

Review on the Implementation of Total Productive Maintenance

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Abstract- Lack of management support is the most common barrier to TPM implementation. Engineers are technically skilled but when it comes to economics and co-operate finance there is still a lot to train and educate. The board of directors speaks in terms of money, present value, and net present value and not in terms of uptime, technical availability or mean time between failures. We also see that our strategies as engineers are not smart enough because we can't quantify the things we want the board to decide on. This paper suggests the use of VDM to identify a winning maintenance strategy and win management support. VDM is the first and only maintenance methodology that really calculates the economic added value of maintenance using net present value (NPV) techniques and industry bench marks.

Keywords- 5S, Total Productive Maintenance (TPM), Overall Equipment Effectiveness (OEE), six big losses, Housekeeping, Autonomous maintenance, Teamwork, value driven maintenance (VDM)

I. INTRODUCTION

Hall (1990) alludes that TPM, which is built on the preventive maintenance concept imported from the USA, was initiated in Japan in 1969. TPM is a people-oriented approach that has been proved to be effective for equipment effectiveness and eliminating breakdowns. Campbell further explains that TPM mobilizes the machine operators to play an active role in maintenance work by cultivating in these front-line workers a sense of ownership of the facilities they operate, and enlarging their job responsibilities to include routine inspection, cleaning, lubrication and minor repair of their machines. Traditionally, these duties fall outside the responsibilities of the machine operator. Thus, TPM involves a restructuring of work relating to equipment maintenance. Being relieved of such routine tasks, the expertise in the maintenance unit can now be deployed to focus on more specialized activities such as major repairs, overhauls, tracking and improvement of equipment performance, and replacement or acquisition of physical assets. Instead of having to continuously fire-fight and attend to numerous minor chores, it can now devote its resources to address strategic issues such as formulation of maintenance strategies, establishment of maintenance management information systems, tracking and introduction of new maintenance technologies, training and development of production and maintenance workers. However Benefits of TPM are usually not realised because of various barriers. In this paper the author is going to review TPM papers to

identify the common barriers to TPM implementation and suggest a good solution to the most common barrier.

Objectives

- Identify most common barrier to TPM implementation.
- Point out the main reasons why that barrier occurs.
- Suggest a solution to the identified barrier.

II. PAPERS REVIEWED

Jamal Ahmed Hama Kareem and Noraini Abu Talib [1]. Investigates the impact of ethical factors on the implementation of 5S and TPM. The researcher concluded that manager-subordinate relationship (empowerment) has a significant influence on the implementation of 5S and TPM; while ethical training, instructions and commands were found to be influential in the implementation of these techniques. The study was a case study of, three cement plants located in Kurdistan, Iraq .Self-administered questionnaire were used in the study. The reliability of the instrument was found to be 0.832 (ethical factors) and for implementation of 5S and TPM (0.787). Reliability using Cronbach alpha indicated that the instrument was reliable as all the alpha values were found to be above 0.70. The factor analysis indicated that the instrument was valid as all the items were found to have more than 0.40 factor loadings and were retained.

Zahid Habib Kang Wang[2].Conducted a study on an assembly line of automatic brake adjusters' at Haldex Brake Products AB and came up with suggestions to implement total productive maintenance on the assembly line. The author suggests new model for measuring OEE is presented with emphasis on each of the three factors separately so that the actual problems should get immediate focus during the group meetings. The author managed to develop work instructions for work station 6 operators.

A.K.M. Masud, Abdullah-Al-Khaled, Seratun Jannat, A.K.M. Sajedul Arefin Khan and Kingshuk Jubaer Islam[3] identified and reduced equipment losses in order to maximize overall equipment efficiency (OEE) by using the techniques of Total Productive Maintenance (TPM).the most significant losses were indicated and eliminated and the overall equipment efficiency (OEE) was improved. KAIZEN was used in this study. They used Kaizen tools such as: PM analysis, why - Why analysis, Summary of

losses, Kaizen register and Kaizen summary sheet to eliminate losses. In this research work, it has been found that OEE has increased to 65% from 59% while a single problem was considered and analyzed by only one tool of TPM (WWBLA). Here, it can also be mentioned that only one cause of the mentioned single problem has been considered. Thus from this research work it can be expected that the OEE could be increased to a very high level by implementing TPM to an industry.

Prof Dr Norzimabinti Zulkufli, Nur Hamai Mart Zal and Prof Dr Faieza Abd [4] evaluated current Total Productive Maintenance for Kaizen activities in the company and to categorized the maintenance activities according to the criticality of the equipment and process using engineering TPM tools, Decision Making Grid (DMG). The general TPM framework was divided into two main stages, which were the implementation of the fundamental activity and the Decision Making Grid technical analysis. The results showed that the selection of the maintenance task based on the failure mode will be more reasonable and practical due to the solid judgments and evaluation gained from the recorded failure data history.

Mustafa Mohamed Grais [5] investigates the problems facing four cement factories in Libya. Following a comprehensive literature review around the research problem; case studies, statistical data, semi-structured interviews, detailed questionnaires and site visits were utilised to evaluate and understand the problems within the four factories. Based on the analysis, the thesis suggests a new Framework and associated models for implementing Total Productive Maintenance (TPM) and identifying the key Factors to improve the overall maintenance performance. The author from his experience in the factory identified several problems such as low productivity, fluctuation in production and the negative effect on the environment. The author also found that motivation would include issues such as rewarding performance, social activities, financial prize/reward, management stability, performance certificate, and increase in salary, especial promotion or higher position, increase in salary.

Islam H. Afefy[6] focuses on a study of total productive maintenance and evaluating overall equipment effectiveness. The calculation of the overall equipment effectiveness in Salt Company (Emisal) in Egypt was carried out. The big six losses in any industry (quality, availability and speed) were also presented. Based on these results, global maintenance management, and production planning were suggested to improve their maintenance procedures and improve the productivity. The comparison between world class and company was carried out. It was found that the company is not achieved the world class A, PE, Qr and OEE. The author suggested that three main techniques to have a good impact to improve the production process and make the maintenance process more effectively which are , computerized maintenance management system, production planned, and total quality management, those techniques

were to help the company operate at high performance rate without any losses.

Alorom, M[7].The researcher designed a framework that identifies the most important factors that affects a successful application of TPM, as well as the tools and techniques that help in the application process. To determine the factors and obstacles when applying TPM, Libyan Iron and Steel Company LISCO was selected as case study. Accordingly, these researches also provided several recommendations, including the application of the concepts and principles of TPM in the company and make it the responsibility of everyone, and work in light of the proposed improvement plan. The significance of management has been highlighted in the study as a way of strengthening the supervision of TPM and top management commitment, particularly considering the measures required at every step or level of implementation. Moreover, the results obtained through the study suggest that the hurdles faced at the individual level helped better in the prediction of TPM program, and hence it can be said that the significance of such barriers and factors can be more than it is stated. Basically, the results suggested that the response of an individual to the TPM would be affected by the balance within the organisational and individual perspective, background and experiences. The study, also, suggested or addressed the need for training of the managers' specifically within the Libyan Iron and Steel Company (LISCO). The study, also, highlights the need for maintaining a positive relation within the organisational culture and employees. Further, consideration from the organisation is required for developing better training and practices for the TPM and its framework while considering the social and economic factors that would affect the implementation of TPM specifically within Iron and steel company.

Jonas Bergsman Anders Hall[8] examined how AstraZeneca can improve maintenance management and work with motivational aspects in order to ameliorate the completion of the TPM pyramid and thus increase the maintenance efficiency. The purpose was fulfilled by providing solution proposals that improves the overall maintenance results which in turn improves the maintenance efficiency. The author proposed that API should look at aspects such as performance indicators but also put an equal focus on less obvious points such as motivating the staff through competitions etc. the author urged them to look at goal settings, TPM and goal setting were intertwined and effectively communicated throughout the organization and managing cultural change in an active way thus making each maintenance staff member take a self interest in the TPM program. In increasing the TPM pyramid completion the author proposed that API should focus on extending the use of the current maintenance system and to introduce performance indicators that can be used for mapping performance.

Dashrathkumar [9] attempts to understand the TPM concept and to generate awareness among the budding technologies about TPM. During research in Shiv plastic Pvt. limited the

author compared OEE before implementing TPM and after implementing TPM data and distorted major problems by TPM based corrective action plan they reduced 60% of the and improved OEE. The author concludes that TPM methodology not only increases the effectiveness of the manufacturing system but also increases the effectiveness of the entire organization through mandatory participation and continuously improves Productivity, quality, cost, Delivery, safety health and Morale.

Prasanth S. Poduval, Dr. V. R. Pramod, Dr.Jagathy Raj V. P[10]. Highlights the difficulties faced by organizations in implementing Total Productive Maintenance (TPM). The paper first explained in brief the concepts of TPM and why TPM is a must for organizations in this complex dynamic business environment. It then takes up the various issues that hamper implementation of TPM in industries. Solutions to overcome the barriers were discussed briefly but will be taken up in detail in another paper with specific reference to refinery scenario .They concluded that Management has to invest in time, money and resources for a successful implementation. The organization as a whole should be dedicated and committed to TPM. This requires transformation of work culture from —It's not my job but yours to —It's our job.

Hemlatasahu, Jagmohanbatham[11]the author improved OEE (Overall equipment effectiveness) by implementing TPM (Total productive maintenance)by using kaizen methodology. TPM was used as a tool to improve equipment reliability by redesign the workforce in equipment care and improve the maintenance function. They reduced the production losses and improve OEE of industry up to 96% by TPM based corrective actions have been planned through this case study in a Jamna auto industry. The main objective was to understand TPM concept and to generate awareness among the budding technologies about TPM. During research in Jamna auto limited they compared before implementing TPM and after implementing TPM data and distorted major problems by TPM based corrective action plan and they reduced 80% problems analyzed by pareto chart and improve OEE. TPM methodology not only increases the effectiveness of the manufacturing system but also increases the effectiveness of the entire organization through mandatory participation and continuously improves Productivity, quality, cost, Delivery, safety health and Morale.

Syed Md. Shahwaz[12]The areas of interest in this thesis are-TPM, the steps involved by the implementation of TPM in an organization, Objective of TPM, TPM – History, Pillars of TPM, Types of maintenance, TPM Targets, TPM in organisation, Fire & Safety department, TPS (Thermal Power Station), BXP (Barauni Expansion Project),Coker. Total productive maintenance is a concept which aims at zero down time. In this paper TPM focuses on Emphasizes Equipment Excellence as backbone of Manufacturing Excellence.

Suzaituladwini Hashim, Nurul Fadly Habidin, Juriah Conding, Nurzatul Ain, Seri LanangJwaya, Anis Fazdlin Mohd Zubir[13].Identified the TPM constructs and innovation performance measures for Malaysian automotive industry and also to develop research model of the TPM and innovation performance measures relationship for Malaysian automotive industry. Based on the proposed conceptual model and reviewed, research hypotheses are being developed. The paper culminates with suggested future research work. This study has important implication for total productive maintenance and innovation performance in Malaysian automotive industry. As such, it is expected to benefit both researchers and practitioners.

Mr.Kishor Kumar Aroor, 2Mr. MadhukaraNayak, Prof.Er.U.SaiKrishna[14] studies TPM and Manufacturing performance of a manufacturing industry. After finishing of detailed literature survey, two small scale manufacturing industries are selected for data collection and TPM analysis work. By visiting those two industries both primary and secondary data's are collected. Values of Overall Equipment Effectiveness (OEE) and Partial productivity are calculated by using standard formulae's and standard methods. By scheduling method of data collection four TPM pillars are analyzed by framing questions. Finally all required results are obtained and analyzed properly for obtaining conclusions.

Richa Sharma and Jagtar Singh [15] identified the effectiveness of 5S practices on TPM implemented organization performance. The result of this study confirms that all 5S principles affect TPM directly or indirectly. Consequently, 5S is an effective tool which strongly supports the objectives of TPM implemented organization to achieve continuous improvement and higher performance. The results of this research confirm that the 5S practice is seen as an effective technique that can improve housekeeping, environmental performance, health and safety standards in an integrated holistic way. However, 5S execution is an essential prerequisite of implementation of Total Productive Maintenance.

III. CONCLUSION

Lack of managerial support was identified as the most common barrier. In all the papers reviewed OEE is used as a means to justify the need to implement TPM.TPM is the best practice to improve OEE, improve uptime but if economic ties go down there is nothing in that methodology to get grip on lowering cost. Hence to identify the best maintenance practice and convince management to invest in maintenance VDM is the best methodology. VDM determines the dominant value drive by considering the 4 ways in which maintenance adds value to a company which are asset utilisation, cost control, resource allocation safety health and environment. These value drivers change over time. Dominant value drivers may differ per plant, per production line depending on the product's life cycle. The equation below is a VDM equation which is a modification of the net present value equation.

$$PV_{\text{maintenance}} = \sum \frac{\{F_{\text{SHE},t} \times (CF_{\text{AU},t} + CF_{\text{CC},t} + CF_{\text{RA},t} + CF_{\text{SHE},t})\}}{(1+r)^t}$$

Value driven maintenance determines the winning maintenance strategy and value added from investing in a particular maintenance strategy. Hence the need to implement TPM should be justified by VDM. This will make is easy to convince management to invest in a maintenance strategies. OEE should only be used as a means to monitor progress when implementing TPM.

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