

Analysis of Total Productive Maintenance in Automobile Servicing Sector

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ABSTRACT: Today, machine maintenance and in particular, implementing an appropriate maintenance strategy has become increasingly important for manufacturing industries. Total Productive Maintenance (TPM) is an excellent approach for maintaining plants and equipment's which optimizes the equipment effectiveness, eliminates breakdown and promotes autonomous operator maintenance through day-to-day activities, which involves the total work force. This paper presents the study and overview of implementation of TPM in an automobile spare parts manufacturing industry to enhance OEE. For this purpose, the current OEE of machines are analyze and critical machine is selected for implementation of TPM. The methodology includes step wise implementation of 5S, Autonomous maintenance, Kaizen and Planned maintenance. After implementation of TPM on the critical machine increase in availability, performance and quality is achieved thereby enhancing overall equipment effectiveness. Comparison of OEE before and after TPM implementation validates the success of TPM implementation in the industry.

Key Words: TPM (Total Productive Maintenance), OEE (Overall Equipment Effectiveness), AM (Autonomous Maintenance), KK (KobetsuKaizen), PM (Planned Maintenance).

I. INTRODUCTION

The time-loss and material-waste are because of unskilled operators, maintenance personnel, processes, tooling problems and non-availability of components in time. There are few other losses like idle machines, idle manpower, rejected parts, quality waste etc. The quality related waste is of great importance because it took all the time of the production process and get wasted when the product is done. Also, it matters in terms of time, material and the hard earned reputation of the company. There are few other invisible losses

like operating the machines against its specification (e.g. below the rated speed), startup loss, bottle necks in the process and break down of the machines. To avoid the above- said losses, a revolutionary concept of TPM has been adopted by many industries across the world. Zero oriented concepts like zero inventories, zero lead time, zero defects, and zero tolerance for waste, breakdown and zero accidents are becoming the pre-requisite for the production plant which can be achieved by implementing TPM.

TPM is analyzed into three words:

- **Total:** This means that every individual in the company, from the top management level to the shop floor workmen level.
- **Productive:** This means no wasted activity or the production of goods and services that meet or exceed customer's expectation.
- **Maintenance:** Keeping equipment and plant in good working order i.e. in as good as they are in original condition at all the time.

1.1 TPM techniques/methods

TPM (Total Productive maintenance) is one of a lean tool, a maintenance program which gives a totally new approach for maintaining plant and equipment. This maintenance program is used for increasing the efficiency of the machines and the processes. TPM gives a way for excellent planning, organizing, monitoring and controlling practices through its unique eight-pillars and 5S foundation methodology. TPM is the approach to equipment maintenance that helps in achieving perfect production with:

- Nobreakdowns
- No small stops or slowrunning
- Nodefects
- Noaccidents

TPM emphasizes proactive and preventative maintenance to maximize the operational efficiency of the equipment. It increases the delay time for the maintenance of the

equipment as the operator is cleaning and lubricating the equipment every day. For successful implementation of TPM greater involvement from everyone in the plant is needed. In right environment, this can be very effective if implemented correctly in a machine shop of the plant. This will help in improving productivity by increasing- up time, reducing cycle times and eliminating defects. [5]

TPM 5S foundation

This refers to five Japanese words seiri, seiton, seison, seiketsu, shitsuke. These represent the guidelines to organize and manage the workspace so that a visual controlled and efficient production becomes possible. The main objective of 5S is to keep the workplace clean and organized. [7]

Autonomous maintenance

It follows the structured approach to increasing the skill levels of operators so that they can understand, manage and improve their equipment and processes. [8]

Kaizen

It means adjusting the process (Kai) to become good (zen). Kaizen also stands for implementing small improvements, step by step to make the process easier. [7]

Planned maintenance

Its aim is to achieve zero breakdowns. Its approach is to establish a management system that extends the equipment reliability at best cost. [8]

Quality maintenance

It aims to assure zero defects conditions. It understands and controls the process interactions between man, materials, machines and methods that could enable defects to occur. This pillar prevents defects from occurring in the first place, rather than installing inspection system to detect the defect after it has been produced. [8]

Training

It is aimed to have multi-skilled employees. Education and Training is given to operators to upgrade their skills. Training is essential both for their personal development and for the successful implementation of TPM. [6]

Office TPM

Its aim is to improve productivity, efficiency in the administrative functions and identify and eliminate losses. Office TPM includes analyzing procedures and processes to increase office automation. [6]

Safety, Health, and Environment

This pillar creates a safe workplace and a surrounding area that is not damaged by the process or procedures. It is not just safety related but covers zero accidents, zero burdens (Physical or mental stress on employees) and less pollution. [8]

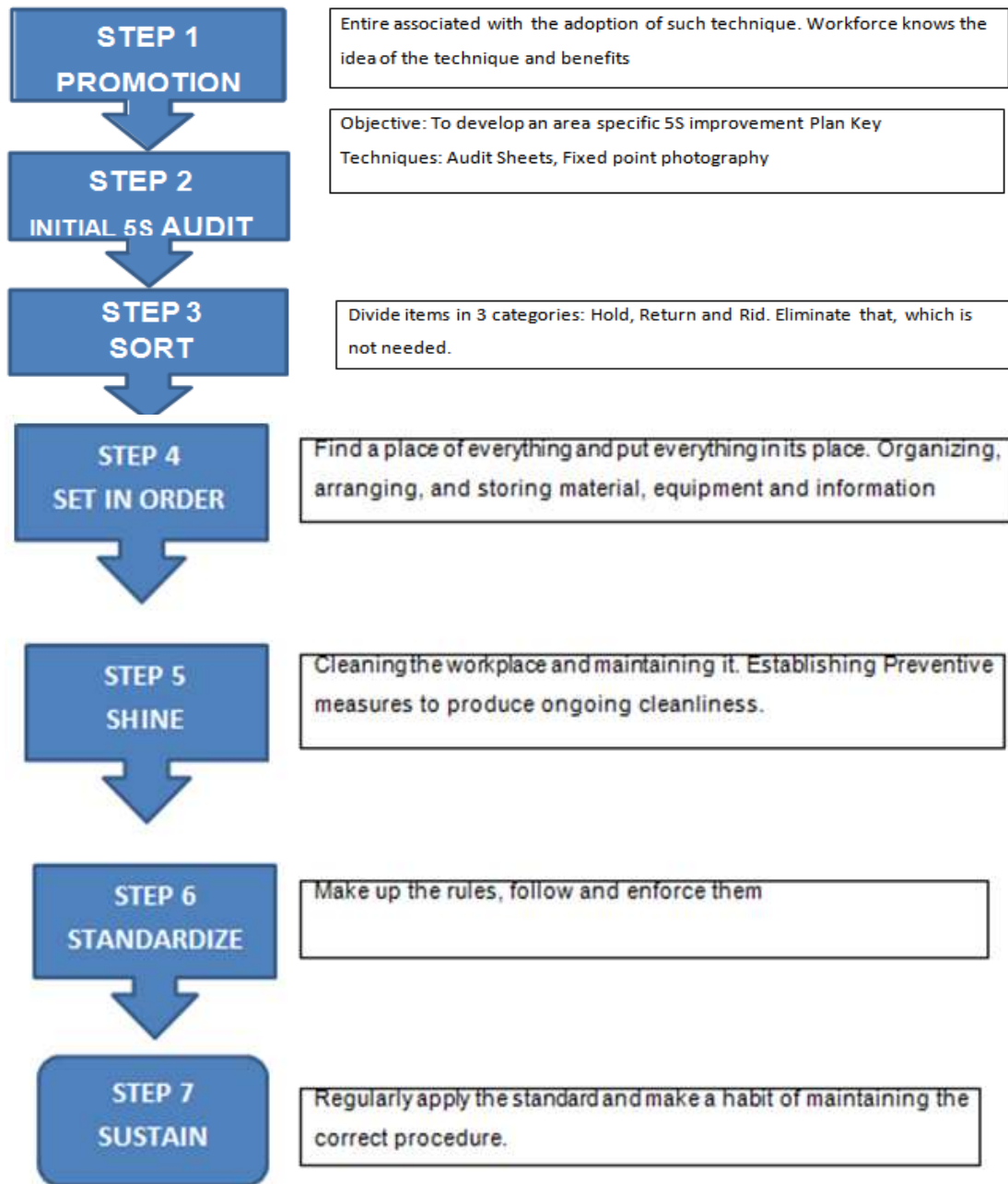
5S:5S is a methodology to reduce waste and to improve productivity through maintaining a well-organized workplace and using visual signs to accomplish the more consistent operational result. Implementation of this method will start with the clean-up and organizing the work-place and it should be the starting point for the shop-floor transformation. The 5S pillars, Sort (Seiri), Set in Order (Seiton), Shine (Seiso), Standardize (Seiketsu), and Sustain (Shitsuke) provide a methodology for organizing, cleaning, developing, and sustaining a productive work environment. Below table 2, shows the 5S and there translation or meaning in English.

Table 5S translation

Japanese Term	English Translation	Equivalent 'S' term
Seiri	Organization	Sort
Seiton	Tidiness	Set in Order
Seiso	Cleaning	Shine
Seiketsu	Standardization	Standardize
Shitsuke	Discipline	Sustain

5S encourage the operators to improve the physical setting of their work and helps them in reducing the waste, unplanned downtime, and in-process inventory. A properly implemented 5S would result in significant reductions in the space, time and efforts needed for existing operations.

Below figure3 shows how the 5S methodology planned to implement in the Company.



5S methodology system as used in lean servicing

Implementation of 5S in MAHINDRA & MAHINDRA Company:

Step 1: Promotion:

Entire associated with the adoption of such technique. Workforce knows the idea of the technique and benefits.

- Various presentations are given to the employees to make them understand what TPM is and how to implement it, the first step is to work on its foundation i.e.5S.

- An interview of the employees has been taken to know the level of their understanding of TPM.
- Questionnaires are made to aware them about TPM.

Step 2: Initial 5S Audits:

To develop an area specific 5S improvement Plan

- To develop an area specific 5S improvement Plan Key Techniques: Audit Sheets, Fixed point photography.

- Internal audits are made to find and divide the areas to implement the TPM
- Ownership is given to operators at the place where they are working. They need to maintain the 5S methodology in their area.
- Prizes, Incentives will be given to employee, who maintains it.
- Internal audits are made to check whether operators are following the TPM methodology or not.

Step 3: Sort

Divide items in 3 categories: Hold, Return and Rid. Eliminate that, which is not needed.

- The area next to machine is now divide items in 3 categories: Hold, Return and Rid. Eliminate items which are not needed.
- Engine oil tanks are lying in the work shop, where they are taking the unnecessary space and making it difficult for free movement. The tank is now stored at the designated place assigned for tanks.



Before (Engine oil tanks are lying in the workshop shop)



After (Tanks at designated place)

Step 4: Set in Order

- Find a place of everything and put everything in its place. Organizing, arranging, and storing material, equipment and information
- Proper places are assigned for each machine to put its raw material. Earlier raw- material of one machine was lying on area of other machine because of which the area becomes messed up and it became hard for operator to work there.



Before (Unorganized machine parts)
 After (Organized machine parts)

- Machine parts were not properly arranged at the floor area. Now the materials are arranged properly and it can have been seen from figure that now there is enough space to put more material.



Before (Unorganized spare parts)
 After (Organized spare parts)

Sharp metal pieces were lying inside the shop floor. The metal pieces are taken out from the shop floor and kept at the scrap material area. Now there is enough empty space for other things to do here. Quality racks can be placed here which will help the shop to be more organized.



Metal-sheetsinshop Cleanedshop

Step 5: Shine

Cleaning the workplace and maintaining it. Establishing preventive measures to produce ongoing cleanliness

- The shop was not cleaned as the tools, scrap boxes and scrap metal are lying everywhere. The materials are properly arranged and the shop is cleaned. Now it is easy to move around the shop.

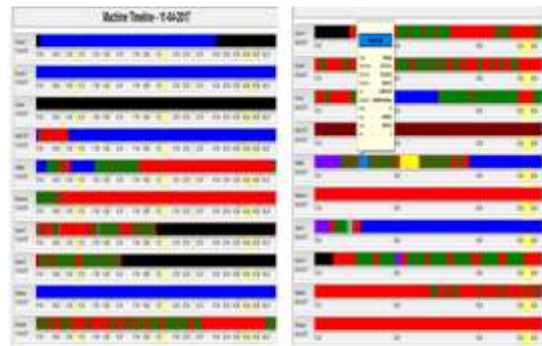


clean shop

Step 6: Standardize

Make up the rules, follow and enforce them.

- No operator was filling the real time update in the software which makes it difficult to understand that's what is happening in the machine. Real time updates show the present operation of them achine. There are different colors assign for each activity in the software and it is connected through LAN to office PCs. Fore.g.-Black color is for offline, Red is for stopped, Blue is for setting, green is for in-cycle, brown is for breakdown, purple is for maintenance, etc. Now operators are filling the real time details in the software, so that everyone can see online which operation is going right now in the machine. As shown in the below figures operators are not filling details during servicing, maintenance, etc. in the software earlier but now we can see the different colors in the software for the real time status of the machine .



Before (Notupdatedsoftware) After (Real-time updatedsoftware)

- Employee's details are not displayed on the notice board. It was hard to find the correct information from the employees as their phone number and email addresses are hard to find. Employee's details are displayed on the notice board with all the details like name, designation, phone number, email address, Skype id, etc..

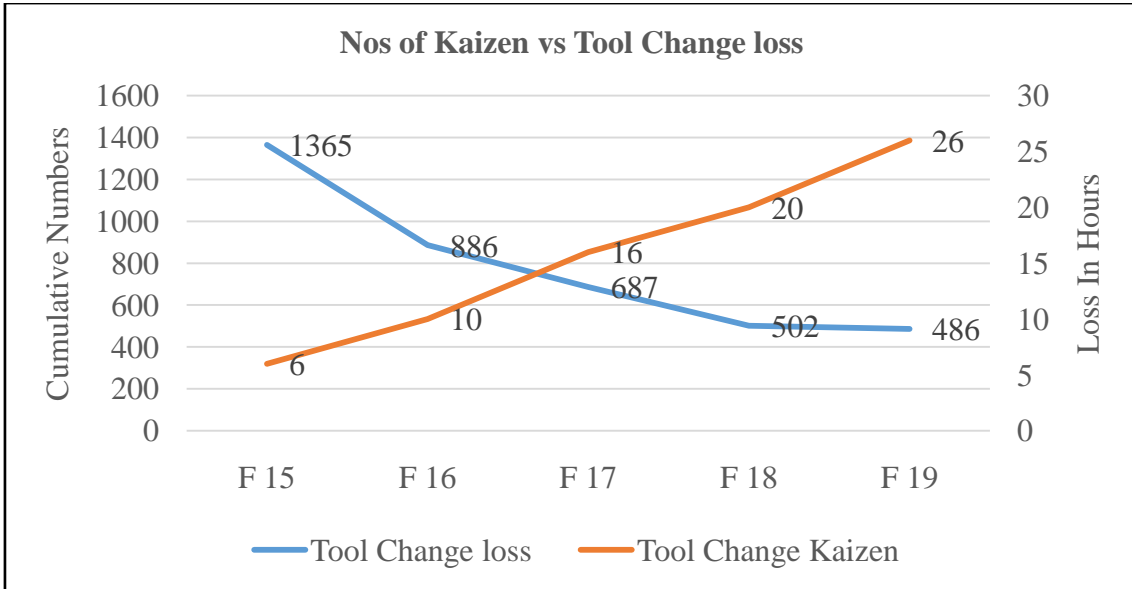


Employees information

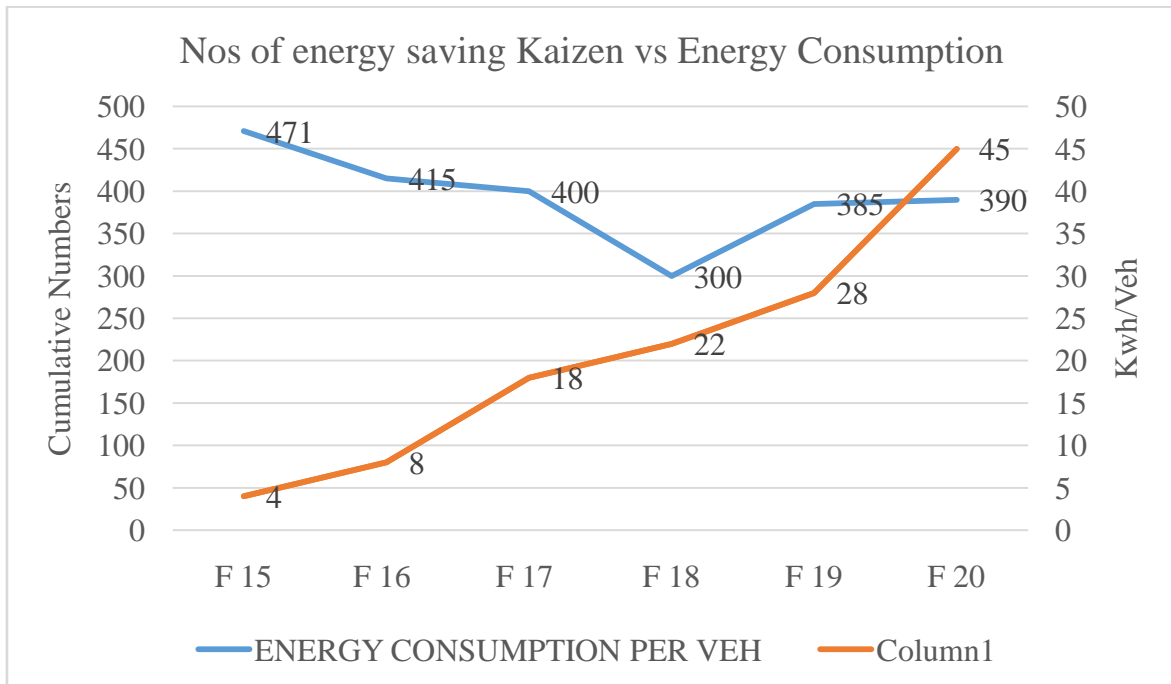
Step 7: Sustain

Regularly apply the standard and make a habit of maintaining the correct procedure. The Supervisor has given the responsibility to check

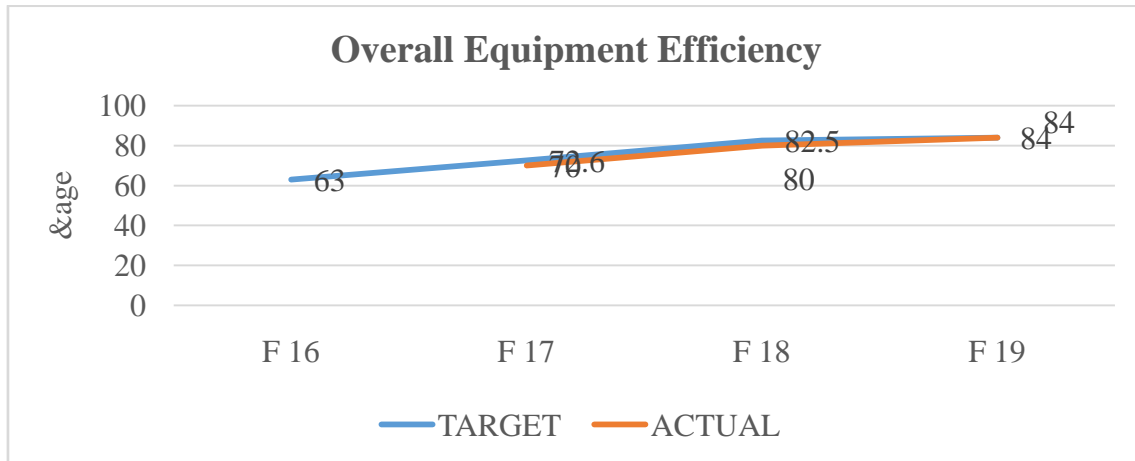
whether the operators are following the standard or not, If they are not following then it supervisors responsibility to make them follow it.



Reduction in Tool change loss & Increase no. of kaizen



Energy consumption & Energy saving kaizen



Increase in Overall Equipment Effectiveness

II. CONCLUSIONS

The implementation of focused improvement pillar in Supreme Mobiles Pvt Ltd (M&M). remained very successful and the overall result achieved after focused improvement pillar in terms of P, Q, C, D,S, M for the year of 2014-15-2019 are conclude as:

Productivity

- 1) OEE Greater than 85% **Quality**
- 1) Quality improve by achieving zero losses and defects. 2) Reduce Rework

Cost

- 1) Maintenance cost reduction,

Delivery

- 1) Faster delivery of the components by reducing the lead time
- 2) Reduction of Vehicle changeover time by 10 mins

Safety

- 1) Achieve up to 95%

Morale

- 1) Kaizen/ team/ year increase by 8 times.
- 1) 5.6.1 1', Q, C, D, S, M for TTM
- 2) he results of TPM achievement obtained after implementation of KK pillar named as
- 3) focused improvement in Supreme Mobiles Pvt Ltd for the year of 2014-13.
- 4) **Productivity:** -
 - 1) Increase in Veh/man/month by 1.7 times
 - 2) 13breakdown incidences/month reduced by 89%
 - 7) **Quality:** -
 - 1) Field Quality improved by 27%
 - 2) Machine shop scrap and rework reduced by 83%

Cost:-

- 1) Maintenance cost reduced by 28%
- 2) Tool cost reduced by 31%

Delivery: -

- 1) 100% schedule adherence
- 2) Equipment development lead time reduced by 51%

Safety:-

- 1) Zero Accidents
- 2) First Aid incidents improved by 95%

Morale:-

- 1) Kaizen /team/year increased by 8.5 times.

AWARD ACHIEVEMENT

Supreme Mobiles Pvt Ltd successfully achieve the TPM targets and objectives for their consistent efforts & achieved the Bharat Institute of Planning and Maintenance (BIPM) award "TPM Excellence Award" 2018.

FUTURE SCOPE

Today the competition in the in the industrial corporate is all time high. So in that situation TPM is the only thing which stands between success and failure of the companies. TPM can be implemented not only in industries but also for construction. building maintenance, transportation, and in variety of other situation. There is a need to extend the TPM philosophy or to incorporate some new pillar in order to perform some innovative or creative activities. The companies which have implement the TPM Level-I are interested to continue TPM Journey. In India there are some companies which have implemented the TPM up to Level-III. These companies are the motivation for Other companies to implement the TPM up to Level-III. The researches need to

explore the facts responsible for the success/ non-success of the higher phases of TPM implementation.

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