



Total Productive Maintenance- A Tool for World Class Manufacturing

Panchali Singh

(Department of Business Management, Dr.Shakuntala Misra National Rehabilitation University, Mohaan Road,
Lucknow, Uttar Pradesh, India)

*Email: panchalihimanshu@yahoo.com

Abstract- Total productive maintenance (TPM) has been widely applied in many industrial fields, especially in Japanese industrial companies. From a management point of view, this is an activity that involves all members of the company, from company president down to the most junior company employee. During high growth era companies are making technical progress in automation and centralization of the plants, which needs large amount of manual work to maintain the automation systems. The strategy of maintaining the equipment of a plant is crucial for the effectiveness of manufacturing. Total productive maintenance (TPM) is a maintenance program, which involves concepts for maintaining plant and equipments effectively. This paper discusses TPM as tool for World Class Manufacturing.

Keywords: Total productive maintenance (TPM), World Class Manufacturing ,

INTRODUCTION

A fundamental component of world-class manufacturing is that of the Total Productive Maintenance (TPM), which has been recognized as one of the significant operation strategy to regain the production losses due to equipment inefficiency. TPM is the methodology that aims to increase both availability of the existing equipment hence reducing the need for the further capital investment. It is a Japanese philosophy that focuses upon achieving zero breakdowns and zero defects by maintaining the equipments throughout its use. TPM integrates all areas of an organization. TPM is all about teamwork, it is a strategy that can help to achieve a world class level of overall equipment effectiveness (OEE) which is otherwise become difficult to achieve solely by equipments. OEE takes into consideration the availability rate of the machinery and equipment, the efficiency rate at which it operates and the quality rate of the products produced.

Need of TPM

TPM was introduced to achieve the following objectives. The important ones are listed below.

- Avoid waste in a quickly changing economic environment.
- Producing goods without reducing product quality.
- Reduce cost.
- Produce a low batch quantity at the earliest possible time.
- Goods send to the customers must be non defective.
- Involve equipment operators in the simple, day-to-day basics of equipment cleanliness and checks to enhance employee ownership in maintaining and identifying equipment problems immediately.

LITERATURE REVIEW

TPM is designed to maximize the overall equipment effectiveness. It involves all departments that plan, use and maintain equipment, involves all employees from top management to front line workers . The concept of TPM was developed in Denso, A tier one automotive supplier in the Toyota group of suppliers, during 1960s and 70s in Japan. The central thrust of the programme was the complete elimination of the “six major equipment losses”. The key concept behind effective improvements was autonomous maintenance. The concept of overall equipment effectiveness (OEE) and focused improvement were found to be quite encouraging for success of TPM . The aim of the TPM is to improve the labor productivity and to reduce the maintenance cost. The work of the Japanese consultant Koichi in Nissan Motors were acknowledged as 10% reduction in maintenance cost, 30% reduction in manpower and 140% increase in labor productivity were reported. Author reported that labor productivity increases by 140%-150% and maintenance cost decreases by 15%. Customers claim that poor quality reduces by 20%-25% and machine breakdowns by 98% . TPM aims to develop both the company and its employees individually. It aims to bring equipment to peak operating condition by eliminating the losses that hamper plant effectiveness. That is to achieve zero breakdowns, zero defects and zero accidents . TPM concepts involve commitments to long-range planning, especially on the part of senior management. Typically, TPM is initiated as a “top-down” exercise, but only implemented successfully via “bottom-up” participation. However, consensus building may take about three years, from the planning phase, for sustainability to be achieved in a large organization. TPM is a manufacturing-led

initiative that emphasizes the importance of (i) people with a 'can do' and continual improvement attitude and (ii) production and maintenance personnel working together in unison. TPM combines the best features of productive and preventive maintenance (PM) procedures with innovative management strategies and encourages total employee involvement. TPM does not provide a quick or easy solution. It usually requires changes in employees' attitudes and values, which take time to imbibe. Quick and company-wide performance gains should not be expected during the initial phase. TPM helps organize maintenance activities by applying the following actions :-

- Cultivate a sense of ownership in the operator by introducing autonomous maintenance – the operator takes responsibility for the primary care of his/her plant.
- Use cross-functional teams consisting of operators, maintainers, engineers and managers to improve individual employee and equipment performances.
- Establish an optimal schedule of clean-up and PM to extend the plant's Life span and maximize its uptime .

TPM brings maintenance into focus as a necessary and vitally important part of the business: maintenance should no longer be regarded as a non-profit-making activity. The goal is to minimize the frequency and magnitudes of emergency and unscheduled maintenance interruptions. In all, TPM implementation will involve design, operation, maintenance, engineering and sales activities, and may require hiring or appointing a TPM coordinator whose responsibility is to advocate through an educational programme the TPM concepts to the workforce, and check that they are being implemented. Each person becomes a "stakeholder" in the process and is encouraged to do his or her best to

contribute to the success of the team . TPM requires a drastic change in the traditional mindset of work culture and maintenance approaches. For this active top management support is crucial to overcome resistance of employees, especially during the transition period.

A positive strategic outcome of TPM implementations is the reduced occurrence of unexpected machine breakdowns, which ultimately results in enhanced profits in the organization. The results of the analyses indicate that TPM controls manufacturing cost, quality, and delivery time. TPM can be a strong contributor to the strength of the organization and has the ability to improve MP (Manufacturing performance). With competition in manufacturing industries rising relentlessly, TPM can be the maintenance philosophy prevents the failure of an organization. It is a maintenance programme that works with TQM and lean management. The willingness of employees within an organization to accept "change" for the better is an essential prerequisite for successfully implementing TPM. Form the above literature it is clear that TPM shall enhance the organizational profitability by changing the mindset of people involved and led to continuous improvement in the organization.

TPM Eight Pillars

The key areas of TPM are addressed by eight different activities, popularly termed as eight pillars of TPM. Eight-pillar methodology of TPM, results in rise in labour productivity via contraction in maintenance costs and production stoppages and thereby having cut back on downtimes . The eight TPM pillars include- Autonomous Maintenance, Focused Maintenance, Planned Maintenance, Quality Maintenance, Education & Training, Safety, Health & Environment, Office TPM, and Development Management .

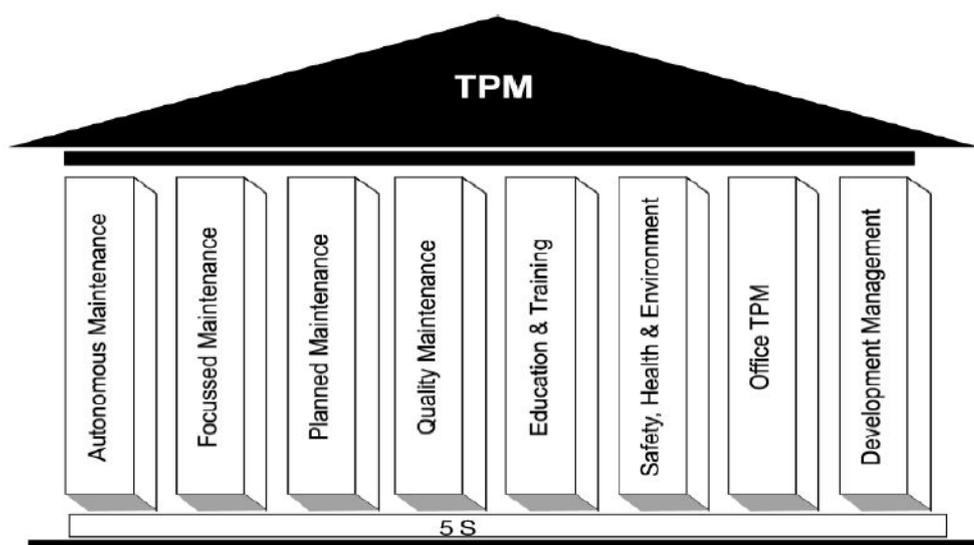


Fig. 1 Eight pillars approach for TPM implementation (suggested by JIPM)

THE FOUNDATION OF TPM

TPM starts with 5S. It is a systematic process of housekeeping to achieve a serene environment in the work place involving the employees with a commitment to sincerely implement and practice housekeeping. **If this 5S is not taken up seriously, then it leads to 5D. They are Delays, Defects, Dissatisfied customers, declining profits and Demoralized employees.** Following are the pillars of 5S.

1-a SEIRI - Sort out: This means sorting and organizing the items as critical, important, frequently used items, useless, or items that are not need as of now. Unwanted items can be salvaged. Critical items should be kept for use nearby and items that are not be used in near future, should be stored in some place. For this step, the worth of the item should be decided based on utility and not cost. As a result of this step, the search time is reduced.

1-b SEITON -Organize: The concept here is that "Each items has a place, and only one place". The items should be placed back after usage at the same place. To identify items easily, name plates and colored tags has to be used. Vertical racks can be used for this purpose, and heavy items occupy the bottom position in the racks.

1-c SEISO - Shine the workplace: This involves cleaning the work place free of burrs, grease, oil, waste, scrap etc. No loosely hanging wires or oil leakage from machines.

1-d SEIKETSU - Standardization: Employees have to discuss together and decide on standards for keeping the work place / Machines / pathways neat and clean. These standards are implemented for whole organization and are tested / inspected randomly.

1-e SHITSUKE -Self discipline: Considering 5S as a way of life and bring about self-discipline among the employees of the organization. This includes wearing badges, following work procedures, punctuality, dedication to the organization etc.

TPM Pillar 1 - JISHU HOZEN (Autonomous maintenance) This pillar is geared towards developing operators to be able to take care of small maintenance tasks, thus freeing up the skilled maintenance people to spend time on more value added activity and technical repairs. The operators are responsible for upkeep of their equipment to prevent it from deteriorating.

TPM Pillar 2 – Focused Maintenance (KAIZEN) The principal behind focused improvement is the KAIZEN. It is believed that small improvements of large numbers have more effect than large improvements of small numbers in any organization. KAIZEN is a Japanese word, where

“Kai” stands for change, and “Zen” stands for good or better. Kaizen principle is all about seeking small improvements. KAIZEN is executed on a continuous basis, which comprises of people across every level of the hierarchy of an organization. It requires almost negligible investment. This pillar aims to reduce losses in the workplace that are bottlenecks to plant efficiencies. Using a systematic procedure losses are eliminated in a phased manner. These activities can be implemented in both production as well as administrative areas.

TPM Pillar 3 - Planned Maintenance It is aimed to have trouble free machines and equipments producing defect free products for total customer satisfaction. Maintenance types are discussed in topic 3.1.1 earlier.

TPM Pillar 4- Quality Maintenance It is aimed towards customer delight through highest quality through defect free manufacturing. Focus is on eliminating non-conformances in a systematic manner, much like Focused Improvement. We gain understanding of what parts of the equipment affect product quality and begin to eliminate current quality concerns, and then move to potential quality concerns. Transition is from reactive to proactive (Quality Control to Quality Assurance).

TPM Pillar 5 – Training It is aimed to have multi-skilled revitalized employees whose morale is high and who has eager to come to work and perform all required functions effectively and independently. Education is given to operators to upgrade their skill. It is not sufficient know only "Know-How" by they should also learn "Know-why".

TPM Pillar 6 -Safety, Health, Environment Taret 1. Zero accident, 2. Zero health damage 3. Zero fires. In this area focus is on to create a safe workplace and a surrounding area that is not damaged by our process or procedures. This pillar will play an active role in each of the other pillars on a regular basis.

TPM Pillar 7- Office TPM It must be followed to improve productivity, efficiency in the administrative functions and identify and eliminate losses. This includes analyzing processes and procedures towards increased office automation. Office TPM Office TPM aims at improving productivity and efficiency of the administrative functions by identifying and eliminating losses. It includes activities such as analyzing the procedures and processes for increased office automation. It targets several major losses in administrative work such as cost and processing loss in the areas of accounts, procurements, and sales and marketing that leads to high inventories

TPM Pillar 8- Development Management- This pillar is aimed towards making use of previous learning's in developing the maintenance practices for new systems.

It consists of minimizing the problems occurred in the existing system so as to avoid repeating the same for the new ones.

BENEFITS OF TPM IMPLEMENTATION

TPM comprises of almost all the organizational elements, which team-up so that equipments become more effective in sustaining higher organization goals. TPM may be implemented in those organizations who wish to become world leader. TPM seeks to achieve higher productivity, better quality, less failures, cost reduction, dependable deliveries, inspiring working surroundings, improvements in confidence and safety of the employees. The bottleneck behind the implementation of TPM is that it has the capability to increase throughputs of an organization both monetary and non-monetary. Another influential paradigm is that TPM requires no or very little capital investments in human resources, which in turn create wonders for the work force, shaping them to become more proactive in their decision making. TPM holds the basis of a scientific field which deals with the health of machine. Previously unknown and hidden manufacturing losses can also be identified with the help of overall equipment effectiveness (OEE). Scores of OEE can be traced which can help to improve manufacturing processes. The functions that are delivered by OEE are rich in nature and are truly important to find the appropriate time needed for production and also to identify the causes of lost in productivity. The importance can be understood by the very fact that even as minute as 1% improvement in OEE index can prove vital and improve profits and productivity drastically.

CONCLUSIONS

In this paper an effort has been made to exhibit a critical review about TPM philosophy. Efficient TPM

implementation initiative highlights maintenance related problems, with a view to enhance performance of equipments. An essential prerequisite to implement TPM productively requires the motivation of employees within an organization to get ready to welcome the change for betterment. The rate of progress towards final goal will be based on the eagerness to accept change by one and all. TPM pillars that serve as guidance to effective TPM implementation program leads to improve in overall OEE. TPM will only succeed where people from all levels remain committed towards bringing the much needed cultural shift in the organization. TPM also focuses on to provide the much needed training and regular analysis of the success or failure of the consequent initiatives of improvements.

REFERENCES

- [1]. Hongyi Sun Richard Yam Ng Wai- Keung The implementation and evaluation of Total Productive Maintenance (TPM)—an action case study in Hong Kong manufacturing company. *International Journal Advance in manufacturing Technology (2003) Vol22: pp224-228.*
- [2]. I.P.S. Ahuja and J.S. Khamba An evaluation of TPM implementation initiatives in an Indian manufacturing enterprise. *Journal of Quality in Maintenance Engineering (2007) Vol.13 No.4 pp338-352.*
- [3]. Marcelo Rodrigues, Kazuo Hatakeyama, Analysis of fall of TPM in companies, *Journal of Material Processing Technology (2006) 276-279.*
- [4]. Alok Kumar A Uplap, R.S.Dalu, Ravikant V.Paropate, P.S.Ghawade, S.R.Kewate, Implementation Strategy of Total productive Maintenance in Indian Industries, Its Challenges & Remedies: An overview. *4th International Conference on advance in Mechanical Engineering (2010), 235-239.*
- [5]. *DENSO Introduction to Total Productive Maintenance Student study guide TPM100-April2006*
- [6]. Industrial Maintenance Management-Sushil Kumar, Shrivastava, (S Chand & Company Ltd.)