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REVIEW ARTICLE

A TACTIC FOR EMPLOYING TOTAL PRODUCTIVE MAINTENANCE IN PRODUCTION INDUSTRIES TO ENHANCE PRODUCTIVITY

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ABSTRACT

To accomplish flourishing accomplishment of total productive maintenance (TPM), first of all, literature review was completed meticulously to comprehend the fundamental perceptions of total productive maintenance. Outcomes achieved all the way through the observed revise divulges the anecdotal leanings in the overall equipment effectiveness and productivity of the machines. Further, observed study was conducted about automotive industries based on real time training was done to obtain achievable results. Finally questionnaires were distributed to assess information on successful implementation of total productive maintenance in the industry. The outcomes emphasize the foremost roots ensuing in the downhill time and enhancement in the productivity. A relative revise between world group industries where total productive maintenance has been employed and industries which do not pursue, total productive maintenance makes out the assorted ditch leading to dwindle in the overall efficiency of the industry and makes available important implications spotlighting on the paybacks and tactic for employing total productive maintenance in industries. Total productive maintenance is matter-of-fact modus operandi expected at capitalizing on the usefulness of amenities that are used within our association. It ascertains a arrangement of productive maintenance, wrappering the intact existence cycle of equipment, swathes all department, engages partaking of all workforces from top to bottom and endorsess petite faction autonomous activities. At some point in high augmentation epoch industries are building technological steps forward in automation and consolidatation of the industries, which desires bulky quantity of physical exertion to keep up the automation systems. The stratagem of upholding the equipment of a industry is decisive for the effectiveness of production. At the same time as the competitive environment in the world persists to amplify the rate of knots, our plan exertion plans to assist industries to glance for novel approach to put away on costs, build up workforces to countenance outlook confronts and convey about a new ethnicity at place of work.

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INTRODUCTION

Scaffold of total productive maintenance looks for to take advantage of equipment effectiveness all the way through the existence of the equipment. It endeavors to retain the equipment in optimum circumstance with the purpose of thwart astonishing breakdown, speed losses, and quality defects happening from route activities. There are three eventual purposes of total productive maintenance are zero defects, zero accident and zero breakdowns. Nakajima advises that equipments should be maneuver at hundred percent capacity hundred percent of the time. Total productive maintenance was pioneered to pull off the subsequent purposes as keep away from wastage in a hastily altering cost-effective surroundings, producing commodities devoid of tumbling product quality, reduce cost, produce a high batch quantity at the initial doable time, commodities hurl to the customers must be non defective. Types of maintenance are breakdown maintenance, preventive maintenance, periodic maintenance, predictive maintenance. Breakdown maintenance is that operator lingers until equipment not pass and refurbish it. This equipment could be used when the equipment failure does not considerably impinge on the operation or production or produce any noteworthy loss excluding repair cost. Preventive maintenance is a each day maintenance as cleaning, inspection, oiling and re-tightening, plan to retain the fit clause of equipment and put off malfunction all the way through the avoidance of worsening, periodic inspection or equipment circumstance analysis, to assess deterioration. It is advance divided into periodic maintenance and predictive maintenance. The image of human being existence is extensived as a result of deterrent pills, the equipment service life can be lengthened

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by burdening preventive maintenance. Periodic maintenance or time based maintenance consists of periodically inspecting, servicing and cleaning equipment and replacing components to put off sudden malfunction and route harms. Predictive maintenance is a manner in which the service life of important component is envisaged rooted in check up or analysis, with the intention of exploit the components to the edge of their service days. Measured up to periodic maintenance, predictive maintenance is condition based maintenance. It deals with leaning ethics, as a result of computing and exploring information about deterioration and utilizes a shadowing scheme, considered to keep an eye on circumstances all the way through an online system. Equipment with design achilles' heel must be redesigned to perk up reliability or perking up maintainability. Maintenance prevention points toward the design of a new equipment. Achilles' heel of contemporary machines are adequately considered on location information leading to malfunction anticipation, uncomplicated maintenance and averts of defects, safety and ease of production and are included before charging a new equipment. Corrective maintenance perks up equipment and its components so that preventive maintenance can be accomplished reliably. Benchmarking on overall equipment effectiveness, productivity, quality, cost, delivery, safety and morale etc. can assist a association to consciousness of zero breakdown, zero defect, zero machine stoppage, zero catastrophes, zero pollution, mostly to pull off high reliability or flexibility of equipment and condense costs all the way through curtailing depletion of operator hours, raw material, power, tools etc. which hand round as the eventual purpose of total productive maintenance. It has been envisioned as a widespread production approach to advance equipment performance. The stratagem rudiments embrace cross panels to eradicate blockades to machine upbeat time, meticulous preventive maintenance courses, superior maintenance operations management efficiency, equipment maintenance training to the buck level, and information systems to maintain the advancement of introduced equipment with lesser cost and higher reliability. Total productive maintenance gets acrosss maintenance into center of attention as a indispensable and fundamentally essential division of the commerce. It is no lengthy considered as a non earnings activity. Downward time for maintenance is planned as a division of the production daytime and, in some cases, as an integral element of the production process. The purpose is to embrace disaster and unscheduled maintenance to a minimum. It can be measured as the medicinal discipline of machines. Total productive maintenance is a maintenance course which entails a recently distinct perception for keeping up industries and equipment. The purpose of the total productive maintenance course is to noticeably enhance production while, at the same time, escalating workforce confidence and job satisfaction.

LITERATURE REVIEW

Total productive maintenance plans to help in production in reshuffle production and other commerce functions, and acquiring unrelenting earnings. The planned outcome of total productive maintenance accomplishments is the reduced incidence of unanticipated machine breakdowns that interrupt production and make possible to losses, which can go over millions of dollars annually. Overall equipment effectiveness method includes schedule from all equipment production conditions guidelines into a measurement system that facilitates prodcution and operations panels perk up equipment performance and, therefore, condense equipment cost of tenure. In this viable time, industries are go-getting to perk up customer's satisfaction and minimize production costs. Conventionally, production costs are minimized by means of mounting the interim between failures of the production equipment on the one hand and minimizing maintenance costs on the other. Cutting maintenance costs alone will not facilitate to minimize the production cost, but may make possible ineffectiveness of the production equipment. Since such the essential causal approach of total productive maintenance is to maximize production equipment effectiveness, which is characteristically considered by the overall equipment effectiveness. An overall equipment effectiveness rating may be used to contrast dissimilar positions within an individual commerce group, and may persuade planned asset and other significant decisions. If industry has an overall equipment effectiveness of eighty five percent or exceeding, then it is measured to be a world group industry.

The usually used maintenance performance signs are measures of equipment performance, such as availability, reliability and overall equipment effectiveness, process performance, such as the ratio of achieved to planned work, as well as of schedule compliance. And cost performance, such as labor and material costs of maintenance. Total productive maintenance plans are paying attention upon dealing with major losses, and wastes associated with the production systems by heartwarming continuous and systematic evaluations of production system, thereby distressing significant developments in production facilities. The assessment of total productive maintenance efficiency can assist significantly superior managerial competences athwart a assortment of extents. Total productive maintenance utilizes overall equipment effectiveness as a quantitative scedule for measuring the performance of a productive system. overal equipment effectiveness is the solution for assessing the sensation of implementation total productive maintenance course. The generally purpose of total productive maintenance is to heave the overall equipment effectiveness. Overall equipment effectiveness is intended by acquiring the product of availability of the equipment, performance efficiency of the process and rate of quality products. Overall equipment effectiveness affords a approach to gauge the effectiveness of production operations from equipment to an entire production industry or numerous production industries in a faction. In doing so Overall equipment effectiveness endows with a inclusive depiction of where producion time and money is being vanished and reveals the factual, concealed capability of the industry.

It develops into the input decision support gizmo for unremitting expansion courses. Total productive maintenance spotlights on optimizing planning and scheduling. Total productive maintenance is a innovative Japanese concept. The origin of total productive maintenance can be marked out back to 1951 when preventive maintenance was introduced in Japan. However the conception of preventive maintenance was in use from USA. Nippondenso was the initial industry to set up industry wide preventive maintenance in 1960. Preventive maintenance is the conception wherein, operators produced commodities by means of machines and the maintenance group was committed with exertion of sustaining those machines, however with the automation of Nippondenso, maintenance developed into a dilemma as more maintenance workforces were requisited. So the executive resoluted that the usual maintenance of equipment would be accomplished by the

operators. Preventive maintenance together with maintenance prevention and maintainability developments confered origin to productive maintenance. The aspire of productive maintenance was to get the most out of industry and equipment effectiveness to pull off optimum existence cycle cost of production equipment. By then Nippon Denso had completed quality circles, concerning the workforces involvement. Thus all employees took part in implementing Productive maintenance Maintenance group took up only essential maintenance works. Founded on these improvements, Nippondenso was awarded the illustrious industry award for mounting and realizing total productive maintenance, by the Japanese institute of plant engineers. Thus Nippondenso which by now followed preventive maintenance also further autonomous maintenance completed by production operators. The maintenance bunch departed in the equipment adaption for improving reliability. The adaptations were completed or included in novel equipment. This initiate maintenance prevention. Thus Nippondenso of the Toyota group developed into the first industry to obtain the total productive maintenance certification.

Sculpt of total productive maintenance

Total productive maintenance is acceptance of existence cycle approach for perking up the taken as a whole concert of production equipment, enhancing productivity by means of extremely aggravated workforces which is pulled off as a result of job bulge and The use of intended petite faction activities for recognizing the basis of breakdown, doable industry and equipment amendments. The foremost disparity amid total productive maintenance and Total quality management is that the operators are also completed to engage in the maintenance process. Total productive maintenance is to pull off zero defects and zero breakdown and zero catastrophes in all functional areas of the association. It entail workforce in all echelons of association. It outlines diverse quality circle to condense imperfections and self maintenance. Aim of total productive maintenance are to enhance productivity and assists to rectify customer complaints, condense the production cost, satisfy the customer necessitates, decrease catastrophes, chase pollution control measures. It extends higher confidence level among the workforces and carry on the work place clean, neat and nice-looking, positive amend in the stance of the operators, pull off purposes by means of functioning as quality circle, carve up understanding and occurrence, the workforces dig up a sensation of possessing the machine.

Step1: Appropriate indulgent, assurance and vigorous concern of the top management is required. Senior management should have consciousness course, after which statement is completed to the entire. Make known it in the abode arsenal and situate it in the notice board. Hurl a correspondence to the entire concerned individuals if mandatory. Total productive maintenance embraces upgrading, autonomous maintenance, quality maintenance etc. , as division of it. When quality circle are approved, it should watch out of the entire individuals requirements.

Step2: Training of 5S and 8P is to be done. A necessitate severe training and some now an awareness are specified. Seize workforce who subjects to places where total productive maintenance by now lucratively employed.

Step3: At this moment every vicinity is benchmarked and whip up a goal for attainment. It is implemented. Pulling off preventive maintenance award is the evidence of accomplishment a adequate stage. In this stage eight actions are conceded which are entitled eight pillars in the advancement of total productive maintenance action.

Step4: Find out overall equipment efficiency

Overall equipment efficiency=Availability of the machine x Performance efficiency x quality rate

Availability of the machine-Availability is proportion of time, machine is actually available, out of time, it should be available.

Quality rate-Which is percentage of high-quality components out of total produced.

5S: Building harms observable is the first stride of development. Seiri, Seiton, Seiso, Seiketsu, Shitsuke is Japanese term, english translation of Seiri is association, equivalent 'S' term is sort, english translation of Seiton is tidiness, equivalent 'S' term is systematise. english translation of Seiso is cleaning, equivalent 'S' term is systematize, english translation of Seiketsu is standardisation, equivalent 'S' term is standardize, english translation of Shitsuke is discipline, equivalent 'S' term is self discipline.

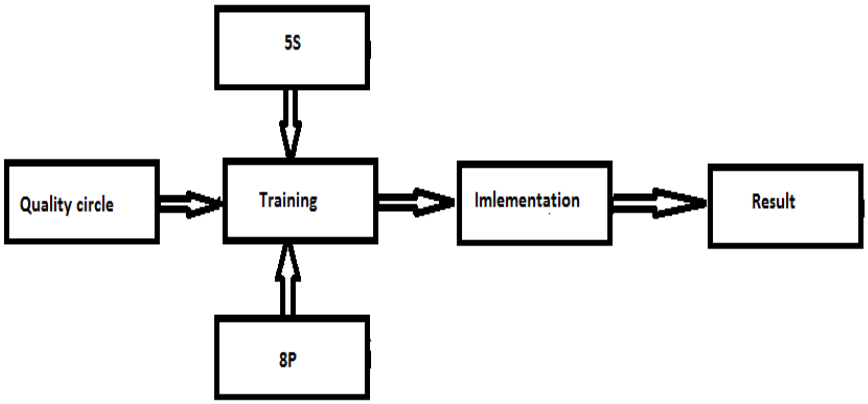

Fig 1. Sculpt of TPM

Seiri (Sort): For it, the value of component should be resoluted founded on efficacy and not cost. In consequence of it, the rummage around instance is condensed. It is sorting and systematizing the components as critical, imperative, repeatedly used components, ineffectual, or components that are not necessitate as of now. Redundant components can be rescued. Critical components should be held in reserve for use close by and components that are not be used in in the neighborhood of upcoming, should be piled up in a few place.

Seiton (Tidiness): In it, the components should be positioned flipside after custom at the same place or each components has a place and only one place. To make out components simply, name platters and colored labels has to be used. Upright stands can be used for this purpose and weighty components engage the underneath location in the stands.

Seiso (Systematize): It entails clearout the work place open of burrs, misuse grease, misuse oil, mistreat, scrap and baggy lynching wires or oil leakage from machines.

Seiketsu (Standardize): This standards are employed for whole association and are experienced or looked over arbitrarily. Workforces has to confer together and fix on on standards for keeping the work place and machines or alleyways efficient and clean.

Shitsuke (Self discipline): It embraces wearisome emblems, subsequent exertion routes, regularity, enthusiasm to the association etc. Taking into consideration 5S at the same time as a approach of existence and convey about self-discipline amongst the workforcess of the association.

workforce participation. Targets of autonomous maintenance are to prevent the occurrence, reduce oil consumption, reduce process time. Steps in autonomous maintenance are to preparation of workforces, initial cleanup of machines, take counter measures, fix tentative standards, general inspection, autonomous inspection, standardization and autonomous management. Alert the workforces about total productive maintenance and deformities in equipments. Tutor the workforces to cleanup of machines, supervisor and technician should discuss and set a date for implementing, arrange all componentss needed for cleaning, on the arranged date, workforces should clean the equipment completely with the help of maintenance department, dust, stains, oils and grease has to be removed, following are the stuffs that has to be taken care while cleaning as oil leakage, loose wires, unfastened, bugs and bolts and worn out parts, after clean up problems are categorized and suitably tagged. White tags is located where problems can be deciphered by operators. Pink tag is positioned where the assist of maintenance department is necessitated, contents of tag is transferred to a register, make note of area which were inaccessible, finally close the open parts of the machine and run the machine. Counter measures are to inaccessible regions had to be reached easily, prevent work out of machine components necessary action must be taken, machine components should be modified to prevent accumulation of dirt and dust. Tentative standard is to schedule has to be made and followed strictly, schedule should be made regarding cleaning, inspection and lubrication and it also should include details like when, what and how. In general inspection, the workforces are trained in disciplines like pneumatics, electrical, hydraulics, lubricant and coolant, drives, bolts, nuts and safety, this is necessary to improve the

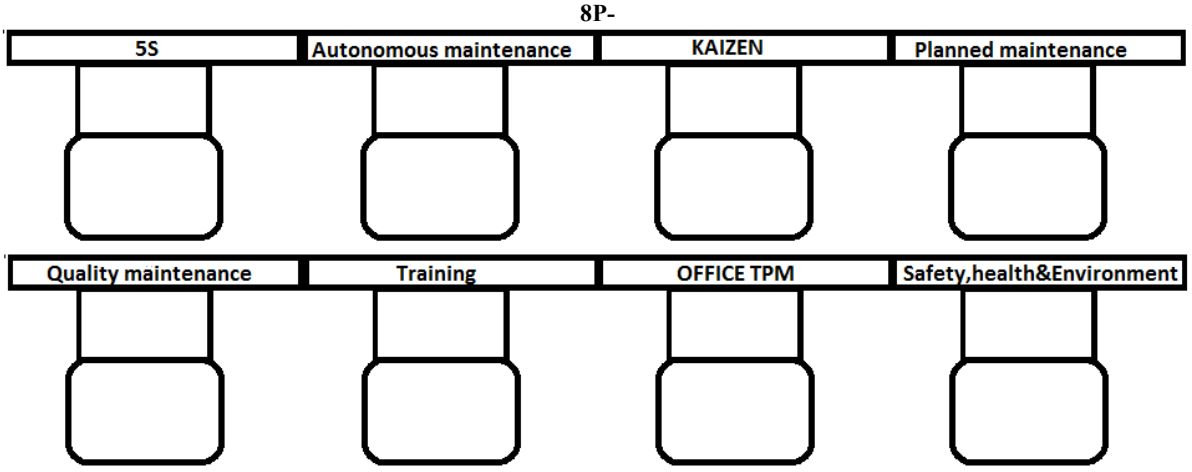

Fig. 2. 8 Pillars

P1 (5S)- Total productive maintenance sets up with 5S. Clearout and put in order the workplace facilitates the quality circle to unearth tribulations. Tribulations cannot be evidently observed when the work place isnot put in order.

P2 (Autonomous maintenance): The operators are responsible for upkeep of their equipment to thwart it from failing. It is stuffed on the way to building up operators to be able to make sure of petite maintenance errands, thus ease up the experienced maintenance operator to splurge time on more value included activity and methodological revamps. Policy of autonomous maintenance is to uninterrupted operation of equipments, flexible operators to operate and maintain other equipments, eliminating the defects at source through active technical skills of workforces and to use inspection manuals correctly, after acquiring this new knowledge the workforces should share this with others, by acquiring this new technical knowledge, the operators are now well aware of machine parts. Autonomous Inspection is new methods of cleaning and lubricating are used, each workforce prepares his own autonomous chart or schedule in consultation with supervisor, components which have never given any problem or part which don't need any inspection are removed from list permanently based on experience, including good quality machine components, inspection that is made in preventive maintenance, he frequency of cleanup and inspection is reduced based on experience. Standardization is upto the previous stem only the machinery or equipment was the

concentration. However in this pace the neighborings of machinery are systematized. Necessary components should be organized, such that there is no searching and searching time is reduced. Work environment is modified such that there is no difficulty in getting any component, everybody should follow the work instructions strictly, necessary spares for equipments is planned and procured. Autonomous management must be achieved by continuous improve through Kaizen.

P3 (KAIZEN): Kaizen is contrary to big extravagant innovations. Kaizen necessitates no or little asset. The standard behind is that a very hefty number of small developments are to move about effectual 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. Kaizen means change for the better. Basically kaizen is for small improvements, but carried out on a continual basis and involve all people in the organization. Policy is KAIZEN is to practice concepts of zero losses in every sphere of activity, practice concepts of zero losses in each field of activity, unremitting recreation to pull off cost reduction targets in all resources, unyielding recreation to look up over all industry equipment effectiveness, extensive use of preventive maintenance analysis as a tool for eliminating losses, focus of easy handling of operators. Target of KAIZEN is to achieve and sustain zero loses with respect to minor stops, measurement and adjustments, defects and unavoidable downtimes. It also aims to achieve manufacturing cost reduction. The objective of total productive maintenance is maximization of equipment effectiveness. Total productive maintenance aims at maximization of machine utilization and not merely machine availability maximization. As one of the pillars of total productive maintenance activities, Kaizen pursues efficient equipment, operator and material and energy utilization, that is extremes of productivity and aims at achieving substantial effects. Kaizen activities try to thoroughly eliminate sixteen major losses as failure losses or breakdown loss, setup or adjustment losses, cutting blade loss, start up loss, minor stoppage or idling loss, speed loss, defect or redraft loss, timetabled downtime loss, working motion loss, streak association loss, logistic loss, measurement and adjustment loss, energy loss, Die, jig and tool breakage loss, yield loss.

P4 (Planned maintenance): It is aimed to have trouble free machines and equipments producing defect free products for total customer satisfaction. This ruptures maintenance downward into four factions as preventive maintenance, breakdown maintenance, corrective maintenance, maintenance prevention. 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. Policy of Planned maintenance is to achieve and sustain availability of machines, optimum maintenance cost, reduces spares inventory, improve reliability and maintainability of machines. Target of Planned maintenance is zero equipment failure and break down, improve reliability and maintainability, reduce maintenance cost, ensure availability of spares all the time. Steps in Planned maintenance is equipment evaluation and recoding present status, restore deterioration and improve weakness, building up information management system, prepare time based information system, select equipment, parts and members and map out plan, prepare predictive maintenance system by introducing equipment diagnostic techniques and evaluation of planned maintenance.

P5 (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 as focused improvement. It helps to gain understanding of what component of the equipment affect product quality and begin to eliminate current quality concerns, then move to potential quality concerns. Transition is from reactive to proactive. Quality maintenance activities is to situate equipment stipulations that preclude quality defects, rooted in the essential conception of preserving perfect equipment to maintain perfect quality of products. The condition are checked and measure in time series to very that measure values are within standard values to prevent defects. The changeover of computed values is watched to envisage possibilities of defects occurring and to take counter measures before hand. Policy of it is defect free conditions and control of equipments, quality maintenance activities to support quality assurance, focus of prevention of defects at source, in line detection and segregation of defects, effective implementation of operator quality assurance. Target is to achieve and sustain customer complaints at zero, reduce in-process defects, reduce cost of quality.

P6 (Training): It is aspired to have multi skilled revitalized workforces 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. The goal is to create a industry full of experts. The different phase of skills are do not know, know the theory but cannot do, can do but cannot teach, can do and also teach. Policy of training is to focus on improvement of knowledge, skills and techniques, creating a training environment for self learning based on felt needs, training curriculum or tools or assessment etc conductive to workforce revitalization, training to remove workforce fatigue and make work enjoyable. Target of taining is to achieve and sustain downtime due to want men at zero on critical machines, achieve and sustain zero losses due to lack of knowledge or skills or techniques, aim for hundred percent participation in suggestion scheme. Steps in educating and training activities are to setting policies and priorities and checking present status of education and training, establish of training system for operation and maintenance skill up gradation, training the employees for upgrading the maneuver and maintenance skills, preparation of exercising almanac, kick-off of the system for training, evaluation of activities and study of future approach.

P7 (Office TPM): Office total productive maintenance should be established after stimulating four added pillars of total productive maintenance. Office total productive maintenance must be pursued to enhance productivity, efficiency in the administrative functions and identify and eliminate losses. This includes analyzing processes and procedures towards increased office automation. Office total productive maintenance deals with twelve major beatings as routing loss, cost loss together with in areas such as procurement, accounts, marketing, sales leading to high inventories, communication loss, idle loss, set-up loss, accuracy loss, office equipment breakdown, communication strait breakdown, handset and fax lines, time spent on retrieval of information, non availability of correct on line stock status, customer complaints due to logistics,

expenses on emergency dispatches or purchases. A senior person from one of the support functions as Head of finance, MIS, Purchase etc should be heading the sub-committee. Members representing all support functions and people from Production & quality should be included in subcommittee. Total productive maintenance coordinate plans and guides the subcommittee as providing awareness about office total productive maintenance to all support departments, identify the scope for development in every function, gather related information, assist them to decipher problems in their encircles, framework an activity board where progress is monitored on both sides - results and actions along with Kaizens., find out to cover all workforces and circles in all functions. Benefits of office TPM are involvement of all people in support functions for focusing on better plant performance, better utilized work area, reduce repetitive work, reduced inventory levels in all parts of the supply chain, reduced administrative costs, reduced inventory carrying cost, reduction in number of files, reduction of overhead costs to include cost of non-production or non capital equipment, productivity of people in support functions, reduction in breakdown of office equipment, reduction of customer complaints due to logistics, reduction in expenses due to emergency dispatches or purchases, reduced manpower, clean and pleasant work environment.

P8 (Safety, health and environment): 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. Utmost importance to Safety is given in the plant. Manager is looking after functions related to safety. Targets of Safety, health and environment are zero accident, zero health damage, zero fires.

Conclusion

Today, with competition in industry at an all time high, total productive maintenance may be the only thing that stands between success and total failure for some companies. It has been proven to be a course that works. It can be adapted to work not only in industries and in a variety of other situations. Workforces must be educated and convinced that total productive maintenance is not just another course that management is totally committed to the course and the extended time outline necessary for full implementation. If everyone involved in a total productive maintenance course, an unusually high rate of return compared to resources invested may be anticipated.

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