

## Research Article

# TPM Strategies in Manufacturing SMEs of Punjab - An Empirical Investigation

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## A B S T R A C T

The strategy of maintenance management of the equipment of a plant is very useful for the effectiveness of manufacturing system processes. This study has been carried out in manufacturing SMEs (small-medium enterprises) of Punjab to assess the performance of maintenance management strategies and practices. Questionnaire approach followed by quantitative analysis has been employed to ascertain the importance level of different TPM strategies and practices involved maintenance management approach. Result indicated that manufacturing organizations are highly focused on breakdown maintenance for carrying out maintenance management activities.

**Keywords:** Maintenance Management, Manufacturing Industry and Breakdown Maintenance

## Introduction

The manufacturing organization has encountered an extraordinary level of change management over the most recent three decades, including extreme changes in the board approaches, process and product advancements, expectations of customer and competitive behavior (Ahuja et al., 2006). Manufacturers have realized the need to continuously improve their operations to compete successfully. The global marketplace has witnessed an increased pressure from customers and competitors in manufacturing as well as the service sector (Singh et al., 2018). The adjustments in the present business condition are described by extraordinary challenge on the inventory side and elevated unpredictability in customer requirement on the demand side (Singh and Singh, 2014). These changes have left their unmistakable marks on the different facets of the manufacturing organizations (Gomes et al., 2006). Increase in customer demand, created by the procedure of

steady change in the world wide and national competitive condition, has influenced the manufacturing companies all around. Companies that need to get by in the present profoundly competitive business condition must address the requirement for top notch, lower costs and progressively compelling and swifter Research and Development (R&D) (Gotoh, 1991). The development of new technology, sophisticated high-production systems and assembly lines has ushered in a new era in manufacturing (Singh et al, 2018).

In the present fast-changing marketplace, gradual upgrades in manufacturing operations don't ensure the continued benefit or the survival of the company. Competitive pressures and changing production management standards, lately, have expanded the significance of solid and steady production equipments (McCarthy, 2004). The ongoing competitive trends have been pushing manufacturing organizations to rethink the importance of expanding

equipment efficiency and asset use and of improving the quality and responsiveness of upkeep administrations to meet the association's objectives to accomplish world-class status (Oke, 2005). Maintenance has traditionally been considered as a supporting, nonproductive and non-value-adding function of a business. The maintenance function has typically been regarded as a necessary evil and an operating expense to be minimized and not treated as an investment in increasing the process reliability in many organizations (Patterson *et al.*, 1996). An effective maintenance program can make significant contributions to production efficiency, plant availability, reliability and organizational profitability (Maggard and Rhyne, 1992). Presently, irrespective of the business domain, companies must focus on speed, efficiency to be globally competitive and the long-term health of any organization depends on its commitment to continuous maintenance (Singh and Singh, 2017). The aim of this study is to assess the performance of maintenance management practices in manufacturing SMEs of Punjab.

### Research Design, Research Instrument and Research Methodology

For this survey, Questionnaire has been prepared which consists of four different sections. First section consists of questions related to importance level of maintenance management strategies and importance level other maintenance management practices has been designed on the scale (1= Not at all Important; 2=To a small Extent; 3=To a Moderate Extent; 4=To a Large Extent). The questionnaire has been pre-tested for content ambiguity and clarity by experienced managers of G.S Auto International Ltd of Punjab. The research methodology for the present work is as follows:

- Exhaustive Literature Review
- Formulation of Problem
- Generation of Questionnaire
- Testing of the Questionnaire
- Quantitative Analysis
- Role of Maintenance management strategies and practices

### Result and Conclusion

The manufacturing SMEs are selected randomly from Punjab Industrial Directory and filling of questionnaire has been done on snow-ball sampling technique/convenience sampling technique. The questionnaire has been sent to 100 companies and response of 23 companies has been obtained representing response rate of 23%. Descriptive statistics and reliability has been measured using SPSS software.

### Result and Discussion

#### Reliability and Descriptive Statistics

The reliability coefficient/ cronbach alpha has been calculated for different maintenance management strategies and practices. The importance level of these strategies has been calculated from mean and reliability has been measured from value of cronbach alpha. Table 1, shows the descriptive statistics and t statistics for strategies.

#### Result Discussion of Findings I

The reliability coefficient of maintenance management strategies is adequate for operations management research {Value of reliability should be greater or equal to 0.7(Singh and Singh, 2018)}. The calculated values of t are greater than critical value of t which signifies all values are significant and claims are justified. Further results indicated that Breakdown maintenance is rated most important strategy of maintenance management followed by preventive maintenance, corrective maintenance, predictive maintenance, mobile maintenance, computerized maintenance management and reliability centered maintenance.

#### Level of Importance of Maintenance Management Practices

Again descriptive statistics and t stat as been calculated for maintenance management practices. Table 2, shows the descriptive statistics calculated for different maintenance management practices in terms of main practices.

**Table 1. The graphical representation of optical density against pH**

Strategies	Mean	t-statistics	Cronbach Alpha
Preventive Maintenance	3.347826	8.339428	0.78
Breakdown Maintenance	3.695652	10.63237	
Predictive Maintenance	3.173913	8.657016	
Autonomous Maintenance	3.043478	5.127422	
Mobile Maintenance	3	4.591659	
Corrective Maintenance	3.304348	8.899438	
Computerized Maintenance Management	2.913043	4.612626	
Reliability centered Maintenance	2.826087	5.526858	
Critical value of t=2.074			

**Table 2. Level of importance of maintenance management practices**

Practices	Mean	t-statistics
<i>Planned maintenance</i>		
Planning efficient and effective PM, PdM and TBM systems over equipment life cycle	3.086957	7.109956
Establishing PM check sheets	3.434783	10.3884
Improving MTBF and MTTR	3.043478	7.843122
<i>Quality maintenance</i>		
Achieving zero defects	3.434783	13.57543
Tracking and addressing equipment problems and root causes	3.478261	10.65531
Setting 3M (machine/ man/ material) conditions	3.478261	11.95309
<i>Development management</i>		
Minimal problems and running in time on new equipment	3.173913	7.853955
Utilize learning from existing systems to new systems	3.130435	7.161198
Maintenance improvement initiatives	3.26087	7.46518
<i>Critical value of t=2.074</i>		

## Results Discussion of the Findings 2

The sample statistics for all practices is significant since value of calculated t is greater than critical value of t. Results indicated that establishment of preventive maintenance checklist is rated most important in terms of planned maintenance followed by Planning efficient and effective PM, PdM and TBM systems over equipment life cycle and Improving MTBF and MTTR; In terms of Quality Maintenance, setting 3M (machine/man/material) conditions and Tracking and addressing equipment problems and root causes are rated most important followed by achieving zero defects; Maintenance improvement initiatives are rated most important in terms of development management followed by minimal problems and running in time on new equipment and utilize learning from existing systems to new systems.

## Conclusion and Limitation

From the results and discussion, it is concluded that preparation of checklists is the most important planned maintenance activity for carrying out maintenance management. Root cause analysis of maintenance problems is significantly important quality maintenance activity for carrying out maintenance practices effectively. Setting condition of 3Ms for carrying out quality maintenance is the most improvement maintenance management practice. Development of maintenance management initiatives taken by the manufacturing SMEs plays a significant role in carrying out development management in the organizations. Maintenance after breakdown is significantly employed by manufacturing industry of Punjab. Since there is only 1 respondent from each organization, so there is possibility of method variance. Moreover the filling of questionnaire from the companies has been done on convenience sampling technique.

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