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Total Productive Maintenance- A Review

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Abstract: ***The purpose of this paper is to present the literature review of Total productive maintenance (TPM). Objectives of TPM is zero breakdown, zero losses, zero defect and zero health hazard and hence increase quality and productivity in manufacturing industries. There are 8 TPM pillars and this paper also explains the overview of TPM pillars and how it play an active role in manufacturing system. Overall Equipment Effectiveness (OEE) is used to recognize the improvement or success in TPM. TPM furnish a method for the attainment of world class levels of OEE through people and not through technology or systems alone.***
Keywords: Availability, Efficiency, Performance, Preventive maintenance, Total productive maintenance.

I. INTRODUCTION

TPM adapted from TQM, which evolved as a result of Dr. W. Edwards Deming's influence on Japanese industry. When the problems of plant maintenance were examined as a part of the TQM program, Preventive Maintenance was introduced in Japan in the late 1950s. M/s Nippon Denso Co. Ltd. of Japan, a supplier of M/s Toyota Motor Company, Japan became the first company to obtain the TPM certification. Objectives of TPM is zero breakdown, zero losses, zero defect and zero health hazard and hence increase quality and productivity in manufacturing industries. Reference [1] a major benefactor of TPM, has defined TPM as a new approach to maintenance that optimizes equipment effectiveness, promotes autonomous maintenance and eliminates breakdowns by operators through day-to-day activities.

Reference [2] presented a case study analysis of OEE and TPM in Steel Company in Jordan. After implementing he found that quality factor is increase to 99% of overall equipment effectiveness equation and where in performance it got 72% and availability reaches 76%. Different type of techniques like, computer maintenance management system, production planning and control and Single minute exchange die were suggested to the industry to increase the productivity and to improve their maintenance procedures.

Reference [3] used Structural Equation Modeling (SEM) to investigate the relationship between manufacturing performance (MP) and Total Productive Maintenance (TPM). They find that TPM has a significant and positive relationship with low cost, strong delivery performance and high levels of quality.

Reference [4] proposed work for the implementation of the TPM program in a manufacturing industry. Through empirical study of implementing TPM barriers in the adoption of TPM and problems occurred during implementation are examine. By using the empirical approach towards the methodology results in proper implementation of TPM.

Reference [5] introduces the work for survey to determine the level of TPM practices in automotive industry. To perform the required statistical analysis of the data from surveys they utilized Statistical Package for Social Sciences (SPSS) software. TPM knowledge and understanding and critical success factors (CSFs) in TPM implementation were systematically categorized in this paper.

Reference [6] describes that to fulfill the demand of customer need continuously improvement of the processes, performance of products and services is must. Some important factors are to be recognized which play a role in the success of TQM. These important factors are termed as CSFs (critical success factors) and Pareto analysis quality tool which is used for sorting of the CSFs.

Reference [7] reduced the production losses and improve overall equipment effectiveness of industry up to 96% in a Jamna auto industry and proposed tool to improve equipment reliability and improve the maintenance function. The OEE is product of performance efficiency of process, quality performance of manufacturing operations and equipment availability.

Reference [8] introduced some critical factors which affect OEE are loading time, standard cycle time, down time, unit produced defect unit and actual cycle time of the pharmaceutical industry. OEE is a symptom of eight major equipment related losses which are set-up and adjustment, cutting blade change, equipment failure, start-up, speed, defect and rework and equipment shutdown and minor stoppage and idling. A planned maintenance program has been suggested to make the production process quite smooth and increased efficiency.

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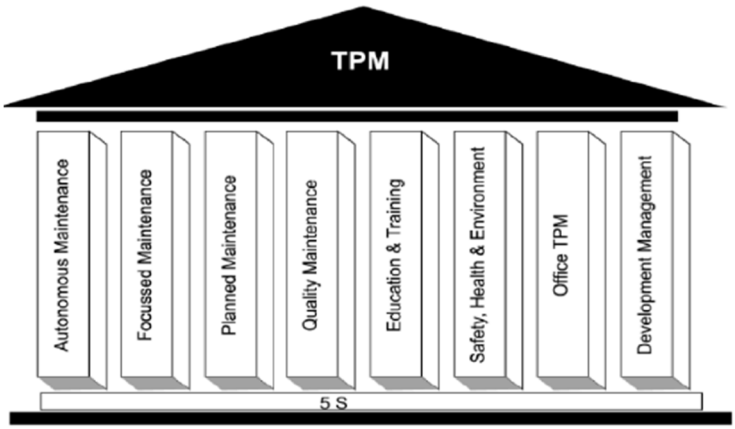
Reference [9] implementing TPM concept in automotive manufacturing company at Gujarat. They has improved OEE from 63% to 79% after implementation of TPM. They indicate the improvement in quality of product and improvement in productivity.

Reference [10] presented literature review on Total Productive Maintenance (TPM) and an overview of TPM implementation practices adopted by the manufacturing organizations. To terminate barriers in successful TPM implementation they also provides some appropriate enablers and success factors.

Reference [11] presented detailed implementation of TPM in the cold rolling plant. Results attained are quite encouraging in terms of improvement OEE (overall equipment effectiveness), reduction in number of accidents on shop floor and motivated employees. And also proposed strategy of maintaining the equipment of a plant.

Reference [12] introduced the paper for reviews the significant literature related to design, implementation, and maintenance of TPM programs in manufacturing industry and examines the basic concepts of TPM. Investigation includes the human interactions, analytical tools, organizational structures and success criteria associated with the implementation of TPM.

II. TPM PILLAR



TPM starts with 5S. It is a systematic process of housekeeping to achieve an untroubled environment in the work place. Problems cannot be clearly seen when the work place is unorganized. Organizing and cleaning the workplace helps the team to identified problems. Making problems visible is the first step of improvement. 5S is a base program before the implementation of TPM. If this 5S is not taken up seriously, then it leads to 5D defects, delays, dissatisfied customers, demoralized employees and declining profits.

Table1: 5S meaning

Japanese Term	English Translation	Equivalent 'S' Term
Seiri	Organization	Sorting
Seiton	Tidiness	Systematic Arrangement
Seiso	Cleaning	Shine
Seiketsu	Standardization	Standardize
Shitsuke	Discipline	Self-Discipline

A. Autonomous Maintenance (Jishu Hozen)

Jishu Hozen means individuals carry out routine cleaning, lubrication, inspection, possible repairs, and detection of abnormalities and precision checking of their own equipment to prevent forced deterioration.

1) Aims:

a) Improvement in workplace effectiveness.

b) 1S, 2S and idea for not dropping thing on floor.

c) MUDA reduction hence unwanted movement reduction.
d) Both hand operation, within reach, single touch up pick up.
2) Seven Steps of Jishu Hozen:
a) Initial cleaning and tagging of abnormalities
b) Counter measures against
c) Source of contamination
d) Hard to access area
e) Preparation of tentative standards of C, L, I, T, A by operator coached by PM personnel.
f) General equipment inspection
g) Autonomous inspection'
h) Standardization
i) Autonomous management

B. Planned Maintenance (PM)
1) Aims:
a) Trouble free machines and equipment.
b) Defect free products for total customer satisfaction targeting zero equipment failure and break down.
c) Improving MTBF, MTTR.
2) Planned Maintenance Divided into Four Categories:
a) preventive maintenance
b) corrective maintenance
c) break down maintenance
d) maintenance prevention
3) Seven Steps Methodology of Planned Maintenance:
a) Initial status identification and tagging with operators.
b) Provide help in making the counter measures and restore the machine condition-Resolve Red Tags.
c) Preparation of tentative maintenance standards + check sheet (Equipment wise)
d) Inspect & find the quality Component of Machine
e) Improve the quality of Maintenance
f) Study & application of reduction of maintenance check point & Application of Diagnostics
g) Horizontal Deployment on other machines

C. Quality Maintenance (QM)
1) Aims:
a) Achieve Zero Defect and Zero Rework
b) Elimination of scrap
c) Zero Customer Complaints (Internal as well as External).
2) Quality Maintenance Role:
a) Capture defect data m/c wise, stage wise, cell wise, PU wise.
b) Analysis of defects stage wise, phenomena wise through stratification, Q.A. matrix, Why-Why & Why-OK sheets.
c) Root cause analysis of each defect/physical phenomenon and take countermeasures and or evolve kaizens.
d) Implementations of countermeasures to prevent defects.
e) Set conditions of equipment & process such that process does not produce defects.
f) Implement countermeasures beforehand by predicting quality defects through trends of measured value.
g) Horizontally deploy countermeasure with sustenance plan.
3) Kobetsu Kaizen:
a) Understanding, capture, prioritizes & analysis of all 16 types of losses.
b) Keep record of all GENBA KAIZENS.
c) Data collection analysis towards applicable losses.

d) Initiate actions to enhance OEE.
e) Establishment of co-relation of loss to the KAIZENs done.
f) Conversion of all KAIZENS in Cost Benefits.
g) Develop Loss Cost Matrix to minimize the losses.
4) Education & Training:
a) To impact education and training to all employees related to TPM
b) To asses the present skill level of employees & gap analysis
c) Develop skill enhancement plan for employees
d) Multi-skilling of employees.
e) Motivation of employees through reward and recognition

D. Office TPM

Office TPM should be started after activating four other pillars of TPM (JH, KK, QM and PM).

1) Aims:
a) To improve productivity
b) Examine processes and procedures towards increased office automation
c) Efficiency in the administrative functions and identify to eliminate losses

E. Safety, Health and Environment

1) Aims:
a) To achieve zero accident
b) To make the safe working condition
c) Free from pollution
d) Free from health hazard

F. Tool Management and Development Management

1) Tool Management:
a) Reduction in tool inventory
b) Reduction in tool cost per part
c) Reduction in loss due to tool adjustment and tool setting
d) Reduce setup change time
2) Development Management:
a) Takes all inputs from the plant data system and incorporates into new equipment design.
b) Systematic approach towards MP design.
c) New equipment with all inputs incorporated.
d) Takes all inputs from operators for maintainability and operability.

III. OVERALL EQUIPMENT EFFECTIVENESS (OEE)

OEE is the gold standard for measuring manufacturing productivity. It identifies the percentage of manufacturing time that is truly productive. OEE is broken down into three factors: Performance, Availability and Quality.

Availability: Availability takes into account unplanned and planned stops. An availability score 100% means the process is always running during planned production time.

$$\text{Availability Rating (A)} = \frac{\text{Total available time} - \text{Loss time}}{\text{Total available time}}$$

Performance Rating: Performance takes into account slow cycles and small stops. A performance score of 100% means when the process is running it is running as fast as possible.

$$\text{Performance Rating (P)} = \frac{\text{Theoretical cycle time} * \text{Actual number of parts produced}}{\text{Operating available time}}$$

Quality Rating (Q): Quality takes into account defects. A quality score 100% means there are no defects.

$$\text{Quality Rating (Q)} = \frac{\text{Number of OK parts}}{\text{Total parts produced}}$$

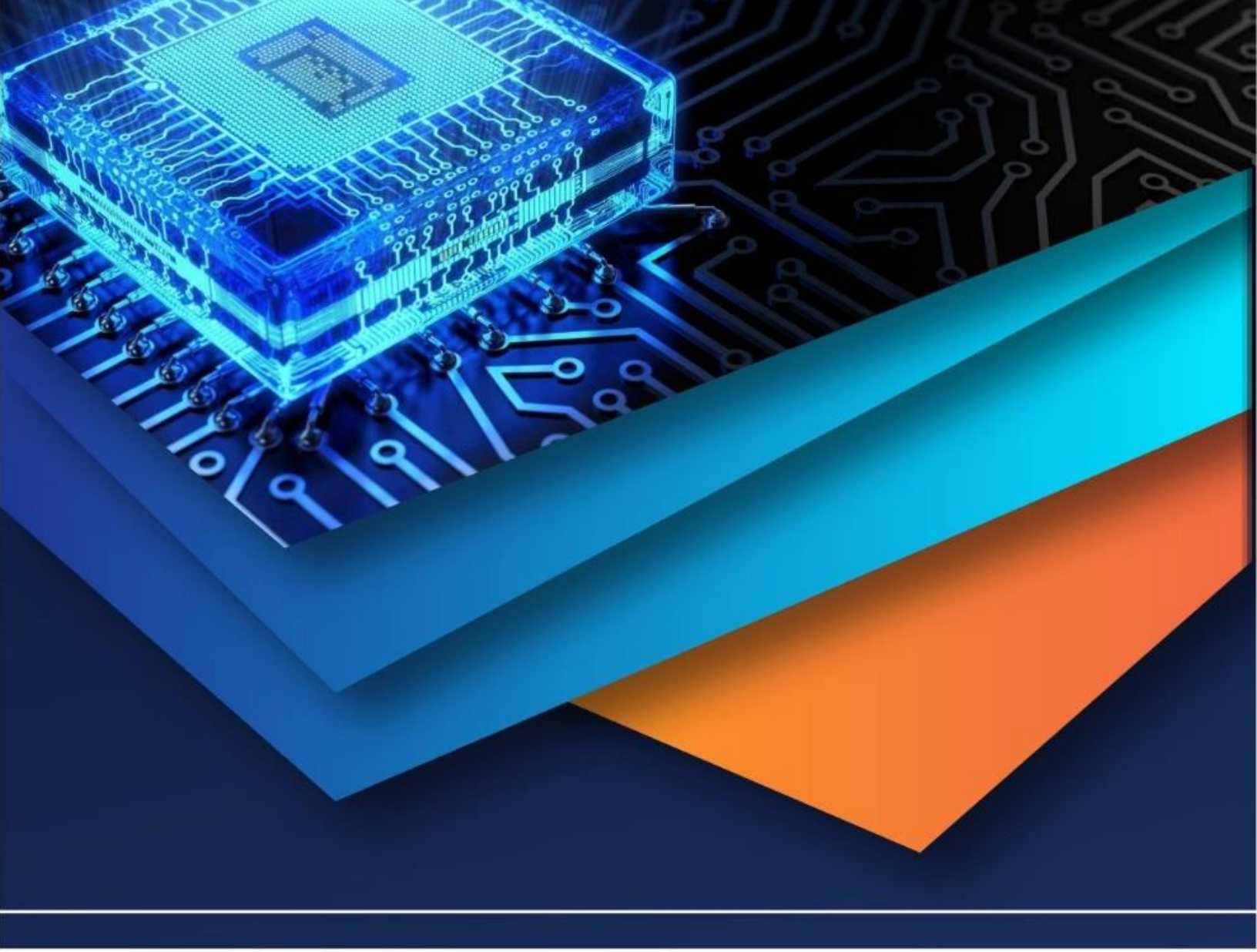
OEE = Availability Rating * Quality Rating * Performance Rating

IV. CONCLUSION

Success of TPM depends on eight pillars like Jishu Hozen, Planned Maintenance, Quality Maintenance, Kobestu Kaizen, Eductaion & Training, Office TPM, Safety, Health & Environment and Tool management & Development Management. It observes that there is a need for further study on the role of TPM in manufacturing industries. TPM increases the performance efficiency, availability and the quality rate, results in improvement of the OEE of the equipment. TPM also used to achieve zero defects, zero breakdowns and zero accident. Based on the findings of this review therefore it is suggested that more substantial benefits to be addressed by future research related to TPM.

REFERENCES

[1] S. Nakajima. (1989). T P M development program: Implementing total productive maintenance. Productivity Press, Portland, OR.
[2] O. T. R. Almeanazel. "Total productive maintenance review and overall equipment effectiveness measurement." JJMIE, vol. 4, no. 4, pp. 517-522, 2010.
[3] K. E. McKone, R. G. Schroeder, and K. O. Cua. "The impact of total productive maintenance practices on manufacturing performance." Journal of operations management, vol. 19, no. 1, pp. 39-58, 2001.
[4] K. Sharma, G. Gera, R. Kumar, H. K. Chaudhary. “An Empirical Study Approach on TPM Implementation in Manufacturing Industry”, International Journal on Emerging Technologies, vol. 3, no. 1, pp. 18-23, 2012.
[5] MY, Badli Shah. "Total productive maintenance: a study of Malaysian automotive SMEs." Proceedings of the World Congress on Engineering. Vol. 3. 2012.
[6] F. Talib1, Z. Rahman and M. N. Qureshi. "Pareto Analysis of Total Quality Management Factors Critical To Success for Service Industries. International Journal for Quality research, vol. 4, no. 2, 2010.
[7] A. Bangar, H. Sahu. “Improving Overall Equipment Effectiveness by Implementing Total Productive Maintenance in Auto Industry”, International Journal of Emerging Technology and Advanced Engineering, ISSN NO. 2250-2459, vol. 3, no. 6, June 2013.
[8] T. A. Ali, M. M. Allama, and M. S. Parvez. "A total productive maintenance (tpm) approach to improve production efficiency and development of loss structure in a pharmaceutical industry." Global Journal of Management and Business Research, vol. 10, no. 2, 2010.
[9] R. Singh, A. M. Gohil, D. B Shah and S. Desai. "Total productive maintenance (TPM) implementation in a machine shop: A case study." Procedia Engineering, vol. 51, pp. 592-599, 2013.
[10] I. P. S. Ahuja, and J. S. Khamba. "Total productive maintenance: literature review and directions." International Journal of Quality & Reliability Management, vol. 25, no. 7, pp. 709-756, 2008.
[11] M. Dogra, V. S. Sharma, A. Achdeva and J. S. Dureja. “Tpm- A Key Strategy for Productivity Improvement In Process Industry”, Journal of Engineering Science and Technology, vol. 6, no. 1, pp. 1 – 16, 2011.
[12] T. R. Pomorski. "Total productive maintenance (TPM) concepts and literature review." Total Productive Maintenance Concepts and Literature Review April 30 (2004).
[13] J. P. Acharya and M. J. Bhatt. "A Brief Literature Review on Total Productive Maintenance", 2014.
[14] W. Wakjira and M. A. P. Singh. "Total productive maintenance: A case study in manufacturing industry." Global Journal of Research in Engineering, vol. 12, no. 1, 2012.



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