

TPM: LITERATURE REVIEW AND DIRECTIONS FOR FUTURE RESEARCH

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ABSTRACT

Total productive maintenance (TPM) is an approach to improve and enhance productivity. TPM improves the overall effectiveness of equipment with the active involvement of operators. The objectives of this paper are to review the literature on TPM and based on this summarize the findings in the form definitions of TPM as given by various researchers, benefits achieved as a result of TPM implementation, targets of TPM, and implementation aspects of TPM. In the end, some concluding observations and directions for futurere search.

Key words: Total productive maintenance, attributes, benefits, implementation

INTRODUCTION

With the development of faster means of communication, better quality computers and rapid transportation systems, manufacturing is no longer restricted at local level, but has become global in character. A manufacturing company has to become competitive for its survival. Confronting these challenges, companies world-wide are forced to find ways to reduce costs, improve quality, and meet the ever-changing needs of their customers. One successful solution has been the adoption innovative techniques like TPM.

The basic idea of TPM was originally developed and formalized into a sophisticated management system by Japan. It made progressive strides in countries like USA, Europe and other south Asian countries after its successful implementation in Japan. Total productive maintenance (T P M) is a method of maximizing equipment performance, availability, and quality with the total involvement of the production operators, technicians, engineers, supervisors and managers. For staying in competitive market an organization must have continuous improvement throughout the organization with innovative plan .TPM is the right approach for continuous improvement with innovative tools like kaizan, quality circles, employee involvement, waste minimization, planned maintenance etc. This paper attempts to summarize the main findings from literature survey on TPM and then suggest some research directions.

SUMMARIZED FINDINGS FROM LITERATURE SURVEY**TPM definitions**

The definitions of TPM as given by various researchers are tabulated in table 1.

Name of Author	Definitions
Nakajima (1984)	TPM is a manufacturing program designed primarily to maximize equipment effectiveness throughout its entire life through the participation and motivation of the entire work force.
Christian(1994)	Total productivity maintenance (TPM) is a maintenance productivity improvement practice analogous to the use of total quality management.
Eugene (1996)	Total productive maintenance (TPM) provides a comprehensive, life cycle approach, to equipment management that minimizes equipment failures, production defects, and accidents.
Jorge (1997)	Total productive maintenance (TPM) is the process of maximizing equipment performance, availability, and quality with the total involvement of the production operators, technicians, engineers, supervisors and managers.
Venketesh (2007)	TPM is considered as a medical science of total productive maintenance.
Dale and Cooper (2008)	TPM, a scientific company-wide approach in which every employee is concerned about the maintenance, quality and efficiency of his or her equipments.

Shahanaghi and Yazdian(2009)	In the recently released European Standards regarding maintenance, total productive maintenance is defined as “the combination of all technical, administrative and managerial actions during the life cycle of an item intended to retain it in, or restore it to, a state in which it can perform the required function”.
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*Table 1. Definitions of TPM by different authors.***Benefits of TPM**

Various benefits as stated by various researchers are shown in table 2.

Name of author	Benefits of TPM as reported in literature survey
Nakajima (1984)	Satisfy the customer's needs by 100 % (delivering the right quantity at the right time, in the required quality.)
Wireman(1991)	Achieve goals by working as a team.
McCone and Weiss(1995)	Reduce manufacturing cost by 30%.
Chand (2000)	Horizontal deployment of a new concept in all areas of the organization.
Waeyenbergh (2002)	Keep the work place clean, neat and attractive.
Corners(2006)	Favorable change in the attitude of the operators.
Gosavi (2006)	Higher confidence level among the employees.
Venkatesh (2007)	Increase productivity and OPE (overall plant efficiency) by 1.5 or 2 times.
Shahanagh (2009)	Follow pollution control measures.

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Table2. Benefits of TPM as a reported in literaturesurvey

Implementation Aspects of TPM

The following steps are used in implementation of TPM in an organization are as follows;

(i) Preparatory stage

(a) Announcement by management to all about TPM introduction in the organization

Proper understanding, commitment and active involvement of the top management is needed for this step. Senior management should have awareness programmes, after which announcement is made to all. Publish it in the house magazine and put it in the notice board. Send a letter to all concerned individuals if required.

(b) Initial education and propaganda for TPM

Training is to be done based on the need. Some need intensive training and some just awareness. Take people who matter to places where TPM already successfully implemented.

(c) Setting up TPM and departmental committees

TPM includes improvement, autonomous maintenance, quality maintenance etc., as part of it. When committees are set up it should take care of all those needs.

(d) Establishing the TPM working system and target

Now each area is benchmarked and fix up a target for achievement.

(e) Master plan for institutionalizing

Next step is implementation leading to institutionalizing wherein TPM becomes an organizational culture. Achieving PM award is the proof of reaching a satisfactory level

(ii) Introduction stage

This is a ceremony and we should invite all. Suppliers as they should know that we want quality supply from them. Related companies and affiliated companies who can be our customers, sisters concerns etc. Some may learn from us and some can help us and customers will get the communication from us that we care for quality output.

(iii) Implementation

In this 8 activities are carried which are called eight pillars in the development of TPM activity. Of these four activities are for establishing the system for production efficiency, one for initial control system of new products and equipment, one for improving the efficiency of administration and are for control of safety, sanitation as working environment.

Pillar 1 – 5S

TPM starts with 5S i.e. Seiri (sort), Seiton (Systemize), Seiso (Sweep), Seiketsu(Standardize), Shitsuke (self discipline) Problems cannot be clearly seen when the work place is unorganized. Cleaning and organizing the workplace helps the team to uncover problems. Making problems visible is the first step of improvement

Pillar 2- JishuHozen (Autonomation)

This pillar is geared towards developing operators to be able to take care of small maintenance tasks, thus freeing up the skilled maintenance people to spend time on more value added activity and technical repairs. The operators are responsible for upkeep of their equipment to prevent it from deteriorating.

Pillar 3- Kaizen

"Kai" means change, and "Zen" means good (for the better). Basically kaizen is for small improvements, but carried out on a continual basis and involve all people in the organization. Kaizen is opposite to big spectacular innovations. Kaizen requires no or little investment. The principle behind is that "a very large number of small improvements are more effective in an organizational environment than a few improvements of large value. This pillar is aimed at reducing losses in the workplace that affect our efficiencies. By using a detailed and thorough procedure we eliminate losses in a systematic method using various Kaizen tools. These activities are not limited to production areas and can be implemented in administrative areas as well.

Pillar 4- Planned Maintenance

It is aimed to have trouble free machines and equipments producing defect free products for total customer satisfaction

With planned maintenance we evolve our efforts from a reactive to a proactive method and use trained maintenance staff to help train the operators to better maintain their equipment.

Pillar 5-Quality Maintenance

It is aimed towards customer delight through highest quality through defect free manufacturing. Focus is on eliminating non-conformances in a systematic manner, much like Focused Improvement. We gain understanding of what parts of the equipment affect product quality and begin to eliminate current quality concerns, and then move to potential quality concerns. Transition is from reactive to proactive (Quality Control to Quality Assurance).

QM activities are to set equipment conditions that preclude quality defects, based on the basic concept of maintaining perfect equipment to maintain perfect quality of products. The condition is checked and measure in time series to verify that measure values are within standard values to prevent defects. The transition of measured values is watched to predict possibilities of defects occurring and to take counter measures before hand.

Pillar 6- Training

It is aimed to have multi-skilled revitalized employees whose morale is high and who has eager to come to work and perform all required functions effectively and independently. Education is given to operators to upgrade their skill. It is not sufficient know only "know-how" by they should also learn "know-why". By experience they gain, "know-how" to overcome a problem what to be done. This they do without knowing the root cause of the problem and why they are doing so. Hence it become necessary to train them on knowing "Know-why". The employees should be trained to achieve the four phases of skill. The goal is to create a factory full of experts.

Pillar 7- Office TPM

Office TPM should be started after activating four other pillars of TPM (JH, KK, QM, and PM). Office TPM must be followed to improve productivity, efficiency in the administrative functions and identify and eliminate losses. This includes analyzing processes and procedures towards increased office automation.

Pillar 8

In this the focus is on,

- Zeroaccident,
- Zero healthdamage
- Zerofires.

In this area focus is on to create a safe workplace and a surrounding area that is not damaged by our process or procedures. This pillar will play an active role in each of the other pillars on a regular basis. A committee is constituted for this pillar, which comprises representative of officers as well as workers. The committee is headed by senior vice President (Technical). Utmost importance to Safety is given in the plant. Manager (Safety) is looking after functions

related to safety. To create awareness among employees various competitions like safety slogans, Quiz, Drama, Posters, etc. related to safety can be organized at regular intervals.

(iv) Institutionalstage

By all their activities one would has reached maturity stage. Now is the time for applying for PM award. Also think of challenging level to which you can take this movement.

CONCLUDING OBSERVATIONS

TPM concept has changed the way manufacturing organizations do things. Some of the TPM concepts are completely opposite to traditional ways of thinking. It is human nature to resist change, and the implementation of TPM system is typical of this. People resist these new ideas and call them risky. But it is important to realize that TPM will not work if it has to be forced against everybody's will. Voluntary participation and training is necessary.

Being a philosophy, TPM does not restrict itself to high technology manufacturing environments which make extensive use modern technologies like flexible manufacturing systems (FMS) or computer integrated manufacturing (CIM). TPM philosophy is valid in any manufacturing environments, regardless of the level of automation in the technology hardware. Similarly, the philosophy is not limited to any specific type of industry nor does the size of the organization matter. Organizations of different sizes, in a variety of industries, have successfully implemented TPM philosophy. Indeed, some applications have shown that TPM is eminently suited to non- manufacturing situations as well as, such as in service and administrative work situations. There are very less studies conducted on TPM in Indian industries. There is need to carry more studies of Indian industries with focus on potential benefits and implementation aspects of TPM. Some survey based studies of Indian industries may be conducted to collect the data on extent of use of TPM in industries, problems in implementation etc. Data can be analyzed and appropriate models can developed in Indian context. Some case studies may be conducted to get some useful insights into the relevance of TPM in Indian industries.

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