

Chemical, Civil and Mechanical Engineering Tracks of 3<sup>rd</sup> Nirma University International Conference  
on Engineering  
(NUICONE 2012)

## Total Productive Maintenance (TPM) Implementation in a Machine Shop: A Case Study

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### Abstract

Quality and Maintenance of manufacturing systems are closely related functions of any organization. Over a period of time two concepts have emerged which are Total Productive Maintenance (TPM) and Total Quality Management (TQM) along with other concepts to achieve World Class Manufacturing system. In this paper experience of implementing Total Productive Maintenance is shared and investigated for a company manufacturing automotive component. Concept is implemented in the machine shop having CNC turning centers of different capacity. Overall Equipment Effectiveness is used as the measure of success of TPM implementation. The losses associated with equipment effectiveness are identified. All the pillars of TPM are implemented in a phased manner eliminating the losses and thus improving the utilization of CNC machines.

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Selection and peer-review under responsibility of Institute of Technology, Nirma University, Ahmedabad.

*Keywords:* Total Productive Maintenance, Total Quality Management, 5-S, Kaizen.

### Nomenclature

<i>A</i>	Availability
<i>OEE</i>	Overall Equipment Effectiveness
<i>PE</i>	Performance Efficiency
<i>QR</i>	Quality Rate

### 1. Introduction

In today's industrial scenario huge losses/wastage occur in the manufacturing shop floor. This waste is due to operators, maintenance personal, process, tooling problems and non-availability of components in time etc. Other forms of waste includes idle machines, idle manpower, break down machine, rejected parts etc. are all 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. There are also other invisible wastes like operating the machines below the rated speed, start up loss, break down of the machines and bottle necks in process. Zero oriented concepts such as zero tolerance for waste, defects, break down and zero accidents are becoming a pre-requisite in the manufacturing and assembly industry. 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 goal of the any TPM program is to improve productivity and quality along with increased employee morale and job satisfaction. Earlier preventive maintenance was considered as non value adding process, but now it is essential requirement for longer life cycle of machines in an industry. TPM is an innovative approach to maintenance that optimizes equipment effectiveness, eliminates breakdowns, and promotes autonomous operator maintenance through day-to-day activities involving the total workforce.

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Nakajima S.[1] done pioneering work and has given basic definition of TPM, its importance, goals of TPM, objectives of TPM, merits and demerits of TPM and steps to be followed while implementing TPM. Also author has described about challenging limits for TPM, method for calculation of OEE, possible areas of wastage of resources which may occur. I. P. S. Ahuja et al.[2] gives in-depth review on TPM literature published. Author has summarized eight pillars for the success of TPM implementation as shown in Fig. 1. F. Ireland et al.[3] given a study of total productive maintenance implementation in three companies. Nakajima's seven steps of autonomous maintenance was the focus for implementation. Ross Kennedy et al.[4] give the concept of TPM<sup>3</sup> means third generation TPM which is having eight pillars instead of seven pillars. TPM<sup>3</sup> is an enhanced Australian approach applying the principles and practices of the Toyota Production System and the Toyota Way - Lean and TPM. Ki-Young jeong et al.[5] gives the detailed loss classification scheme for computing OEE for a capital intensive industry. F. T. S. Chan et al.[6] implemented the concept of TPM in semiconductor industry. Authors have reported 83% improvement in equipment productivity. Marcelo Rodrigues et al.[7] discussed the reasons of failure of TPM implementation and concluded that the shallow involvement of the people of various levels is the main reason of the failure of TPM. G. Chand et al.[8] reported to implement the concept in cellular manufacturing system having forming shop, tool room and product test room. In the paper they have reported 62% OEE and concluded the need of sustained TPM implementation to achieve world class OEE level of greater than 85%. M. C. Eti et al.[9] implemented the concept in Nigerian industry and concluded that TPM can succeed only if necessary training is provided and time is given to monitor the success or failure of improvement activities.

In this paper experience of implementing TPM concept in automotive manufacturing company (RBD Engineers Ltd., Khatraj, Gandhinagar, Gujarat) is discussed. All the pillars of TPM are implemented in a phased manner leading to continuous improvement of the company. In the section 2 various pillars are explained and approach taken to implementation is also mentioned. Section 3 discusses the analysis of the data before and after implementation of the TPM. Section 4 gives the conclusion of the present work.

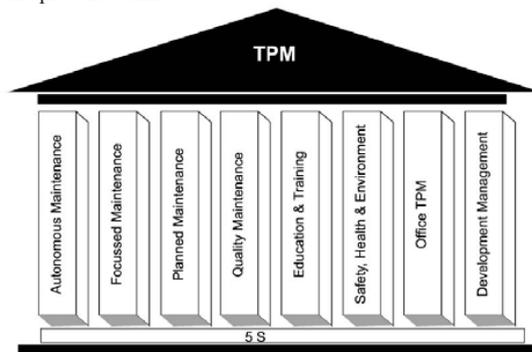


Fig. 1 Pillars of TPM [2]

## 2. TPM Implementation

TPM concept is implemented in a phased manner in a machine shop of a company manufacturing automotive components. In each phase one TPM pillar is implemented. Overall equipment effectiveness (OEE) is taken as a measure of success of TPM implementation. Approach of implementation of each pillar is discussed in following subsections.

### 2.1. 5-S

TPM starts with 5S. 5S can be called as foundation stone of TPM implementation. It is a Japanese way of housekeeping. Problems cannot be recognized is the work place is unorganized. Cleaning and organizing the workplace helps us to pop up the problems. Making problems visible and seen to the people gives an opportunity of improvement. If this 5S is not taken up seriously, then it leads to 5D i.e. Delays, Defects, Dissatisfied customers, Declining profits and Demoralized employees. Meaning of each 'S' is explained in Table 1.

Table 1: Meaning of 5-S

Japanese Term	English translation	Equivalent 'S' term
Seiri	Organization	Sort
Seiton	Tidiness	Systematize
Seiso	Cleaning	Sweep
Seiketsu	Standardization	Standardize
Shitsuke	Discipline	Self-discipline

### Approach:

The concept of 5S is introduced to the Quality Circle formed in the company and to the workers as well. Current situation of the workplace was studied by 5S audit using check sheets and ratings were calculated. Table 2 gives the detailed 5S implementation report.

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