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HYBRID IMPLEMENTATION OF TOTAL PRODUCTIVE MAINTENANCE (TPM): A CASE STUDY OF A BREWERY

WILSON, E. O[1*], AMGBARI, C. O[2], JACOB, U. I[3]

[1]Department of Mechanical Engineering, Akwa Ibom State Polytechnic, Ikot Osurua, Akwa Ibom, Nigeria PMB 1200.
[2]Department of Mechanical Engineering, Federal Polytechnic, Ekowe, Bayelsa State, Nigeria. PMB 110.
[3]Department of Mechanical Engineering, Akwa Ibom State University, Akwa Ibom State, Nigeria.
Corresponding Author:
wilson.okon@akwaibompoly.edu.ng
ORCID Number: 0000-0001-9405-1631; ORCID Number: 0009-0003-1301-0574; & ORCID Number: 0000-0001-6256-6681

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Abstract

Losses which occur during the production process have the ability to affect the finances of a manufacturing facility negatively. To this end, it becomes imperative to find a companywide measure of identifying and combating these losses. Total Productive Maintenance, TPM is an engineering maintenance and management framework which ensures that losses incurred on the job floor which affect equipment performance are reduced and eliminated. Its main task is to identify losses and ensure they are eliminated. It is a companywide framework which needs both management as well as junior employee full involvement for success to be recorded. TPM has eight, 8 pillars which ideally are implemented using 8 distinct departments created in the facility it is being implemented. These departments constitute both skilled and experienced senior and junior employees hence to establish 8 departments, a large workforce as well as resources is needed. Research has shown that implementing TPM is capable of ensuring loss reduction and it is more comfortable for large facilities with many employees and resources to

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imbibe than it is for smaller facilities. To this note, it becomes a challenge for small and medium enterprises involved in manufacturing to also benefit from TPM. This research shows an alternative route of implementing TPM with little resources and manpower. This is shown by revealing how a local brewery implemented the 8 pillars of TPM using a hybrid pillar system.

Introduction

In today's Industrial scenarios in the country, huge losses/wastes occur in the manufacturing job floor. These losses are due to operations, maintenance personnel, process, tooling problems and non-availability of components in time. Other forms of waste include, idle machines, idle manpower, breakdown of machines, rejected parts, (Oga, J, 1998). The quality related waste are of significant importance as they matter most to the company in terms of time, material, hard earned loss, breakdown of the machines and bottle necks in process. Zero oriented concepts such as zero tolerance of waste, defects, breakdowns and zero accidents are becoming a pre-requisite in the manufacturing industry,(Agyris, 2001).

TPM is a business process improvement concept which was developed in Japan over the past several decades and which started to gain popularity around the world. The concept was developed initially with production as its central focus and has since been adopted to improve all aspects of companies operations. TPM creates a corporate culture which constantly strives to eliminate losses through overlapping small group activities within the site. When properly implemented it creates the environment to achieve the three Zs of TPM namely Zero Defects, Zero Breakdown, and Zero Accident, (Ahmed, 2011).

Enormous benefits have been reported in the literature following the implementation of TPM programs.

Statement of the Research Problem

The purpose of this research is to study the implementation of TPM at the brewery plant with the aim to understand how its benefits are being achieved, how it could possibly be enhanced and how the gains made by the brewing company could be replicated in similar companies in the industry in order to reduce losses and improve productivity.

Objectives of the Study

The main objective of this research is to study and assess the method of implementing Total Productive Maintenance (TPM) at Champion Breweries Plc, Akwa Ibom State. The specific objectives include to:

i. Study how TPM is organised at Champion Breweries Plc, Akwa Ibom State.

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ii. Study the implementation strategies of the Autonomous Maintenance (AM) and Planned Maintenance (PM) pillars of TPM at Champion Breweries Plc, Akwa Ibom State.

Total Productive Maintenance

The concept of TPM originated in Japan's manufacturing industries, initially with the aim of eliminating production losses due to limitations in the Just in time (J1T) process for production operations. Seichi Nakajima is credited with defining the fundamental concepts of TPM and seeing the procedure implemented in hundreds of plants in Japan; the key concept being autonomous plant maintenance, (Deming, 1991).

TPM is a major departure from the "you operate, I maintain" philosophy. It is the implementation of productive maintenance by all associated personnel (whether machine operators or members of the management team), based on the involvement of all in the continual improvement of performance, (Almeanazel, 2010). The three components of the concept are:

(i) Optimized equipment-effectiveness.
(ii) Autonomous-operator maintenance.
(iii) Company-led small-group activities, throughout the entire organization.

This is a "high-employee involvement" approach. It leads to improved creative group-efforts, greater individual effort, personal responsibility, and lively innovative problem- solving meetings. TPM concepts involve commitments to long-range planning, especially on the part of senior management. Typically, TPM is initiated as a "top- down" exercise, but only implemented successfully via "bottom-up" participation, (Lee, 2002). However, consensus building may take about three years, from the planning phase, for sustainability to be achieved in a large organization.

Advantages of Total Productive Maintenance (TPM).

TPM helps organize maintenance activities by applying the following actions, (Bekkers, 2012):

(i) Cultivates a sense of ownership in the operator by introducing autonomous maintenance. Here the operator takes responsibility for the primary care of his/her equipment. The tasks include cleaning, routine inspection, lubrication, adjustments, minor repairs as well as the cleanliness of the local workspace.
(ii) Uses cross-functional teams consisting of operators, maintainers, engineers and managers to improve individual employee and equipment performances.

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(iii) Establishes an optimal schedule of clean-up and PM to extend the plant's lifespan and maximize its uptime.

Total Productive Maintenance (TPM) Pillars

The basic practices of TPM are often called the pillars or elements of TPM. The entire edifice of TPM is built and stands, on eight pillars (Campbell and Jardine, 2001). TPM paves way for excellent planning, organizing, monitoring and controlling practices through its unique eight-pillar methodology. TPM initiatives, as suggested and promoted by Japan Institute of Plant Maintenance (JIPM), involve an eight pillar implementation plan that results in substantial increase in labour productivity through controlled maintenance, reduction in maintenance costs, and reduced production stoppages and downtimes, (Hughes, 2022). The core TPM initiatives classified into eight TPM pillars or activities for accomplishing the manufacturing performance improvements include autonomous plant maintenance: focused maintenance: planned maintenance: quality maintenance: education and training; office TPM; development management; and safety, health and environment (Ireland and Dale, 2001).

The detailed maintenance and organizational improvement initiatives and activities associated with the respective TPM pillars are as follows:

Pillar 1-5S

TPM starts with 5S, (Ahuja and Kumar, 2009). It is a systematic process of housekeeping to achieve a serene environment in the work place involving the employees with a commitment to sincerely implement and practice housekeeping. Problems cannot be clearly seen when the work place is unorganized. Cleaning and organizing the workplace helps the team to uncover problems, (Levitt, 2012). Making problems visible is the first step of improvement. 5S is a foundation program before the implementation of TPM.

Pillar 2- Autonomous maintenance (AM):

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 adding activity and technical repairs. The operators are responsible for the upkeep of their equipment to prevent it from deteriorating. The aim of this pillar is to maintain the machine in new condition. The activities involved are of a very simple nature, (Hughes, 2002). This includes cleaning, lubricating, visual inspection, tightening of loosened bolts etc.

AM targets are:

i. Uninterrupted operation of equipment.

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ii. Flexible operators to operate and maintain other equipment.
iii. Eliminating the defects at source through active employee participation.

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. This pillar is aimed at reducing losses in the workplace that affect efficiency, (McQueen, 2000). By using a detailed and thorough procedure, losses are eliminated 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.

Kaizen targets are:

i. The practice of the concept of zero losses in every sphere of activity.
ii. The relentless pursuit to achieve cost reduction targets in all resources.
iii. The relentless pursuit to improve overall plant equipment effectiveness.
iv. Extensive use of PM analysis as a tool for eliminating losses.

Pillar 4 - Planned Maintenance (PM)

This pillar is aimed at having trouble free machines and equipment producing defect free products for total customer satisfaction.

PM effort is evolved from a reactive to a proactive method and trained maintenance staff are used to help train the operators to better maintain their equipment. PM targets when achieved help to sustain availability of machines, optimum maintenance cost, reduction in spare inventory, and improvement of reliability and the maintainability of machines, (Ljungberg, 1991).

Pillar 5-Quality Maintenance (QM)

This pillar is aimed towards customer satisfaction through production of highest quality products and through defect free manufacturing. Here the focus is on eliminating rejects in a systematic manner, much like focused improvement, (Tsang, 1998). QM activities are to set equipment conditions that produce quality products, based on the basic concept of maintaining perfect equipment to maintain perfect quality of products, (Tsang, 1995). The condition is checked and measured in time series to verify that measured 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 beforehand. According to Tsang and Chan, (2000). QM policy are showed below:

i. Defect free conditions and control of equipment.
ii. Quality maintenance activities to support quality assurance.

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iii. Focus of prevention of defects at source.

Pillar 6-Training and Education Pillar:

This pillar is aimed at having multi-skilled revitalized employees whose morale are high and who are eager to come to work and perform all required functions effectively and independently. Education is given to operators to upgrade their skill, (Kaplan and Norton, 1996). By experience they gain, "Know-How" to overcome a problem and know what has to be done. The employees should be trained to achieve the four phases of skill.

The goal is to create a factory full of experts. The different phase of skills are:

i. Phase 1-do not know.
ii. Phase 2-know the theory but cannot do.
iii. Phase 3-can do but cannot teach.
iv. Phase 4-can do and also teach.

Pillar 7- Office TPM

Office TPM should be started after activating the four other pillars of TPM (APM, Kaizen, PM, and QM), (Ohno, 2007). 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-Safety, Health and Environment

In this area focus is on creating a safe workplace and a surrounding area that is not damaged by our processes or procedures. This pillar plays an active role in each of the other pillars on a regular basis. Safety, health and environment targets are, zero accident, zero health damage, and zero fires, (McQueen, 1999).

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) looks 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.

METHODOLOGY

The procedures for this study have been chosen to meet each of the project objectives. Although there are 8 pillars of TPM, the pillar which is more related directly to production, quality and maintenance are the AM and PM pillar, (Nakajima, 1988). This is because these pillars deals with equipment maintenance which is solely responsible for equipment

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uptime, production volume and quality. Hence, this research has focused on the AM and PM pillars of TPM at the brewery.

Methods

The methods used in the research were:

i. Studying and/ application of relevant theories and models.
ii. Data collection from maintenance and production log books at Champion Breweries Plc, Akwa Ibom State.

TPM Pillar Structure in Champion Breweries Plc

Due to the fact that champion breweries is a low volume capacity production company, for TPM to be implemented completely in a structured manner, the brewery dose not launch the core 8 pillars driven by classical individual pillar teams.

Instead, the 8 pillars are implemented using 3 hybrid teams. These 3 teams implement the 8 pillars of TPM at the establishment. Below is Figure 1 showing the distribution of the 8 pillars.

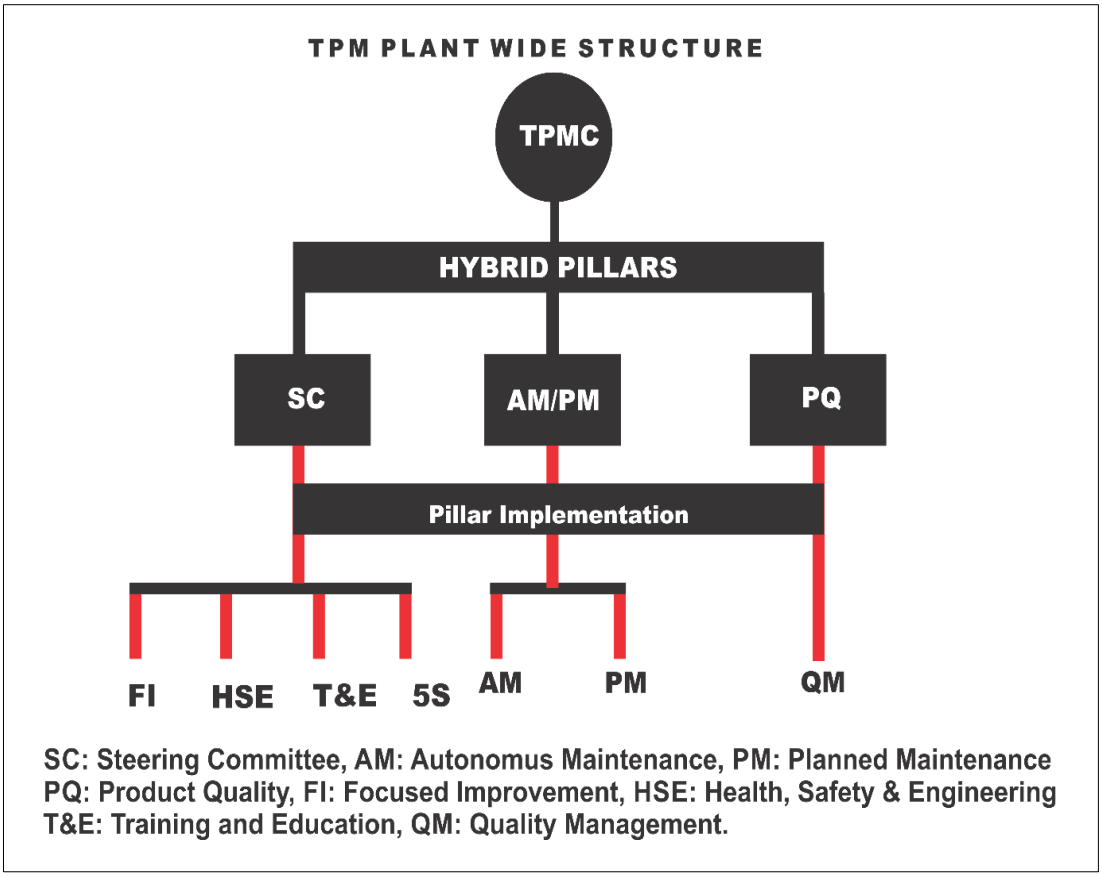

Figure1: TPM Implementation structure at the brewery

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Combination of the 3 Hybrid Pillars of TPM at Champion Breweries Plc

The hybrid pillars constitute the following:

(i) The steering committee: this hybrid team acts as a pillar which implements the following pillars:

- Health, Safety and Education (HSE) Pillar
- Training and Education (T & E) Pillar

It is also in charge of constituting focus improvement (FI) teams. These are special teams tasked with the objective of solving specific problems in the facility.

(ii) The AM / PM Pillar team: This team take care of implementing the following pillars:

- Autonomous Maintenance pillar
- Planned Maintenance pillar

(iii) The Production Quality (PQ) Pillar team: This pillar team will implement the Quality Management (QM) pillar.

Table 1: break down of pillar functions by the 3 Hybrid Pillars

S/N	STEERING COMMITTEE	AM/PM PILLAR	PQ PILLAR
1	Focused Improvement team constitution	Autonomous Plant Maintenance (AM) Pillar	Product Quality (PQ) Pillar
2	Safety, Health and Environment Pillar	Planned Maintenance (PM) Pillar	
3	Training and Education Pillar		

Conclusion

The research has established that Champion Breweries Plc implements the 8 pillars of TPM with just 3 hybrid teams against the 8 teams used by standard companies worldwide. This is as a result of the relatively low man power and resources at their disposal. The Steering Committee (SC), the Autonomous maintenance and planned maintenance pillar (AM/PM) team and the Production quality pillar (PQ) team constitute the hybrid teams.

Recommendations

After conducting a study of TPM at the facility and carrying out analysis on production data, the following recommendations are proposed.

(i) That management should show more commitment to the TPM process by giving more resources to departments so that losses can be tackled more effectively and speedily. This will boost employee morale which always has a positive effect in every ramification of the facility.

(ii) That management should leverage the wisdom of more experienced staff. After working on a plant floor for a significant amount of time, experienced staff who are

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extremely knowledgeable about all the little quirks each line has should be made to train new employees and make it a point that they pass that knowledge on. Often this kind of information can help in diagnosing possible downtime problems before they even occur.

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