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# Implementation of Total Productive Maintenance: In a Machine Shop

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***Abstract*—***The purpose of this paper is to review the literature on Total Productive Maintenance (TPM) and to present an overview of TPM implementation practices adopted by the Machine shop. It also seeks to highlight appropriate enablers and success factors for eliminating barriers in successful TPM implementation. TPM is one of the lean tools, a maintenance program which gives a totally new approach for maintaining plant and equipment. Therefore, methodology like TPM is necessary to get a better result. This plan results in maximum effectiveness of equipment's, tidier, neat and clean workplace and morally boosted employees.*

***Keywords—Total Productive Maintenance, Overall Equipment Efficiency, Availability.***

## I. INTRODUCTION

Now day's huge manufacturing organisation are in race of only increasing the productive while ignoring the maintenance of machines and equipment, due to this, various wastages occurring in the manufacturing shop floor. The wastages may also be is due to operators, maintenance personal, process, tooling problems and non-availability of components in time etc. Other forms of waste includes, idle manpower, breakdown machine, rejected parts etc. are examples of waste. The quality related waste are of significant importance as they matter the company in terms of time, material and the hard earned reputation of the company. In this situation, a revolutionary concept of Total Productive Maintenance (TPM) has been adopted in many industries across the world to address the above said problem. The main aim is to aware and motivate employees in machine shop to ensure that all machines and equipment are self-maintained at regular interval of time and are in running position to increase the productive of machine shop.

## II. PROBLEM STATEMENT

After visiting the Machine shop. Following problems were observed on shop floor:

- Lack of co-ordination between instructors and workers.
- Tools were unorganized.
- Poor utilization of material.
- Machine maintenance was not carried out.
- Time loss occurs during loading and setting of job on machines as too many operations are involved in producing each part.
- Breakdowns of machines due to improper cleaning and lubrication of machines.

All the above mentioned problems are affecting the production rate on production shop floor and thereby affecting Productivity of the Machine Shop. Hence in order to eliminate the above mentioned causes, the eight pillars of Total Productive Maintenance can be used as a continuous improvement program.

## III. OBJECTIVES

The objective of this study is to improve productivity and quality along with increased employee morale and job satisfaction. Introduction of TPM to machine shop will help to improve productivity.TPM was introduced to achieve the following objectives. The important ones are listed below.

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- Avoid wastage in a quickly changing economic environment.
- Producing goods without affecting product quality.
- Reducing cost of maintenance by 100% involvement of employees at regular interval time.
- Produce a low-cost quantity and non-defective goods at the earliest possible time.
- Taking care of customer satisfaction.

## IV. IMPLEMENTATION OF TPM

TPM concept is implemented in sequential step in a machine shop to get objective of this study. In each step TPM pillar is implemented in proper manner. Overall equipment effectiveness (OEE) is taken as a measure of success of TPM implementation. Figure 1.1 shows the TPM foundation and its pillars.

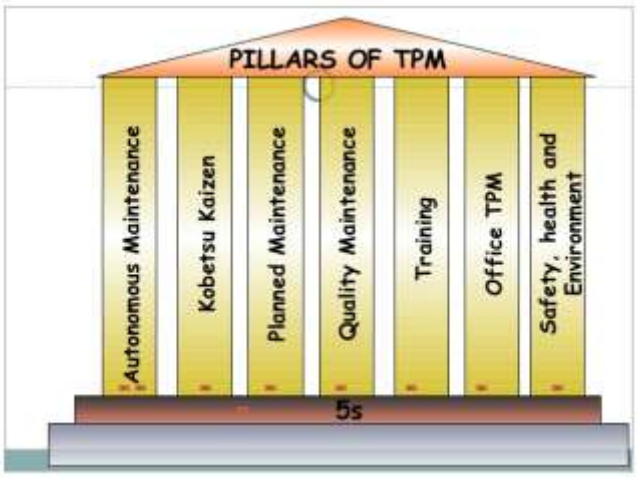


**Figure 1: Pillars of TPM.**

### 4.1 PILLAR 1-5S.

TPM starts with 5S, 5S can be called as foundation stone of TPM implementation. Meaning of each 'S' is explained in Figure 1.2.


**Figure 2: Meaning Of 5S.**

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### 4.2 PILLAR 2-Autonomous Maintenance.

The main aim of autonomous maintenance is increasing the performance of the machine shop in a sustainable way. It enhances the knowledge and ownership of the operators to make them able to face more complex problems related to safety, quality and productivity. It helps operator to maintain their own equipment on an ongoing basis to develop their abilities and sense of responsibility. Its main objective is train, coach and audit autonomous workgroups. It's a first level maintenance and reduces the losses caused by accelerated equipment deterioration. This requires plan involving tools and techniques and best use of resources including employees.

### 4.3 PILLAR 3-Kobetsu Kaizen.

The main aim of this pillar is prioritizing the most important losses and eliminating them on shop floor itself. Kaizen is an ongoing, never ending, lower risk improvement process. It involves everyone in an organization working together to make improvements without large capital investments.

### 4.4 PILLAR 4-Planned Maintenance.

Planned maintenance is a systematic approach to establish and maintain optimal equipment and process conditions, in an efficient and cost-effective way. It is the scheduling of maintenance activities based on observed behavior of machines such as failure rates and breakdown. Firstly, evaluate equipment and understand current conditions and then build a planned maintenance system to restore deterioration and weaknesses

### 4.5 PILLAR 5-Quality Maintenance.

Quality maintenance pillar is concerned with the quality of product produced by equipment and the process control strategy used to ensure that product quality is maintained. The process starts with identifying and prioritizing the quality requirements of the customer in terms of product parameters and then identify the process characteristics which determine these product parameters and set control parameters which ensure good quality product. If equipment is not capable of maintaining these process parameters. Further analysis including P-M analysis is carried out to identifying necessary equipment improvements. Once process parameters have been identified and equipment capability established then develop a proper control plan to monitor and adjust the equipment to maintain process capability. This may include equipment inspections, visual process management and statistical process control.

### 4.6 PILLAR 6-Training.

It is an important pillar as it focuses on skills and training of employees and upgrade their standard so that in future if new technology is adapted by an organization, employees can actively participate in it. Training should be done on periodic basis to get full use to machines and increase the rate of productivity.

### 4.7 PILLAR 7-Office TPM.

This pillar is concerned with the efficiency of administrative processes which support the manufacturing program. These include purchasing and logistics processes as well as general administration to specific activities. It creates an efficient and visually controlled environment for administrative processes. Visual management should allow anyone to understand the status of process and 5s helps to eliminate wasteful searching for information and inefficient duplication of activities.

### 4.8 PILLAR 8-Safety, Health And Environment.

This pillar is concerned with the improvement of safety of an organization which means it focuses on risk assessment, severity, occurrence, detection and reduces the risks which affects human health and environment.

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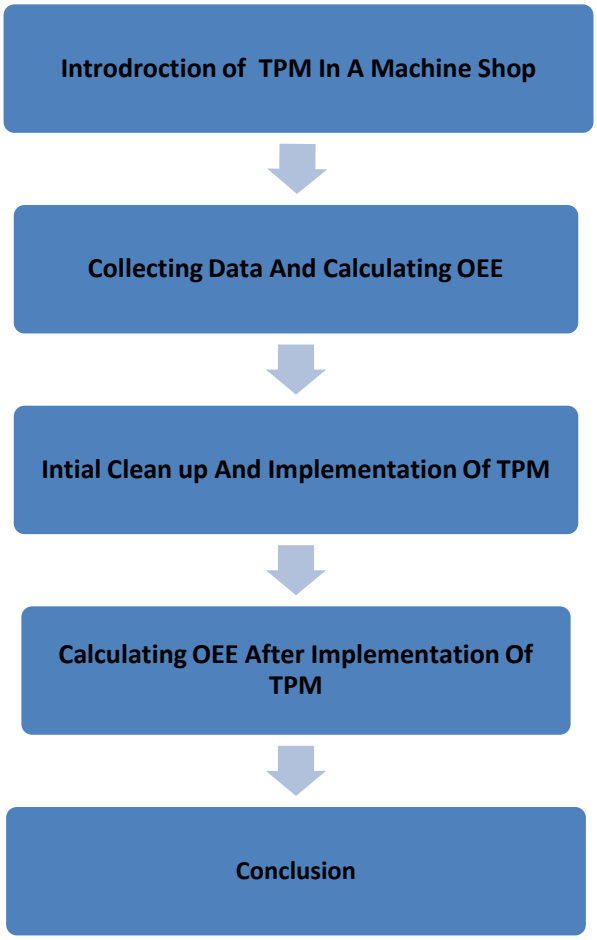
## V. METHODOLOGY




### 5.1. Introduction of TPM

In this step, we introduce TPM to machine shop by explaining about the TPM, objectives of TPM and importance of TPM to supervisor and assistant supervisor of machine shop as this was new concept for them and further we put posters for student awareness about the TPM.

### 5.2. Collecting Data And Calculating OEE.

In this step, we started collecting data like workshop operating time, planned shutdown time, actual operating time, total output, good output. Also data of all machines and equipment and started evaluating the current condition.

Calculation For OEE:

OEE = Availability x Performance x Quality

Availability = Actual Operating Time/Planed Production Time

Planned Production Time = Plant Operating Time – Planned Shut Down Time

Quality = GOOD OUTPUT /TOTAL OUTPUT

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### 5.3. Initial Clean Up and Implementation Of TPM.

In this step, initial cleaning is done of Machine Shop floor and Implementation of TPM i.e. Implementing the TPM pillars (5s, Autonomous maintenance, Kaizen, safety, healthy) is done and followed the PDCA cycle(Plan Do Check Act) for better results.

### 5.4. Calculating OEE after Implementation Of TPM.

Again calculating OEE after implementation of TPM by same formulae and comparing results of the OEE.

## VI. CONCLUSIONS.

On basis of results of OEE further discussions are done and improvements are made in implementing steps. After proper implementation of TPM in the machine shop we have achieve some of the objectives of TPM and increase in productivity.

## VII. CONCLUSION

The literature represented in this study describes the importance of Total Productive Maintenance in the field of production. Today TPM can be viewed as a complete package that incorporate all aspects of business along with the production process. In this study, the problem faced in a Machine Shop is analysed using Total Productive Maintenance approach. The various problems such as production delays has been analysed and implementation of TPM is suggested to bring in improvements. As TPM incorporates all aspects of business, it will bring in all people working in the machine shop right from students to supervisor to work together as a team in order to eliminate the bottleneck. Thus after carrying out stepwise implementation of TPM in the Machine shop, remarkable improvements in productivity, reduction in lead time, reduction in inventories can be achieved thereby increasing the efficiency of machine shop.

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