

TPM Implementation in PNG Distribution Industry

Jagadish Varotaria¹, Chintan Barelwala²

¹P. G. Student, Department of Mechanical Engineering, Gandhinagar Institute of Technology, Gujarat (India),

²Asst. Prof., Department of Mechanical Engineering, Gandhinagar Institute of Technology, Gujarat (India),

Abstract: Total Productive Maintenance (TPM) has been recognized as one of the significant operation strategy to regain the production losses due to equipment inefficiency. Many organizations have implemented TPM to improve their equipment efficiency and to obtain the competitive advantage in the global market in terms of cost and quality. In the implementation of TPM in a manufacturing organization, both Human-oriented and Process-oriented Strategy has been identified as critical success factors. This paper, therefore, focuses on the improvement after TPM implementation in Sabarmati PNG distribution company.

Keywords: Total Productive Maintenance, Overall Equipment Efficiency (OEE), Pareto Analysis, Fishbone Diagram, ERP, SAP Systems.

1. INTRODUCTION

TPM is intended to bring both functions (production and maintenance) together by a combination of good working practice, team working, and continuous improvement. Efficiency and effectiveness of equipment plays a dominant role in modern manufacturing industry to determine the performance of the organizational production function as well as the level of success achieved in the organization. The impact of equipment efficiency has become more and more critical as the widespread utilization and application of highly sophisticated and automated machines in the industry increases. The maintenance of these complicated equipment and machines thus became very crucial and costly to manufacturers. Many organizations began to realize that the continuity of this excellent performance must be supported by a strong backbone of efficient and effective equipment. Traditional maintenance technicians are regarded as passive and non-productive to the current production function. Hence, implementing Total Productive Maintenance (TPM) in the manufacturing industry has emerged as an important operational strategy to overcome the production losses due to equipment inefficiency. TPM is an innovative approach, which holds the potential for enhancing the efficiency and effectiveness of production equipment by taking advantages of abilities and skills of all individuals in the organization.

This paper aims to assess the optimum TPM operational strategy which will increase the chances of a successful TPM implementation within a manufacturing organization in a developing country perspective. At the same time, few implementation issues such as motivators, critical success factors and factors that inhibit the extent and success of TPM implementation in the PNG distribution sector will also be discussed.

2. LITERATURE REVIEW

Human-oriented Strategy

Human-oriented strategy is, generally, strategies that actively involve human administrative application of management methods in achieving high extent of TPM. Three important aspects that are often discussed as the core of Human-oriented strategy are: (1) Top management commitment and leadership, (2) Total Employee Involvement, and (3) Training and Education.

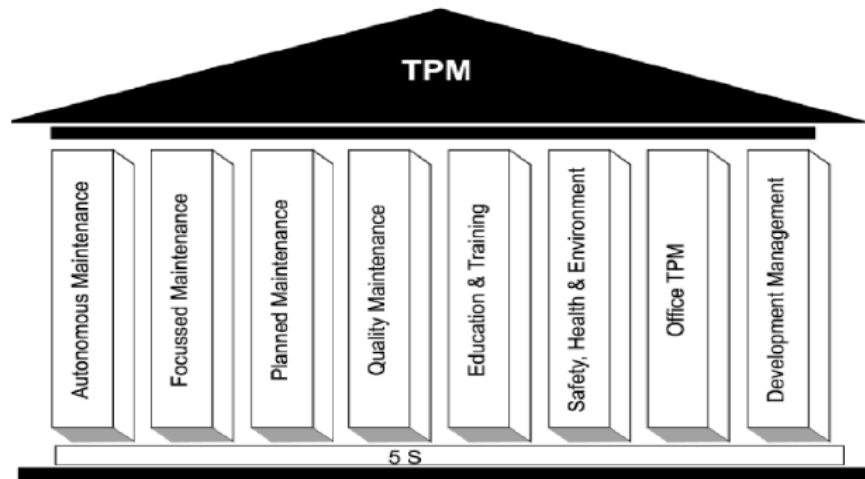


Fig.1. The eight pillars approach for TPM Implementation.

Top Management Commitment and Leadership

TPM requires a drastic change in the traditional mindset of work culture and maintenance approaches. However at the present moment, high resistance is often encountered from the shop floor operators and as well as the maintenance personnel. Top management has the primary responsibility of preparing a suitable and supportive environment before the official kick-off of TPM within their organization. This may include resources allocation and training and education provided to the middle management level as well as the production floor operators.

Total Employee Involvement

While top management commitment and leadership is essential for TPM success, it is not sufficient on its own. The importance of total employee involvement is based on the beliefs that shop floor operators have the most hands-on experience with the machines they operate daily. High level of maintenance awareness and simple routine maintenance tasks are integrated into their daily duties and the final mission ahead is to achieve profitable Autonomous Maintenance by operators.

Training and Education

Training and educational issues had become one of the critical factors to establish successful TPM implementation, where proper education begin as early as during the TPM introduction and initial preparation stages. The entire workforce in the organization need to acquire new knowledge, skill and abilities related to TPM. Education and training is the single most important factor once the necessary commitment has been assured and had become a long-term strategy in the planning schedule to obtain aspirations and skills. Further implementation of TPM sees the training to be essential to the implementation and work performance.

Process-oriented Strategy

While Human-oriented Strategy is important to prepare the foundation prior to implementing TPM, Process-oriented Strategy plays an important role in the next part to achieve a successful TPM implementation in the organization. Process-oriented Strategy includes all kinds of technical approaches to maximize the overall equipment efficiency through quantitatively, increasing the equipment availability and qualitatively, eliminating all production losses that resulted from inefficient equipment. The primary goal of TPM is to achieve the ultimate target of **Zero Loss** and **Zero Breakdown** so that all equipments are performing at its optimal condition. The production function performance is diminished by inefficient equipment that generates losses in terms of failure-loss, performance-loss or defect-loss. In detail, such losses can be refined as Equipment breakdown; Setup and adjustment time loss; Idling and minor stoppages; reduced Performance rate (slower speed); Process failure (defects) and reworks and Startup time losses. The sequential step-wise procedure of Process-oriented Strategy begins with:

- i. Identifying failures or losses and analyze causes.
- ii. Setting improvements to eliminate failures and losses
- iii. Confirming and consolidating results.

The immediate subsequent action after identifying and quantifying the equipment losses is to stratify and analyze the relevant root causes. Some of the analytical methods that had been developed and widely deployed to promote the thorough and systematic elimination of defects in Process-oriented Strategy are PM analysis, Fault-tree analysis (FTA), Failure Mode & Effect Analysis.

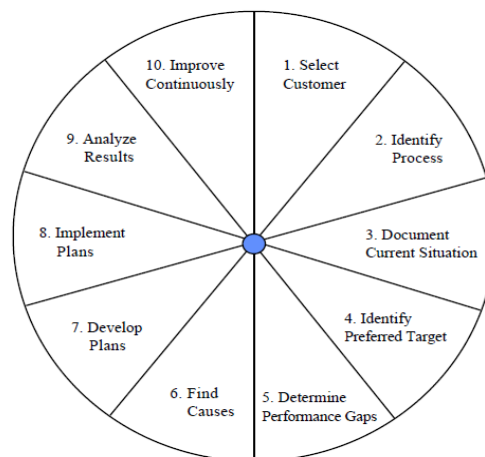


Fig.2. Ten step Process Implementation Model.

3. PROBLEM STATEMENT

Introducing TPM in a PNG distribution industry is still considered a major challenge due to several non-conductive environments in the adoption and implementation process. Lack of commitment and leadership from top management has always been discussed as one of the main factors that inhibit the implementation of TPM. On the other hand, resistance from the employee involved in the TPM program is also regarded as another major reason that explains why TPM fails in many local organizations. Employees refused to endure extra maintenance responsibilities without any rewards, recognition or compensation.

4. RESEARCH METHODOLOGY

A survey approach has been performed as the research strategy in this study to find out different problems in GSPC PNG distribution industry. Total Productive Maintenance (TPM) is a maintenance program, which involves a newly defined concept for maintaining plants and equipment. TPM focuses on maximizing the overall equipment efficiency with involvement of each and everyone in the organization.

4.1 Impact Factor for Implementation of TPM

1. Leadership qualities, management improvement participation.
2. Organizational infrastructure.
3. Culture of collaboration and co-operation.
4. Linking TPM to business strategy & Linking TPM to Quality.
5. Project prioritization and selection Employee Training & Understanding of TPM methodology.
6. Linking TPM to Customers & employees & to create empowerment and authority at all levels.

4.2 Use of CAD/CAM integrated ERP and SAP Systems:

Driving business at a beginner stage in the industry with a small consumer base and partial geographical spread seems to

be a smooth ride for many. Thereafter, phased business expansion for CGD companies always becomes complex and unwieldy, and influenced by many operational, economical and geopolitical factors, such as available gas supply, availability of national grid, existing operations stability, organization effectiveness while managing growing consumer services, available pipeline network and new consumer demand in awarded geographical areas. While addressing these challenges and risks associated with supply, consumer, infrastructure, and regulations, CGD operating companies need to ensure complete visibility, control and effectiveness in their operations. In order to overcome these challenges associated with the operating environment and achieve faster time to market, ensure higher asset utilizations, mitigate risk and uncertainties in operations, and deliver best consumer services, there is strong need of strategic and differentiated approach while selecting right enterprise resource planning (ERP) solution for it.[7]

Current advances in information technology and, in particular, computer-aided design/computer-aided manufacturing (CAD/CAM) and enterprise resources planning (ERP) systems, have led organisations to undertake significant investments in these systems. Next generation manufacturers require both systems to maintain or gain a competitive advantage, reduce risks and improve productivity and viability. In addition, recent attention to the implementation of CAD/CAM systems highlights their important role in automating complex design and next generation manufacturing processes. In the next millennium more manufacturers are likely to implement CAD/CAM and ERP systems and hence issues in the integration of CAD/CAM with ERP systems must become a major concern.

Performance Management is a data from all the maintenance work that was carried out. It will be extracted from the SAP system and stored in the SAP Business Warehouse (BW) for analysis and reporting. Performance Management is aims to enable the users to generate accurate reports to analyze the efficiency and effectiveness of their maintenance work. It is also to provide Operations Unit with a feedback mechanism to track their progress towards best practice. The application related to the gas transport and distribution management, inside a large Gas Distribution Company could be developed using Sap environment. .

4.3 Analysis of the Problem:

Operation and Maintenance department found some service related problems in routine work like,

- Daily complaints ratio very High
- Time duration in solving each complaint is more as compare guideline
- Alteration and modification work of domestic customers not satisfactory
- Alteration pending more then 3-4 months which not followed standard guideline
- Billing not proper as well as bill distribution problematic.
- Standard guide line not followed in Complaint solving, time duration and proper way



Fig.3. Pareto chart analysis from July-2013 to Nov-2013 Domestic Complaints.

5. COMPARISON BETWEEN BEFORE AND AFTER IMPLEMENTATION OF TPM

There are two types of benefits we can get through implementation of TPM in PNG Distribution Company:

<i>Direct Benefits of TPM</i>	<i>Indirect Benefits of TPM</i>
➤ Overall Equipment Efficiency is improved.	➤ Confidence level of employees increases.
➤ Customer complaints reduced.	➤ A clean, neat and attractive work place.
➤ Reduction in the maintenance cost by 30%.	➤ Favorable change in the attitude of the operators.
➤ Satisfying the customer’s needs by 100 % & reduced accidents.	

5.1 Comparative performance of a Model Line:

After implementing TPM in PNG Distribution Company, we noted the specific changes in number of reduction in particular area of gas distribution line are as mentioned below:

Table-I Comparative performance of a Model Line

Major Problems	Before TPM	Changes After TPM
Leakage in Union	9	4
Leakage in Meter Adaptor	21	16
Leakage in Misc (Gas-Tap, TF etc)	4	3
Gas Stop	3	2
Regulator Related	15	8
High Pressure	4	3
Low Pressure	2	3
Burner Related	1	1
False Complaint	75	25
Other	5	4

6. CONCLUSION

The fundamental objective of this paper has been to presents a novel methodology for the implementation of the Total Productive Maintenance (TPM) program in the PNG distribution industry. During research in Sabarmati gas distribution company we have compare before implementing TPM and after implementing TPM data and distort major problems by TPM based corrective action plan we have reduce 80% problems analyzed by pareto chart and improve OEE. TPM methodology not only increases the effectiveness of the gas distribution system but also increases the effectiveness of the entire organization through mandatory participation and continuously improves efficiency, cost, delivery, health, safety and morale of the employees.

REFERENCES

[1]. Prof. A.Bangar¹, Hemlata sahu², Jagmohan batham³ (2013), Improving Overall Equipment Effectiveness by Implementing Total Productive Maintenance in Auto, *International Journal of Emerging Technology and Advanced Engineering*, 3(6), 590-594.

[2]. Wan Hasrulnizam Wan Mahmood, Mohd Nizam Ab Rahman, Husiah Mazli, Baba Md Deros (2009), Maintenance Management System for Upstream Operations in Oil and Gas Industry: Case Study, *World Academy of Science, Engineering and Technology*, 36, 413-419.

- [3]. Banta, V.C. ; Cojocaru, D. (2013), Development Center Tool a software application for change request management, System Theory, Control and Computing (ICSTCC), 17th International Conference, IEEE, 42-47.
- [4]. Fang, L. C. (2000). Implementing TPM in Plant Maintenance: Some Organisational Barriers, *International Journal of Quality & Reliability Management*, 17(9), 1003-1016.
- [5]. Olayiinka S. ohunakin “TPM Implementation in a Beverage industry: A case study” *Journal of Engineering and applied science* 7(2):128-133, 2012
- [6]. Scontrino, M. P. (1995). TPM in Process Industry, *Personnel Psychology*, 48(2), 456-458.
- [7]. Shimbun, N. K. (1995). TPM Case Studies, Portland OR: Productivity Press.
- [8]. M. Mahajan, *Industrial Engineering and Production Management*, Dhanpat Rai & Co., 2012.
- [9]. http://www.ace.ucv.ro/analele/2012_vol2/01_Banta_Viorel.pdf
- [10]. <http://www.informationweek.in/informationweek/news-analysis/176274/selecting-erp-city-gas-distribution-business>