is collected and studied carefully in order to redesign those parts by ensuring that their new design enables standard maintenance practices that are faster, cheaper, and more effective.

The goal of TPM is to increase production significantly by increasing equipment availability, performance, and quality. It also results in job satisfaction of the employee by providing safe work environments. The main objectives of the TPM are:

- a) To improve the overall equipment effectiveness of the plant.
- b) To achieve zero defects, breakdown and accidents in all the areas of the organization.
- c) To involve all the people of the organization in achieving maintenance activities.
- d) To achieve autonomous maintenance.
- e) To schedule maintenance for avoiding breakdowns.
- f) To improve efficiency, effectiveness, and reliability of the maintenance of equipment.
- g) To impart training to the concerned personnel and develop necessary skills.

The eight pillars of TPM revolve around proactive and preventive approaches for increasing the reliability of the equipment. These eight pillars are given below:

- a) **Autonomous maintenance:** It is related to taking ownership of equipment and it is done by operators. The operator is given the responsibility of daily cleaning activities and minor maintenance activities. The operators are given training for such kind of activities which improves the skill and confidence of the operator as they get detailed information about their equipment. This increases the reliability and lifespan of the equipment due to daily maintenance activities and monitoring.
- b) **Focused improvements:** The non-value added activities are responsible for lowering the production and efficiency of any industry. The continuous improvement techniques like kaizen help to improve the quality and efficiency of any industry by identifying and eliminating or reducing the non-value added activities in the production system. The teams are formed with people from various departments of the industry which focus on identifying the issues related to the equipment and provide solutions to those issues through kaizen. The team works together to analyze the root cause of the issues identified, provide solutions and monitor those solutions to ensure continuous improvement.
- c) **Planned maintenance:** Planned maintenance is very important to ensure the zero breakdowns of the equipment. It is decided on various factors of the equipment like running hours, past breakdown records, etc. In order to incorporate planned maintenance in the system, the production departments have to make some buffer of the stock.
- d) **Early equipment management:** It focuses on the design stage of the equipment in order to ensure easy to operate and maintain the capabilities of the equipment. During the design stage following points are taken care of: ease of cleaning, lubrication and inspection, parts accessibility, ergonomics of the equipment, improved changeovers, interactive feedback system, and safety.
- e) **Quality maintenance:** It ensures that the equipment is capable of detecting and preventing errors which helps in improving the quality. Various lean tools are used to help the detection of errors in time in order to ensure the reliability of the production process and quality.
- f) **Training and education:** It involves all the members of the organization starting from a lower level to a higher level. The operators are trained to carry out basic maintenance activities for their equipment which were previously carried out by maintenance personnel only. This gives the confidence to the operator in working as it gives more knowledge about the equipment they are operating. Similarly, the maintenance personnel is given training regarding planned maintenance and other higher level of maintenance activities. The manager level is also imparted training on the maintenance activities so that they can effectively monitor and guide their subordinates for different situations.
- g) **Administrative and office TPM:** The supportive departments are given necessary information regarding the lean concept and their working so that these departments should incorporate these

concepts in their daily routine which will help in eliminating the non-value added activities and thus these departments will also support in improving the overall efficiency of the organization.

- h) Safety, health, and environmental conditions: It ensures that unsafe practices and unsafe environments must be eliminated from the work environment. It ensures safe working conditions to the operators which improves the morale and job satisfaction and thus performance of the operators. The equipment is made safe by providing necessary safety guards and necessary personal protective equipment is made compulsory at the work station to ensure a safe work environment.

3 Conclusion

TPM is necessary for any organization in order to improve their production and efficiency. It provides enough confidence to the operators through safe working conditions and training of the equipment they operate which further leads to improved performance and quality of work. The life span and reliability of the equipment is ensured through planned and autonomous maintenance. The most important part of TPM is the involvement of all the members of the organization for a common goal of improving the performance, availability, and quality through different approaches.

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