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A CASE STUDY ON TOTAL PRODUCTIVE MAINTENANCE (TPM) IN AUTOMOBILE INDUSTRY IN CHENNAI

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Abstract
The efficient and effective maintenance is necessary for manufacturing organizations to attain world class in manufacturing. The Total Productive Maintenance (TPM) system is an approach for improving the performance of maintenance activities. The OEE has revealed and increased rate of performance after implementation of TPM. In a highly competitive automobile business, TPM is the only way to increase the performance of equipments. Breakdown of equipments can be reduced through successful implementation of TPM. The results also indicate that education and training, performance measurement, management of resources, continuous improvement and commitment of top management are the critical success factors for successful implementation of TPM.

Key Words: Automobile, Overall Equipment Effectiveness (OEE), Total Productive Maintenance (TPM).

Introduction

In a high completive business environment, an efficient and dependable production system is necessary for attaining competitiveness (Brah and Chong, 2004). The conventional misapprehension about maintenance being observed as an expenses on operations to be minimized and not as an investment in enhancing reliability of process that has to be realized through excellence in performance of manufacturing system. The development capabilities, technologies and equipments are the main factors that reveal the organizational strength and place it separately from others (Braglia et al, 2006).

Maintenance is now becoming a key strategic tool to enhance competitiveness relatively than an overhead expense which should be managed. The investment in maintenance returns flexibility, safety, dependability, improved quality and lead times (Teresko, 1992). The efficient and effective maintenance is necessary for manufacturing organizations to attain world class in manufacturing. The Total Productive Maintenance (TPM) system is an approach for improving the performance of maintenance activities (Pramod et al, 2007).

TPM is an ordered, continuous and equipment centric improvement process that attempts to optimize the effectiveness of production through identifying and removing equipment and losses in production through participation of employees at different levels of operations actively.

TPM provides an effective management practices through eight pillar methodology of autonomous maintenance, planned maintenance, focused improvement, quality maintenance, safety, health and environment, education and training, office TPM and development management (Rodrigues and Hatakeyama, 2006).

TPM implementation ensures good quality, high productivity, low cost, dependable delivery, few breakdowns, motivating employees, morale and safety of employees (Tripathi, 2005). The automobile industry in India particularly in Chennai has implemented TPM for maintenance improvement intensively in recent times. Therefore, it is necessary to study Total Productive Maintenance (TPM) in automobile industry in Chennai.

2. Pillars of TPM

The Japan Institute of Plant Maintenance introduces TPM principles or pillars is on the basis of implementation of TPM in a orderly way for optimizing equipment efficiency through ideal interaction between equipment and man (Goyal and Jindal, 2015). There are:

PILLAR 1 - Focused Maintenance

This pillar focuses on improvements in all the activities which maximize the overall effectiveness of equipments and plant by removing losses and improving performance.

PILLAR 2 - Autonomous Maintenance

Autonomous maintenance is the process through which operators of equipments bear and responsible for performance of equipments.

PILLAR 3 - Preventive Maintenance
The preventive maintenance means to create and uphold equipments and their process optimally.

PILLAR 4 - Maintenance Prevention Pillar
Maintenance prevention means design the new equipment construction that has easy maintenance, high operational efficiency, high reliability, flexibility, safety and cost effective. Hence, it reduces maintenance costs and depreciation losses.

PILLAR 5 - Education and Training
Training is needed to educate equipment operators for equipment maintenance and optimal operating conditions.

PILLAR 6 - Quality Maintenance
Quality maintenance is the establishing conditions that will prevent defects and achieve zero defects.

PILLAR 7 - Administrative TPM
Administrative TPM is the application of TPM practices for continuous improvement in effectiveness of administrative functions.

PILLAR 8 - Safety and Environment
The safety and environmental pillar is also equally and more important than other pillars.

3. Research Methodology

The study has been carried out in automobile industry in Chennai that has implemented TPM successfully. This approach has directed to the explanation of implementation of TPM for improving competitiveness of automobile companies. The TPM implementation has studied from 30 automobile industrial units through discussions, interviews and industrial visits. The case study method has adopted to know the effectiveness of equipment because of TPM. The percentage analysis is carried out for downtime and mean is calculated for critical success factors for successful implementation of TPM. The improvement in the OEE (Overall Equipment Effectiveness) is worked out and compared before and after TPM implementation.

The availability rate is worked out by

Availability = (Total Loading Time – Total Downtime) x 100 / Total Loading Time

The performance rate is calculated by

Performance = (Total Actual Amount of Product) x 100 / Target Amount of Product

The quality rate is worked out by

Quality = (Processed Quantity – Defective Quantity) x 100 / Processed Quantity

The OEE is calculated by

OEE= Availability x Performance x Quality

4. Results and Discussion

4.1. World Class OEE (Overall Equipment Effectiveness)

The world class OEE is presented in Tabe-1.

Table-1. World Class OEE (Overall Equipment Effectiveness)

OEE Factor	World Class Rate
Availability Rate	>90.00%
Performance Rate	>95.00%
Quality Rate	>99.00%
OEE	85.00%

The world class availability rate is more than 90 per cent, the world class performance rate is more than 95 per cent and the world class quality rate is more than 99 per cent. The world class OEE (Overall Equipment Effectiveness) is 85 per cent or even better.

4.2. OEE (Overall Equipment Effectiveness) Before and After TPM Implementation

The OEE (Overall Equipment Effectiveness) is calculated before and after TPM implementation and the results are shown in Table-2.

Table-2. OEE (Overall Equipment Effectiveness) Before and After TPM Implementation

OEE Factor	Before TPM Implementation	After TPM Implementation
Availability Rate	81.20%	87.30%
Performance Rate	75.80%	81.50%
Quality Rate	95.40	98.60%
OEE	58.72%	70.15%

The availability rate is 81.20 per cent before TPM implementation, while, it is 87.30 per cent after TPM implementation. The performance rate is 75.80 per cent before implementation of TPM where as, it is 81.50 per cent after implementation of TPM. The quality rate is 95.40 per cent before TPM implementation, while, it is 98.60 per cent after TPM implementation. The Overall Equipment Effectiveness (OEE) is 58.72 per cent before implementation of TPM, whereas, it is 70.15 per cent after implementation of TPM.

4.3. Downtime Analysis

The downtime analysis is carried out and the results are shown in Table-3. The results show that nearly 20 per cent of downtime aspects cause 80 per cent of total downtime. It seen that scheduled maintenance and machine breakdown cause nearly 70 per cent of total downtime. Machine breakdown may be reduced but scheduled maintenance is not avoidable.

Table-3. Downtime Analysis

Downtime Name	Downtime (Minutes)	Cumulative Percentage
Scheduled Maintenance	21492	44.52
Machine Breakdown	11770	68.90
Ink Preparation	4168	77.53
Changing Job	3414	84.60
Waiting for Material	2957	90.73
Meeting/ Training	1845	94.55
Power Failure	1426	97.50
Waiting for Instruction	973	99.52
Plate Error	229	100.00
Proof Reading (Quality Checking)	0	100.00

4.4. Critical Success Factors for Successful Implementation of TPM

The critical success factors for successful implementation of TPM were analyzed and the results are shown in Table-4. The results indicate that education and training, performance measurement, management of resources, continuous improvement and commitment of top management are the critical success factors for successful implementation of TPM.

Table-4. Critical Success Factors for Successful Implementation of TPM

Critical Success Factors	Mean
Commitment of Top Management	3.98
Management of Resources	4.24
Education and Training	4.42
Continuous Improvement	4.06
Performance Measurement	4.36

4. Conclusion

The foregoing analysis shows that OEE has revealed and increased rate of performance after implementation of TPM. In a highly competitive automobile business, TPM is the only way to increase the performance of equipments. Breakdown of equipments can be reduced through successful implementation of TPM. The results also indicate that education and training, performance measurement, management of resources, continuous improvement and commitment of top management are the critical success factors for successful implementation of TPM.

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