



ENHANCING PRODUCTIVITY THROUGH TPM CONCEPTS: A CASE STUDY

¹Ashwin B. Virupakshar, ²Anil Badiger

¹Dept. of Industrial and Production Engineering

²Dept. of Automobile Engineering

B.V.B. College of Engineering and Technology, Hubli

Email: ¹ashwin_bv@yahoo.co.in, ²anil@bvb.edu

Abstract

This paper presents the study and implementation of the TPM for the overall productivity of the manufacturing industries. In this study some of the different TPM implementing methods are introduced for the overall improvement of the industry. This study was carried out in India Auto pins Pvt. Ltd. one of the leading fastener producers in Karnataka, India. For the study, the past data is collected from the industry, and the different observations were made in the industries during the study. The many problems were identified during the study and among which the major problem was the slow production rate. By using the TPM techniques and the different methods were introduced such as statistical analysis, reduction of cycle time for each operations by combining the two or more operations by providing the special attachment wherever possible, the other programs of TPM such as training for the workers, Implementation of the eight pillars of TPM, implementation of preventive maintenance check sheet and the Kaizen concepts. After implementation of the TPM concepts many of the direct and indirect benefits are shown, also it improve the overall equipment efficiency of the equipment, high responsive of the employees and also improve the overall productivity.

Keywords— TPM, Kaizen, Productivity, Statistical Analysis.

I. INTRODUCTION

Total Productive Maintenance is a composition of maintaining with newly defined concept and improving the integrity of production and quality through the machines, equipment, process and employees that adds the value to the industry. TPM main objective is to accomplish zero defects, zero breakdowns in all the possible areas of the industries. It helps to form different teams for the maintenance. TPM helps to keep the working environment neat and clean. TPM helps the employee to get the feeling of owning the machine and motivates them to work with more efficient.

TPM plays a very important role in any manufacturing industries especially in fastener industries. It helps the industries to come up with new innovative ideas that can decrease the production or manufacturing cost, it also helps the industries to make use of the costly machineries to the fullest, it helps to educate the employees to work with more efficient and with ease and increasing employee morale and job satisfaction.

Also, Kaizen helps to deliver the small improvement in the industry. It also reduces the fatigue factor of employees. It helps in reducing the cycle time of the different operations. It also helps to increase the availability of the existing equipment. It is instrumental in bringing high quality products and reduce the human factor.

II. LITERATURE SURVEY

Kathleen E. McKone et al.,(1999) The study was carried out in the industry and implemented TPM, which improved the Overall Equipment Effectiveness (OEE) as a result of TPM implementation. *Hemant Singh Rajput et al., (2012)* They carried out the work by gathering information must remain simple and it should be effective for future data analysis, it gives the provision to highlight such problems and possible causes, then it leads to the correction of common problems such as breakdowns and rework. *Badli Shah M.Y (2012)* Throughout this study, it is found that TPM as part of overall maintenance management evolution plays an important role for keeping the assets in good condition to further enhance the manufacturing performance.

III. METHODOLOGY

Now a days the fastener or manufacturing industries needs the TPM implementation for the overall improvement of the same. The research has been carried out in the India Auto Pins Pvt. Ltd. This study has been conducted to determine the different implementation level of TPM techniques. The questionnaire was developed, through which the feedback and problems were recorded. The study is carried out for the one month every day. During the study the major production loses, wastage and quality of the products were pointed out by using the time study and statistical analysis. By looking at the problems it seems that there is huge scope for the overall improvement of the industry and to achieve more profitability by implementing the different TPM techniques.

After identifying the different problems the implementation planning is done. The implementations of the TPM techniques are done in two stages. The first stage includes the statistical analysis for the thread quality improvement. In the second stage the reduction of the cycle time by combining the operations by attaching the special jigs and fixtures. The kaizen concepts are also implemented in the second stage such as the Red Tag, Color coding chart for material segregation, Preventive maintenance charts etc..

IV. CASE STUDY AT INDIA AUTO PINS

The "INDIA AUTO PINS" an ISO 9001-2008 certified company, located in B-91, Industrial Estate, Gokul Road, Hubli, Karnataka India. The major product of the company is Machined components & Fasteners. Currently supplying to the reputed companies namely Wier BDK Valves, Microfinish Valves Pvt. Ltd, Aqua Valves Belgaum Etc. India Auto Pins mainly focuses on manufacturing as per customer's design.

A. During the study the following problems were identified:-

1. Defects identified in finished product (M16 Full Threaded (F.T.) Studs) is Poor quality threading (not as per the standard size) Causes of this defect may be operational errors done by the operator and the error in machine itself. The rejection rate was 9%(If 100 M16 F.T. produced out of which 91 were accepted).
2. During the case study the another major problem was identified that the production rate was low because of the larger cycle time of each different operation of fasteners.

B. Solutions for the above problems:-

1. Solution for problem 1:

During the study the main factors which are affecting the thread quality were identified as Roller die pressure, Roller speed and Material hardness. In order to improve the thread quality as well as to decrease the job rejection, there is a need to identify the best set of combination of the above three factors for machining. For the optimization the statistical analysis is done by conducting the Design of experiments by taking two levels and three factors, the levels being high and low. A complete factorial design was performed to measure the response variable (M16).

TABLE I : FACTORS AND LEVELS

Factors	Level 1	Level 2
Roller Die Pressure	25	35
Roller Speed	16	34
Material Hardness	15	30

Main Effects Plot:

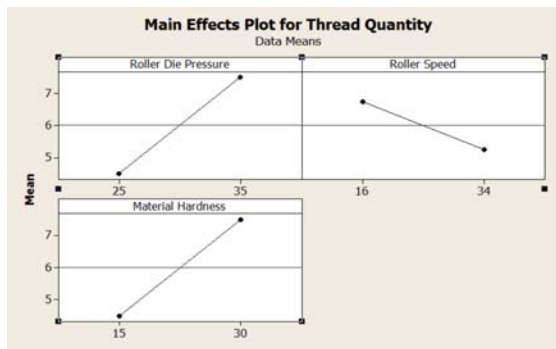


Fig 1 : MAIN EFFECTS PLOT FOR THREAD QUALITY

From the Figure I it can be seen that there is a significant effect of the pressure on the thread quality. The thread quality is greater when the roller speed is low and Material hardness is more. Roller speed, Roller Die Pressure and Material hardness effect thread quality.

Interaction Plot:

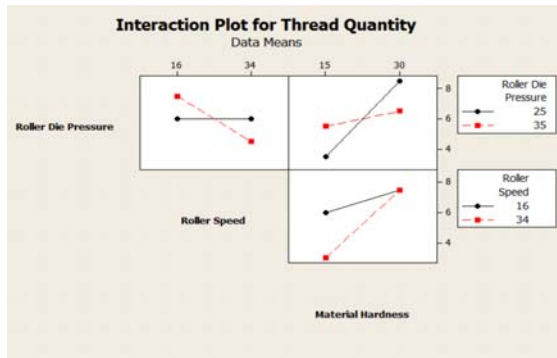


Fig 2 : INTERACTION PLOT FOR THREAD QUALITY

The interaction plot depicts that there is interaction between all the factors. There is a significant interaction between Material Hardness - Roller speed, Material Hardness-Roller speed, Material Hardness- Material Hardness.

From this statistical analysis the optimized combination of factors and levels for best M16 thread quality are as follows:

Roller Die Pressure = 35

Roller Speed = 16

Material Hardness = 15

After adopting the above set of combination of parameters during the manufacturing of M16 F.T. Studs the rejection rate was reduced to 4%.

2. Solution for problem 2:

During the second stage of the TPM implementation the importance is given to increase the production rate. For the study, the traub machine has been selected. During the study it was found that the major causes for the low production rate was the larger cycle time for each operations. In order to reduce the cycle time the operations were combined. Initially there were 4 operations (i.e. Cutting, Chamfering, Grinding and Threading) which were used to perform separately on the different machines, then by seeing the provisions for the special attachments on the traub machine the operations were planned to combined and reduced it to 3. For the reduction of the operations the special tools, jigs and fixtures were attached to the machine as shown in the fig.3.

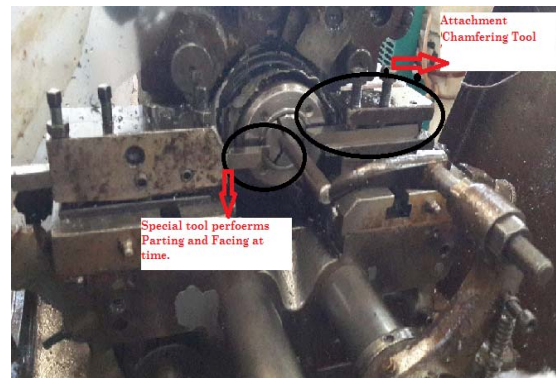


Fig.3 Traub Machine with special attachments

Before attaching a special attachment to the traub machine, there was only one operation performed on that machine, which is parting. After attaching the special attachment the machine started performing two operations (i.e. cutting and chamfering) at time. This saves the two operations cycle time and the two labor cost. This will help for the overall improvement of the production and profitability of an industry.

DATA ANALYSIS:

During the study, the data has been collected every day for one month. In which 15 days data were collected for before TPM implementation and 15 days for after TPM implementation. Before TPM implementation the industry was able to produce an average of 250 M16 full threaded studs and after TPM implementation the industry was able to produce an average of 286 studs. It was found that there was a reduction of a machine and a labor. After implementing TPM around 15% of production

rate was improved. This directly helps the organization's growth and its profitability. The following fig.4 shows the improvement of the production before and after implementing the TPM.

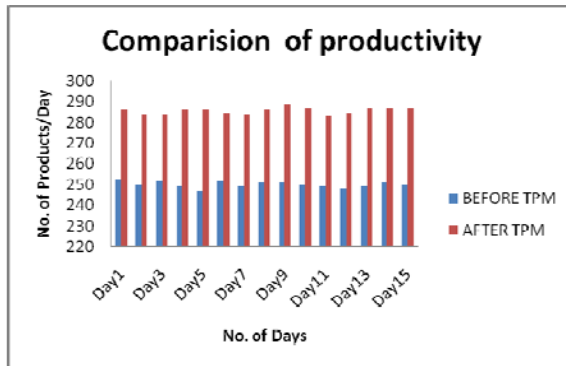


Fig.4 Comparison chart

V. CONCLUSION

From this study it can be seen that TPM plays an very important role in fastener or any manufacturing industries. For the overall equipment efficiency TPM is ideal tool. The TPM helps the management to improve the overall performance of the firm. The different techniques of TPM such as eight pillars of TPM, 5S concepts and Kaizen will make workers to work with more efficient and comfortable. In this study the two TPM implementations are done, one was the quality improvement and another one production improvement. These are done by proper utilization of the same equipment with more efficient. By using some attachments and the proper utilization of the equipments will improve the productivity this can be done by using TPM. This results in the overall improvement of the equipment efficiency, production rate, productivity and reduce the unnecessary usage of the money. From this study it can be conclude that by proper implementation of TPM concepts the manufacturing industries have great benefits with the very less investment. Hence TPM implementation is one of the key factors for the success of an any manufacturing industries.

VI. ACKNOWLEDGMENT

We would like to thank India Auto Pins Private LTD. for providing us the necessary

equipments and space to carry out the study and also we would like to thank Prop. Mr. Avinash Lakundi for his valuable inputs during the research.

References

- [1] Kathleen E. McKone, et al., "The impact of total productive maintenance practices on manufacturing performance" *Journal of Operations Management* 19 (2001) 39–58
- [2] Sarang G. Katkamwar, et al., "Study of Total Productive Maintenance & its Implementing Approach in Spinning Industries". *International Journal of Engineering Trends and Technology (IJETT) - Volume4Issue5- May 2013.*
- [3] Badli Shah M.Y, " Total Productive Maintenance: A Study of Malaysian Automotive SMEs". *World Congress on Engineering 2012 Vol III WCE 2012, July 4 - 6, 2012, London, U.K.*
- [4] Hemant Singh Rajput, et al., " A Total Productive Maintenance (TPM) Approach To Improve Overall Equipment Efficiency". *International Journal of Modern Engineering Research (IJMER) Vol.2, Issue.6, Nov-Dec. 2012 pp-4383-4386 ISSN: 2249-6645.*
- [5] Ahmed, S., Hassan, M.H. & Taha, Z. (2005). TPM can go beyond maintenance: excerpt from a case implementation. *Journal of Quality in Maintenance Engineering*, 11(1), 19-42.
- [6] Ahuja, I.P.S. & Khamba, J.S. (2007). An evaluation of TPM implementation initiatives in an Indian manufacturing enterprise. *Journal of Quality in Maintenance Engineering*, 13(4), 338-52.
- [7] Bhadury, B. (2000). Management of productivity through TPM. *Productivity*, 41(2), 240-51.
- [8] Ahuja, I.P.S. & Khamba, J.S. (2008a). An evaluation of TPM initiatives in Indian industry for enhanced manufacturing performance. *International Journal of Quality & Reliability Management*, 25(2),147-72.