

Productivity improvement of white coal industry by implementing TPM

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Abstract: Total Productive Maintenance (TPM) is a broad approach which employ across various industries to maximize productivity and efficiency by minimizing equipment downtime, reducing defects and optimizing maintenance process. Its fundamental aim is to increase the overall equipment effectiveness (OEE) by involving all employees in maintenance process. Ultimately TPM look for maximizing production rates on the other hand simultaneously decreasing waste and production costs.

The result of implementing the total productive maintenance program is remarkable, it leads to substantial improvement in operational performance and overall output. TPM is becoming a top-grade strategy globally because it helps industries to keep their equipment, machineries running smoothly and boost productivity, making them more competitive in their industries.

Keywords: TPM, implementation, productivity improvement, OEE

I. INTRODUCTION

TPM or Total Productive Maintenance, is a Japanese management concept focused on maintaining and improving production and quality systems gradually by involving all employees, machines, equipment, and processes. due to the global crisis and increased competition, it is now a basic corporate necessity to provide quality products at competitive costs by lowering production costs, which can only be accomplished through increased manufacturing performance [1]. in today's competitive world, industries are recognizing maintenance as a potential course of action for cost saving and achieving the competitive advantages. When it comes to dealing with reliability, availability, maintainability, integration of the maintenance function with engineering and other manufacturing activities in the company may help save a lot of time [1]. Total productive maintenance (TPM) is a methodology that aims to increase the availability of existing equipment hence reducing the need for further capital investment [2]. Total Productive Maintenance (TPM) is an approach that aims to engage all levels of an organization, from top management to frontline employees, in implementing a comprehensive maintenance strategy for all equipment. It focuses on maximizing the effectiveness of equipment throughout its entire lifecycle by involving everyone in activities such as preventive maintenance, autonomous maintenance, and continuous improvement. Total Productive Maintenance aims to optimize equipment effectiveness, maintain a neat workplace, and boost employee morale, ultimately reducing production losses caused by equipment inefficiency.

TPM was introduced to achieve the following objectives:

- Avoid waste in a rapidly changing market condition.
- Produce goods without compromising on standard.
- Lowering overall production costs.
- Produce a low batch quantity at the smallest possible time.

II. LITERATURE REVIEW

The manufacturing industry has experienced an unprecedented degree of change in the last three decades, involving drastic changes in management approaches, product and process technologies, customer expectations, supplier attitudes as well as competitive behaviour (Ahuja et al., 2006) [3]. In today's highly dynamic and rapidly changing environment, the global competition among organizations has led to higher demands on the manufacturing organizations. The global marketplace has witnessed an increased pressure from customers and competitors in manufacturing as well as service sector [4]. The aim of the TPM is to improve the labour 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 labour productivity were reported [5].

TPM ensure the maximum use of the existing equipment and perform the increased production within regular working hour to achieving the cost reduction without sacrificing the product quality. Any company can achieve production efficiency and other excellence by successful utilization of the TPM concepts and the tools and techniques of the TPM [6].

Saureng Kumar et al, (2017), The purpose of this paper is implementation of total productive maintenance, by performing machine wise breakdown analysis. The study establishes that focused on some analysis as section wise breakdown analysis, breakdown types wise and equipment wise breakdown analysis to avoid delay in manufacturing process. A TPM is a medical science of machine which improves the performance of maintenance activity, product and process quality, employee morale and job satisfaction [7]. Bupe. G. Mwanzaa et al, (2015) stated that, in today's industries, the concept of Total Productive Maintenance (TPM) has been worldwide accepted and some also implemented yet it's still possible to find industries facing some maintenance challenges.

The results of the research came double folded by reviewing that, the maintenance department employed 24.3% preventive maintenance, 67.6% breakdown maintenance, and 8.1% not applicable. Overall equipment effectiveness was calculated at 37% which was below the world class standard by 50%. TPM awareness deduced 70.5% of the employees been aware of the TPM concept. 14.7% indicated the concept of TPM would help improve the current maintenance system. 14.7% were not sure. The researchers then designed such a TPM model which would result in effective implementation of TPM in the dynamic business environment for higher competitiveness [8].

Prof. Pradeep Kumar et al (2012) stated that, Total productive maintenance establishes a system of productive maintenance, covers all department, covering the entire life cycle of equipment, involves participation of all employees from top to bottom and also promotes small group autonomous activities. Results obtained through the empirical study reveals the varying trends in the Overall Equipment Effectiveness (OEE) and Total Productivity of the machines taken up for the study. The average values of OEE were found to lay between the ranges of 15% to 60% against world class standards of 85% and Total productivity (TP) varies between 0.09 to 0.34. The results highlight the major causes resulting in the downtime and decrease in the productivity [9]. 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 [10].

Problem statement:

First of all, out of the whole plant process there are some problems identified and was decided to consider these problems for TPM implementation. The bio coal industry is struggling with various challenges, from operational inefficiencies to staying competitive and eco-friendly. Despite technological advancements, productivity remains below, and resources aren't optimized. Traditional management methods aren't cutting it anymore. To stay relevant, adopting Total Productivity Management (TPM) is crucial. But, implementing TPM in the bio coal sector isn't straightforward due to tech complexities, skill gaps, and regulations.

The main task is to create a customized TPM plan that suits the industry, improves operations, encourages innovation, and ensures sustainable growth, all while navigating the complexities of the bio coal market. In the industry there is a congested space for the workers to work on machine, raw materials were waste by storing in a large quantity, there are no proper instrument keeping which leads to waste of time this time can be utilize in the production work. These problems can be solved by implementing TPM in the industry.

Implementation Roadmap for TPM:

Based on the reviewed literature, the following aspects were identified for implementing TPM and adapted in the white coal industry step by step.

- ✓ Focused Improvement
- ✓ Autonomous Maintenance
- ✓ Planned Maintenance
- ✓ Education and Training
- ✓ Overall Equipment Effectiveness

TPM Enhancement program: -

For the development of TPM there are several steps which are discussed below.

Step 1: - Officially declare to implement total productive maintenance within the industry.

- Step 2: - Organize TPM introductory sessions and group training for targeted employees.
- Step 3: - Establish basic TPM guidelines and objectives.
- Step 4: - Create a blueprint outlining the step-by-step process of TPM implementation, from initial preparation to full execution.
- Step 5: - Initiate TPM project.
- Step 6: - Establish a corporate framework dedicated to achieving the highest levels of production efficiency for maximum productivity.
- Step 7: - Execute planned maintenance, manage shutdown procedures, utilize predictive maintenance techniques. Additionally, provide education and training for operational and maintenance teams.
- Step 8: - Establish an early management system.
- Step 9: - Establish a quality maintenance system.

Establishment of a TPM promotion industry: -

Total Productive Maintenance (TPM) is structured around a system of interconnected small groups within an organization, each playing a crucial role in its overall success. In this system leaders of small groups at one level also participate as members of the next higher level. Unlike Quality Control (QC) circle activities, TPM tasks are firmly implanted into the daily work routines of employees, ensuring that maintenance and improvement efforts are ongoing and not treated as separate endeavours. By promoting top-to-bottom alignment, TPM ensures that maintenance and improvement efforts are coordinated across all levels of the organization, driving efficiency, productivity, and overall success.

Focused Improvement: -

Focused improvement (kobetsu kaizen) encompasses all efforts aimed at optimizing the efficiency of equipment, processes, and facilities by systematically eliminating any form of waste. This involves forming teams comprising individuals from various levels within the industry, including managers, engineers, technicians, and line workers. The essential principle is that aggregating numerous small enhancements holds greater significance than pursuing a handful of major improvements.

Autonomous improvement: -

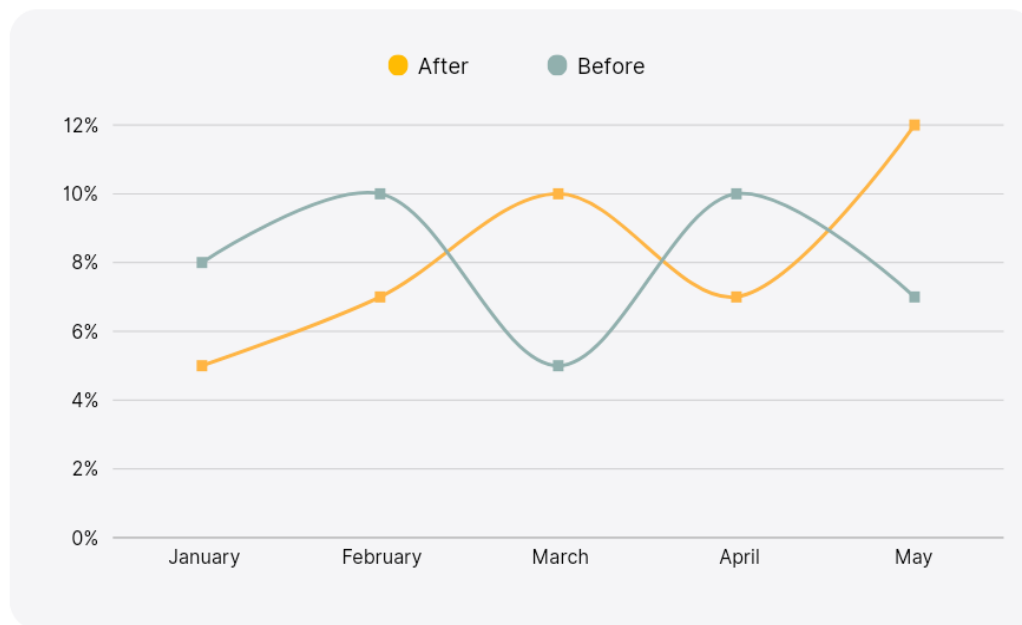
Autonomous maintenance is a methodology where operators take responsibility for routine maintenance tasks on the equipment they use. This includes tasks such as cleaning, lubricating, inspecting, and tightening components. By involving operators in these activities, organizations can improve equipment reliability, reduce downtime, and increase overall productivity.

The successful training program provided workers with the knowledge and skills necessary to recognize potential problems with the equipment they were using. After the training, the workers got really good at noticing when something might go wrong with the equipment. So, they could fix it before it broke down, saving time and money.

Overall Equipment Effectiveness: -

Finally, to assess how well the Total Productive Maintenance (TPM) implementation was working, the Overall Equipment Effectiveness (OEE) of equipment was measured and analyzed every two months. In process industries, it's crucial to make sure production runs smoothly. This means making the best use of equipment, materials, people, and methods. To achieve this, the production process is closely looked at to find and fix any issues or losses that might be holding back production. By regularly monitoring and analyzing OEE, the effectiveness of the TPM implementation can be assessed. Improvements in OEE indicate that the maintenance efforts are reducing downtime, improving equipment performance, and maintaining product quality. This approach enables continuous improvement in production processes, leading to higher productivity and profitability in the long run.

Production Rate



TPM outcomes and discussion after implementation: -

All areas within the industry undergo reorganization, and new cleaning standards were implemented. The initial cleaning process revealed issues that required replacement and repair. The introduction of the new cleaning protocols faced resistance, particularly because operator, storage, and production worker job descriptions previously did not include regular cleaning tasks. Some workers expressed concerns about having enough time to adhere to the new procedures. Additionally, long-term workers who had maintained their own workspaces felt worried about the changes. However, after implementing the standards, workload distribution became more equitable, eliminate the feeling of being solely responsible for cleaning tasks.

When considering the primary significance of TPM in production units, the focus mainly centres on machine maintenance. Workers are primarily tasked with keeping the machines clean, so extensive training was provided to them, encompassing both theoretical knowledge and practical skills in machine cleanliness. However, it's important to note that the objective was not to train workers to become fully-fledged engineers. The list of faults was thoroughly assessed, and all issues consider worthy of repair were addressed, with new investments made accordingly. However, certain points, such as installing brand new working desks and repairing uneven floors, were deemed too costly to address immediately. As a result, these items were postponed for future consideration.

III. CONCLUSION

This paper defines the systematic approach for studying TPM implementation providing valuable insights into the complexities and challenges involved. By adopting a very strict methodology, we have been able to analyze various aspects of TPM implementation, including its objectives, strategies, and impact on organizational performance.

The implementation of Total Productive Maintenance improves the working environment of the industry, increases the production rate, change the layout of industry for being effective, maximize the efficiency of the plan, reduce downtimes and failure of machineries, leading to higher productivity and profitability in the long run.

REFERENCES

- [1]. WASIM.S. HANGAD, Dr.SANJAY KUMAR2,"REVIEW PAPER ON TPM- A KEY STRATEGY FOR PRODUCTIVITY IMPROVEMENT IN MEDIUM SCALE INDUSTRY", International Journal of Scientific & Engineering Research, Volume 4, Issue 11, November-2013
- [2]. Chan, F.T.S.; Lau, H.C.W.; Ip, R.W.L.; Chan, H.K.; and Kong, S. (2005). Implementation of total productive maintenance: A case study. International Journal of Production Economics, 95(1), 71-94. Ahuja, I.P.S.; and Khamba, J.S. (2008). Total productive maintenance: literature review and directions. International Journal of Quality and Reliability Management, 25(7), 709–756.
- [3]. Inderpreet SINGH Ahuja, Jaimal Singh Khamba,"Improved Organizational Behavior Through Strategic Total Productive Maintenance Implementation", www.researchgate.net, January 2006
- [4]. Inderpreet SINGH Ahuja, Jaimal Singh Khamba, "Total productive maintenance: Literature review and directions", International Journal of Quality & Reliability Management, August 2008.
- [5]. Koichi, Nkazato (1989). TPM development programm. Journal of Portland productivity press.
- [6]. Syed Mithun Ali, Md Mosaddek Allama, Sultan 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, April 2010
- [7]. Saureng Kumar, Raj Bhushan, Shubham Swaroop, "Study of total productive maintenance & it's implementation approach in steel manufacturing industry: A case study of equipment wise breakdown analysis" International Research Journal of Engineering and Technology, Volume: 04 Issue: 08, Aug -2017. PP. 608-613
- [8]. Bupe. G. Mwanzaa, Charles Mbohwa, "Design of a total productive maintenance model for effective implementation: Case study of a chemical manufacturing company" Industrial Engineering and Service Science 2015, P.P. 461 – 470
- [9]. Prof. Pradeep Kumar, Dr. K. V. M. Varambally, Dr. Lewlyn L.R. Rodrigues, "A Methodology for Implementing Total Productive Maintenance in Manufacturing Industries–A Case Study", International Journal of Engineering Research and Development, Volume 5, Issue 2, December 2012, pp. 32-39.
- [10]. Eti, M.C.; Ogaji, S.O.T.; and Probert, S.D. (2004). Implementing total productive maintenance in Nigerian manufacturing industries. Applied Energy, 79(4), 385-401