

A Review on Employment of TPM to Improve OEE in Manufacturing Industry

Mayur M Mhamunkar¹, Prof. Arun Kumar²

Student, Department of Mechanical Engineering, VIVA Institute of technology, Mumbai University,
Maharashtra, India¹

Principal, Department of Mechanical Engineering, VIVA Institute of technology, Mumbai University,
Maharashtra, India²

ABSTRACT: In today's extremely competitive and speedily dynamical business surroundings, industries need to supply sort of merchandise at a prime quality level, in least time and for a suitable worth. thus machine maintenance and generally, implementing associate degree acceptable maintenance strategy has become progressively vital. Total productive maintenance (TPM) is one among the foremost well-liked maintenance ways to confirm high machine responsibility, maintaining equipment's in prime operating condition to avoid breakdowns and minimize downtimes within the producing method. This paper reviews the many literature associated with implementation of TPM program in little and medium scale industries so as to attain increase in machine accessibility, performance & method quality thereby increasing overall instrumentation effectiveness (OEE). Investigations includes implementation of TPM pillars to cut back losses related to OEE.

KEYWORDS: Total Productive Maintenance, Quality, Availability, Performance, Overall Equipment Effectiveness.

I. INTRODUCTION

In today's industrial situation sizably voluminous losses occur within the producing work. This waste is thanks to operators, maintenance personal, process, tooling quandaries and non-availability of elements in time etc. alternative kinds of waste comprise of idle force, idle machines, break down machine, abnegated elements etc. In these circumventions, a revolutionary theory of Total Productive Maintenance (TPM) has been accepted in several industries across the globe to deal with the on top of quandaries. TPM builds a detailed correlation among maintenance and productivity, displaying however excellent care of kit can lead to higher productivity. it's a philosophy of perpetual improvement. TPM could be a maintenance program that contains AN incipiently outlined theory for maintaining plants and instrumentation. It's a verified and prosperous technique for introducing maintenance concerns into structure events. It involves operational and maintenance personnel collaborating as a team to chop wastage minimize period of time and ameliorate final product quality. Instrumentation maintenance remains at low priority in most of the diminutive & medium scale producing industries and in addition lack of education regarding instrumentation maintenance is one among the most obstacles. These industries face challenges cognate to product quality, value and technology. They need some distinct circumscriptions since most of them are owner-cum-manager targeted wherever a scientific approach is extremely abundant indigent. however on alternative hand these industries have potential benefits to administer coaching to their managers and staff in their geographical point, as a result of every manager encompasses a only a few numbers of force and in addition they're operating terribly proximate to 1 another. The scope of team formation and participation in these industries is additional facile than in sizably voluminous corporations. Ergo, it's terribly facile and sparing to coach and instruct their workers and therefore the length needed to transfer coaching to lower calibers is far shorter than that of vastly stupendous corporations. TPM includes structure structures, human interactions, and analytical implements so providing a scientific approach for the achieving world category

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor & UGC Approved Journal)

Website: www.ijirset.com

Vol. 6, Issue 8, August 2017

levels of overall instrumentation effectualness not through technology or systems alone however even so through total involvement of individuals operating within the organization.

II. IMPLEMENTATION OF TPM

Implementation of TPM is based on systematic implementation of its pillars. The pillars of TPM are shown in below figure.

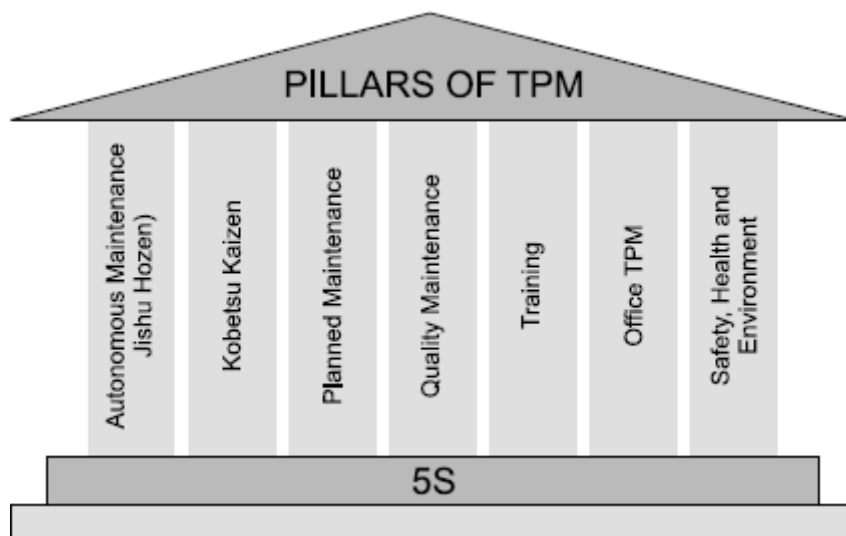


Fig. 1 Pillars of TPM

Many firms struggle nowadays to implement TPM attributable to 2 main reasons. 1st has inadequate information and experience particularly in understanding the relationships between the pillar activities in TPM. One more reason is that TPM wants time, resources and labors than most of those companies believe they will afford. 5S forms the bottom and is that the start line for TPM implementation. The TPM pillars are explained below in tabular format.

III. TPM & OEE

Overall instrumentality effectiveness (OEE) is fictional by Seiichi Nakajima. It provides the way to live the effectiveness of producing operations from one piece of apparatus to a whole set of equipment's in a corporation. In any trade, it's unattainable to work any equipment 100 percent of the time at its most capability to induce 100 percent quality output. Losses are quite common, transfer out the distinction between actual and desired performance. OEE may be operate of the 3 factors particularly accessibility, performance and quality.

$$\text{Availability} = \frac{(\text{Planned production time} - \text{Downtime})}{\text{Planned production time}}$$

$$\text{Performance} = \frac{\text{Ideal cycle time} \times \text{Parts produced}}{\text{Available time}}$$

$$\text{Quality} = \frac{(\text{Total units started} - \text{Defective units})}{\text{Total units started}}$$

Therefore OEE= Availability × Performance × Quality.

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor & UGC Approved Journal)

Website: www.ijirset.com

Vol. 6, Issue 8, August 2017

The losses related to OEE are divided into six major classes, that have effect on the performance of the equipment are shown in below figure.

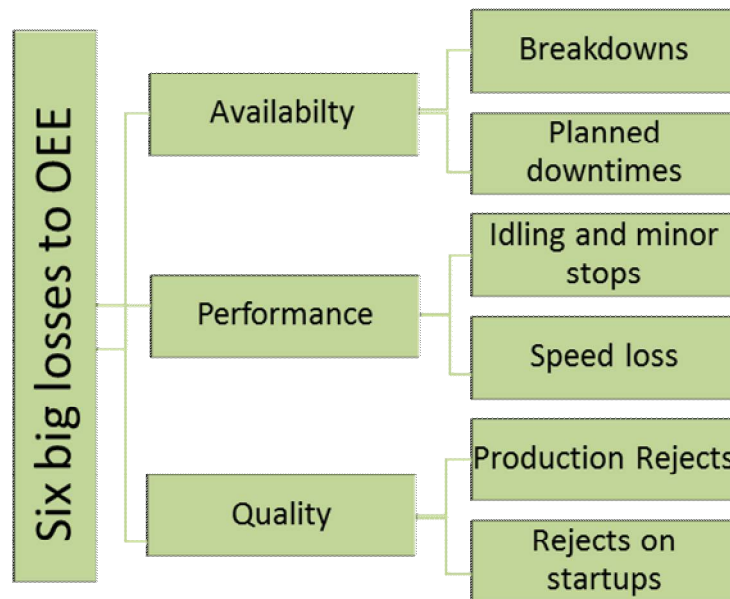


Fig. 2 Losses to OEE

OEE measure is important for each organization that's committed to eliminate the above mention losses through the implementation of TPM. A TPM program uses OEE as a quantitative parameter for mensuration the performance of a production system. A comparison between the expected and current OEE measures will offer the much-needed propulsion for the producing organizations to boost on its maintenance policy. Associate degree overall 86th benchmark OEE is taken into account as foremost performance which needs ninetieth handiness, ninety fifth performances and ninety nine qualities to be achieved.

IV. RELATED WORK

Pradeep kumar, Raviraj shetty and Lewlyn I.r. Rodrigues, applied empirical study supported real time information analysis to attain results. They distributed questionnaires to assess data on productive implementation of TPM. They applied autonomous maintenance (AM) & productive maintenance (PM) to find faults and so improve output, total output and OEE of machine [1].

E.Sivaselvam and S.Gajendran have expressed that using overall equipment efficiency calculations one will confirm this state of affairs within the production system, effectiveness of the maintenance system, things of the machines, worker's talent and use of the machines. conniving the OEE conjointly offers the firm wherever they're and wherever the flaw purpose is and the way to extend. The calculated OEE high cycle time, additional waiting time and low productivity will be recognized [2].

V.R.Muruganatham, M. Sindhu Kavi and S.Raghavendrprabhu have expressed that increase in productivity and quality of labor will be achieved by implementing the TPM (total productive maintenance) pillars and lean ideas of just-in-time (JIT) and KANBAN. They found that implementation of the KANBAN system in tiny scale producing unit resulted in reduction of inventory to minimum levels besides increasing flexibility of producing. Conjointly by

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor & UGC Approved Journal)

Website: www.ijirset.com

Vol. 6, Issue 8, August 2017

implementing the principles of lean producing within the varied processes, standardizations well as improved productivity was achieved [3].

Jignasha P. Acharya and Maharshi J. Bhatt expressed that total productive maintenance (TPM) could be a positive approach to resolve producing downside, aiming zero defect and therefore increasing productivity and quality in producing industries. They conjointly offer an summary of TPM pillars and the way it plays a vigorous role in producing system. They any expressed that TPM focuses on maximising the general instrumentality potency (OEE) with involvement of every and everybody within the organization and therefore the key factors for this implementation are employees involvement and high management support. Conjointly world category TPM implementation is feasible with continual support in any respect the degree at the side of the availability of necessary resources [4].

Vivek B. Patel and Hemant R Thakkar have evaluated that to boost productivity it's essential to boost the performance of the producing systems and therefore the desired production output is achieved through high instrumentality handiness that is influenced by instrumentality irresponsibleness and maintainability. TPM could be an organized instrumentality-centric continuous improvement method that endeavours to optimize production effectiveness by police investigation and eliminating losses related to equipment and production potency with the assembly system life cycle through active team-based participation of staff across all levels of the operational pyramid. TPM methodology could be a verified approach to extend overall equipment effectiveness of apparatus. It involves of eight activities; out of that autonomous maintenance and targeted improvement are 2 key activities to boost instrumentality performance. These activities aim to coach the participants within the theories ANd philosophy of apparatus maintenance and provides them an probability to develop their data and skills [5].

Firdosjahan Khan and Quazi T. have evaluated that Kobetsu KAIZEN approach could be a important pillar of total productive maintenance and that plays a significant task of fusing the kaizen effort across the division. KK pillar appearance into all the losses, analyses the losses exploitation many QC tools and comes up with suggestions that require to be enforced to decrease regular losses. The results of their work enclosed increase in confidence and skill to perform advanced job by operator and employees, increase in possession of the instrumentality and digital computer by operator, amendment in angle and behaviour of worker, improvement in major losses of the machines and OEE of the machines [6].

Jagtar singh, Vikas Rastogi and Richa Sharma have expressed that TPM is barely the one issue that stands between success & total failure. They enforced TPM in automobile producing trade on 3 machines specifically broaching, cylindrical grinding and surface grinding and achieved increase in instrumentality handiness, decrease in work and rejection & increase in rate of performance [7].

Binoyboban, Jenson Joseph have expressed that amendment in performance & quality will be achieved by ever-changing the upkeep policy. They any found that if everybody concerned in TPM program will his or her share, high rate of pay back as compared to investment will be certain. They enforced 5s, kaizen and AM in producing sector and reached progressive growth in OEE [8].

Sarang G. Katkamwar, Sadashiv K. Wadtkarand Ravikant, V. Paropate have expressed that TPM is that the effective tool to extend the productivity of Indian industries and INDIA will vie with the opposite countries during this inflated globalisation. They recommended that employing a see through jh-check sheet, pm-check sheet, one purpose lessons, empirical and comprehensive approach towards the methodology leads to correct implementation of TPM. Later implementation of TPM on model machine they exhibited each direct and indirect edges obtained for instrumentality and workforces severally [9].

Goyal Ravi Kumar and Maheshwari Kapil have lit the requirement of maintenance, TPM characteristics with its totally different pillars, deficiency of TPM in details then the globe category maintenance system with its elements, modules, factors for accomplishment and the way to implement the globe category maintenance system in any trade. They furnish valuable references for maintenance management specialists and researchers operational on maintenance management [10].

Ravikant V. Paropate1 and Dr.Rajeshkumar U. Sambhe expressed that (TPM) could be a basic element of foremost producing that has been recognized jointly of the many operation strategy to regain the assembly losses thanks to instrumentality unskillfulness. They used Microsoft surpass for conniving overall instrumentality effectiveness by considering the values of production amount, breakdown time, productive time, wastage and recycles cotton amount [11].

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor & UGC Approved Journal)

Website: www.ijirset.com

Vol. 6, Issue 8, August 2017

Praveen Kumar R. and Rudramurthy have allotted study on mechanical press so as to analysed continual breakdowns alongside identification of the vital elements, that were underneath breakdown condition. They analysed the explanation for the breakdown and inspected it by the strategy of fish bone diagram and why-why analysis. By this analysis and ways the basis causes of the breakdowns were known that successively helped to develop and improve a brand new preventive maintenance listing for the machine. Through their suggested procedures they achieved increase in availableness of the machine to an exact extent and additionally increase the assembly capability, minimize the upkeep value and scale back the down time. [12]

Dr. Rama, C.G. Prashanthpai, Dr. T. R. Srinivas, Raghavendra M.J. have studied measuring of effectiveness of TPM implementation in producing & service industries. They did an analysis on vary of journals associated with TPM revealed in period of ten to eleven years and have listed that improvement of OEE is detected through availableness, performance & quality thereby showing an efficient tool for scheming effectiveness in TPM [13].

Ashok Kumar and Rajesh Kumar Singh have evaluated the obstacles before producing institutions for adapting to proactive total productive maintenance (TPM) initiatives. They categorised the complications long-faced by the organizations into structure, behavioural, technological, operational, and division obstacles. It's additionally been discovered by the study that effective implementation of TPM initiatives is convincingly achieved by the total hearted commitments of high management. They suggested that high management ought to stress on up co-ordination between departments, purification communication skills, education and coaching of staffs [14].

Ashwin B. Virupakshar and Anil Badiger have listed that to realize overall instrumentation potency TPM is best tool. TPM supports the management to extend the performance of the organisation and by applicable implementation of TPM theories the producing industries will gain excessive edges with the terribly less investment. They achieved change of cycle time for every method by combining 2 or a lot of processes and by providing special attachment where potential for a traub machine thereby increasing its output [15].

Rishi J., Dr. Rama C., Dr. T. R. Srinivas explicit that TPM is best appropriate for attaining lean producing. They with success utilized TPM in automotive axles and achieved higher potency by decreasing setup time and increasing OEE. They allotted swot analysis is order to analyse the matter interconnected with the initial instrumentation makers [16].

Meghraj and Dr. Sridhar K. allotted implementation of TPM in workshop and evaluated the contributions of TPM initiatives through work sampling to attain the planet category OEE that raise the standard excellence. They allotted sampling study to reason the time period and utilization of the machines and to boost OEE. They found that targeted TPM implementation on top of an inexpensive fundamental measure will well contribute towards use of considerable producing performance enhancements, the value and quality is increased considerably by minimizing instrumentation losses and instrumentation failures [17].

Shailendra Kumar Sahu et. al allotted implementation of total productive maintenance is shared and inspected for hardening chamber in bright bar search of an integrated steel mill. They found that deviation in method is reduced and arranged by the implementation of TPM. They explicit that the goal of any TPM program ought to be to advance productivity and quality alongside hyperbolic worker spirits and job satisfaction. Additionally in any producing trade correct maintenance is important so as to urge most production with none loss because of failure of machines or any mechanical elements [18].

Vittaleshwara, Dasharathraj K. Shetty and Prajualpj conducted survey to grasp the standard advancement to hold out winning implementation of TPM. Further, they allotted AN empirical study at the high-end facility of the organization and recorded period of time knowledge. Knowledge was recorded for numerous parameters using the information record sheet. the common values of OEE were found fall between the ranges of zero.14 and 0.7. so TPM and OEE helped the water bottling company to spot antecedent hidden producing losses and inefficiencies. Finally scheming the OEE gave the corporate wherever they're and wherever the weakness purpose is and the way to boost [19].

Mdmerajalam and Antariksha Verma explicit that targeted TPM implementation over an inexpensive fundamental measure will contribute towards realization of great producing performance enhancements. They additionally found that up overall instrumentation effectiveness is one amongst the most edges in implementing TPM .they allotted survey throughout the organization by questioning everybody relating to totally different problems associated with TPM implementation by that winning implementation of TPM was mapped. They additional complete that value of work and repairs scale back because of terribly restricted merchandise rejected because of reduction in breakdown. Thus, the

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor & UGC Approved Journal)

Website: www.ijirset.com

Vol. 6, Issue 8, August 2017

effectiveness of equipment additionally improved considerably eliminating instrumentation deterioration because the equipment is operated expeditiously [20].

V. CONCLUSION

The present study reveals that OEE is enhanced by implementation of TPM particularly in medium scale industries. The 3 factors of OEE i.e. availability, performance and quality is improved by reducing cycle time, setup time, breakdowns, downtimes and eliminating & eliminating production losses which might be achieved through implementation of pillars of TPM. Additionally TPM focuses on involvement of everybody within the organization right from managers to operators thereby up coordination between totally different departments in putting in maintenance program. Concerning seventy fifth of the entire industries in Asian nation area unit of tiny and medium size industries. The big scale industries on different hand purchase most of the elements and elements from these industries. So it's essential that these industries turn out quality merchandise that area unit offered in time and at optimum value. Therefore it's complete that there's have to be compelled to implement TPM in medium scale industries so as to attain overall instrumentation effectiveness.

REFERENCES

- [1] Pradeep Kumar, Raviraj Shetty and Lewlyn L.R. Rodrigues, 2014, "Overall Equipment Efficiency and Productivity of a News Paper Printing Machine of a Daily News Paper Company - A Case Study", International Journal of Engineering Practical Research, 3 (1), pp.20-27.
- [2] E.Sivaselvam and S.Gajendran, 2014, "Improvement of Overall Equipment Effectiveness In a Plastic Injection Moulding Industry", IOSR Journal of Mechanical and Civil Engineering, 3(10), pp. 12-16.
- [3] V.R.Muruganantham, M. Sindhu Kavi and S.RaghavendraPrabhu, 2014, "Analysis and Implementation of Total Productive maintenance, Kanban and JIT Systems In Small Scale Polymer Industry", International Journal of Innovative Research in Science, Engineering and Technology, 3(4), pp. 325-334.
- [4] Jignasha P Acharya and Maharshi J Bhatt, 2014, "A Brief Literature Review on Total Productive Maintenance", International Journal of Advance Engineering and Research Development, 1(5), pp.1-8.
- [5] Vivek B Patel and Hemant R Thakkar, 2014, "Review Study on Improvement of Overall Equipment Effectiveness through Total Productive Maintenance", Journal of Emerging Technologies and Innovative Research, 1(7), pp.720-726.
- [6] FirdosJahan Khan and Quazi T, 2014, "Implementation of Kobetsu Kaizen pillar in Improving Overall Equipment Effectiveness of Machine", International Journal Of Engineering Sciences & Research Technology, 3(7), pp.562-570.
- [7] Jagtar Singh, Vikas Rastogi and Richa Sharma, 2013, "Total Productive Maintenance Review: A Case Study in Automobile Manufacturing Industry", International Journal of Current Engineering and Technology, 3(5), pp.10-16.
- [8] BinoyBoban, Jenson Joseph, 2013, "Enhancing Overall Equipment Effectiveness for a Manufacturing Firm through Total Productive Maintenance", International Journal of Emerging Technology and Advanced Engineering, 3(8), pp.425-429.
- [9] Sarang G. Katkamwar, Sadashiv K. Wadkar and Ravikant V. Paropate, 2013, "Study of Total Productive Maintenance & Its Implementing Approach in Spinning Industries", International Journal of Engineering Trends and Technology, 4(5), pp.1750-1754.
- [10] Goyal Ravi Kumar and Maheshwari Kapil, 2013, "Maintenance: From Total Productive Maintenance to World Class Maintenance", International Journal of Scientific Research and Reviews, 2(1), pp.1-23.
- [11] Ravikant V. Paropate and Dr. Rajeshkumar U. Sambhe, 2013, "The Implementation and Evaluation of Total Productive Maintenance - A Case Study of mid-sized Indian Enterprise", International Journal of Application or Innovation in Engineering & Management, 2(10), pp.120-125.
- [12] Praveen Kumar R and Rudramurthy, 2013, "Analysis of Breakdowns and Improvement of Preventive Maintenance on 1000 Ton Hydraulic Press", International Journal of Emerging Technology and Advanced Engineering, 3(8), pp. 636-645.
- [13] Dr. Ramachandra, C G PrashanthPai, M Dr. T. R. Srinivas, Raghavendra M J, 2016 "OEE - A Tool to Measure the Effectiveness of TPM Implementation in Industries-A Review", Global Research and Development Journal for Engineering, 1(12), pp. 92-96.
- [14] Ashok Kumar, Rajesh Kumar Singh and Tasmee Ahmad Khan, 2016 "Development of Framework for Analyzing the Barriers in Total Productive Maintenance", International Journal of Advance Research and Innovation, 3(4), pp. 82-88.
- [15] Ashwin B. Virupakshar and Anil Badiger, 2016, "Enhancing productivity through TPM concepts: A case study", International Journal of advances in Production and Mechanical engineering, 2(2), pp. 23-26.
- [16] Rishi J, Dr. Ramachandra C, Dr. T R Srinivas, 2016, "Keys to Succeed in Implementing Total Preventive Maintenance (TPM) and Lean Strategies", International Journal for Modern Trends in Science and Technology, 2(07), pp.25-30.
- [17] Meghraj and Dr. Sridhar K, 2016, "Methodology of Evaluating the overall Equipment Effectiveness in Machine Shop Manufacturing Industry through Total Productive Maintenance", International Journal of Science Technology & Engineering, 3(1), pp. 231-36.

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor & UGC Approved Journal)

Website: www.ijirset.com

Vol. 6, Issue 8, August 2017

- [18] Shailendra Kumar Sahu et al, 2016, "Overall Equipment Effectiveness Improvement of Annealing furnace by Implementation of Total Productive maintenance(TPM)-A Case study", International Journal for Innovative Research in Science & Technology,3(7), pp.198-203.
- [19] VittaleshwarA ,Dasharathraj K Shetty and PrajwalPJ,2016, "An Empirical Study Of Effect Of Total Productive Maintenance On Overall Equipment Effectiveness In A Water Bottling Industry", International Journal of Applied Engineering Research,11(8), pp. 5573-5579.
- [20] MdMerajAlam and Antariksha Verma,2016," Case Study on Implementation of TPM", Imperial Journal of Interdisciplinary Research ,2(12), pp.2228-2237.

BIOGRAPHY

Mayur Manohar Mhamunkar

Qualification: ME in Manufacturing System Engineering BE Mechanical,

Research Interests: Manufacturing Systems and Lean Manufacturing, DOE, Quality

Arun Kumar Principal at VIVA Institute of Technology Shrigaon, Veer Sawarkar Road, Virar (E) 401305