

10th Re-Inventing Maintenance

フェデレーテッド・プレス
第10回の再発明するメンテナンス
トータル生産管理
レオンワッサーMBA、P.Eng。
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10th Re-Inventing Maintenance

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“Total Productive Management”

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Total Productive Management

Total Productive Maintenance transforms maintenance into a crucial part of the business structure instead of being merely a non-profit activity.

The crucial tenet is to keep unscheduled and emergency maintenance to a minimum.

This session will discuss the different aspects of TPM including the following:

- TPM targets: zero defects, zero breakdowns and zero accidents
- Aligning the maintenance team to priorities
- Implementing TPM: where to begin
- Measuring TPM performance: the key to effective asset management
- Communicating TPM

Total Productive Management

- * TPM is a management process developed for improving productivity by making processes more reliable and less wasteful.
- * TPM is an extension of TQM (Total Quality Management).
- * The objective of TPM is to maintain the plant or equipment in good condition without interfering with the daily process.
- * To achieve this objective, preventive and predictive maintenance is required.
- * By following the philosophy of TPM we can minimize the unexpected failure of the equipment.
- * To implement TPM the production unit and maintenance unit should work jointly.

Original Goal of Total Productive Management

- * “Continuously improve all operational conditions, within a production system; by stimulating the daily awareness of all employees” (by Seiichi Nakajima, Japan, JIPM)
- * TPM focuses primarily on manufacturing (although its benefits are applicable to virtually any "process") and is the first methodology [Toyota](#) used to improve its global position (1950s).
- * After TPM, the focus was stretched, and also suppliers and customers were involved (Supply Chain), this next methodology was called [lean manufacturing](#).
- * This following gives an overview of TPM in its original form.



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Total Productive Maintenance

- * An accurate and practical implementation of TPM will increase productivity within the total organization, where:
- * A clear business culture is designed to continuously improve the efficiency of the total production system.
- * A standardized and systematic approach is used, where all losses are prevented and/or known.
- * All departments, influencing productivity, will be involved to move from a reactive- to a predictive mindset.
- * Transparent multidisciplinary organization in reaching zero losses.
- * Steps are taken as a journey, not as a quick menu.
- * Finally TPM will provide practical and transparent ingredients to reach operational excellence.

The History of Total Productive Maintenance

- * TPM is an evolving process, starting from a Japanese idea that can be traced back to 1952, when preventive maintenance was introduced into Japan from the USA (Deming).
- * Nippondenso, part of Toyota, was the first company in Japan to introduce plant wide preventive maintenance in 1960.
- * In preventive maintenance, operators produced goods using machines and the maintenance group was dedicated to the work of maintaining those machines.
- * However, with the high level of automation of Nippondenso, maintenance became a problem as so many more maintenance personnel were now required.
- * So the management decided that much of the routine maintenance of equipment would now be carried out by the operators themselves.

Autonomous Maintenance

- * Autonomous Maintenance, one of the features of TPM, is more cost-effective as the operator (compared to a highly skilled engineer) is on a lower pay rate.
- * This is not to reduce costs however; the operator has a better understanding of the how the equipment works daily, can tell if an issue is appearing, can tell if quality is decreasing, and, through constant learning, is allowed to follow a career path to a better job.
- * The maintenance group then focused only on more complex problems and project work for long term upgrades.

The Role of the Maintenance Group in TPM

- * The maintenance group performed equipment modification that would improve its reliability.
- * These modifications were then made or incorporated into new equipment. The work of the maintenance group, with the support and input from operators and production engineers, is then to make changes that lead to maintenance prevention and increased quality through fewer defects and a reduction in scrap levels.
- * Thus preventive maintenance along with maintenance prevention and maintainability improvement were grouped as productive maintenance.
- * The aim of productive maintenance was to maximize plant and equipment effectiveness to achieve the optimum life cycle cost of production equipment.

The Adaptation of TPM by Nippondenso

- * Nippondenso already had quality circles which involved the employees in changes.
- * Therefore, now, all employees took part in implementing Productive maintenance.
- * Based on these developments Nippondenso was awarded the distinguished plant prize for developing and implementing TPM, by the Japanese Institute of Plant Engineers (JIPE).
- * Thus Nippondenso of the Toyota group became the first company to obtain the TPM certifications.

Challenges in Implementing TPM

- * TPM has basically three primary goals:
- * Zero Product Defects
- * Zero Equipment Unplanned Failures and
- * Zero Accidents
- * It sets out to achieve these goals by [Gap Analysis](#) of previous historical records of Product Defects, Equipment Failures and Accidents.
- * Through a clear understanding of this Gap Analysis through [Fishbone Cause-Effect Analysis](#), [Why-Why Cause-Effect Analysis](#), and [P-M Analysis](#) enables physical investigation to discover new latent Fuguai (slight deterioration) during the first step in TPM Autonomous Maintenance, a process called "Initial Cleaning".

Corporate Adaptation of TPM

- * A typical TPM implementation requires company-wide participation and full results can only be seen after 3 years and sometimes 5 years.
- * The main reason for this long duration is due to the basic involvement and training required for Autonomous Maintenance participation where operators participate in the restoring the equipment to its original capability and condition and then improving the equipment.

Fast-Track TPM Implementation

- * An effective “Fast-Track TPM Implementation Approach” has been successful in a paper mill, in electronics industries and documented.
- * It circumvented this problem by assigning Project Teams to do “Autonomous Maintenance” for the AM Steps including:
 - * 1) Initial Cleaning
 - * 2) Eliminating Sources of Contamination and Improving Equipment Accessibility.
 - * 3) Production Operators take over the Autonomous Maintenance after the AM Step 3 (Initial Maintenance Standards) has been established.
- * This has been proven to reduce TPM implementation time by about 50%.

Muda: The Seven Types of Production Losses

- * TPM identifies seven types losses (types of waste) ([muda](#)), namely:
- * Set-up
- * Initial adjustment time
- * Equipment breakdown time
- * Idling and minor losses
- * Speed (cycle time) losses
- * Start-up quality losses, and
- * Process quality losses
- * It then works systematically to eliminate them by making improvements ([kaizen](#)).

The Eight Pillars of TPM Activity

- * TPM has 8 pillars of activity, [\[2\]](#) each being set to achieve a “zero” target. These 8 pillars are the following:
- * Focussed improvement (Kobetsu Kaizen);
- * Autonomous maintenance (Jishu Hozen);
- * Planned maintenance
- * training and education
- * early-phase management
- * quality maintenance (Hinshitsu Hozen);
- * Office TPM
- * Safety, Health & Environment
- * Some organisations also add additional pillars according to their work place like:
- * Tools Management
- * Information Technology

The Five “S” Bases of TPM

- * The Base for the TPM Activity are the five “S”:
- * Seiri (Sorting out the required or not required items)
- * Seition (Systematic Arrangement of the required items)
- * Seiso (Cleanliness)
- * Seiketsu (Standardisation)
- * Shitsuke (Self Discipline)

The Pillars & Their Details

- *
 - a) Efficient Equipment Utilisation
 - b) Efficient Worker Utilisation
 - c) Efficient Material & Energy Utilisation
- * Focused improvement (Kobetsu Kaizen) - Continuously even small steps of improvement.
- * Planned Maintenance - It focusses on increasing availability of equipment & reducing Breakdown of Machines.
- * Initial Control - To establish the system to launch the production of new product & new equipment in a minimum run up time.
- * Education & Training - Formation of Autonomous workers who have skill & technique for autonomous maintenance.
- * Autonomous Maintenance (Jishu Hozen) - It means "Maintaining one's equipment by oneself". There are 7 Steps in & Activities of Jishu Hozen.
- * Quality Maintenance (Hinshitsu Hozen) - Quality Maintenance is establishment of machine conditions that will not allow the occurrence of defects & control of such conditions is required to sustain Zero Defect.
- * Office TPM - To make an efficient working office that eliminate losses.
- * Safety, Hygiene & Environment - The main role of SHE (Safety, Hygiene & Environment) is to create Safe & healthy work place where accidents do not occur, uncover & improve hazardous areas & do activities that preserve environment.
- * Other Potential Pillars:
 - * Tools management
 - * Increase availability of equipment by reducing tool reset time
 - * Reduce tool consumption cost and increase tool life

TPM Success Measurement

- * A set of performance metrics which is considered to fit well in a lean manufacturing/TPM environment is [overall equipment effectiveness](#), or OEE.
- * For advanced TPM world class practitioners, the OEE cannot be converted to costs using Target Costing Management (TCM) OEE measurements are used as a guide to the potential improvement that can be made to equipment and by identifying which of the 6 losses is the greater, then the techniques applicable to that type of loss.
- * Consistent application of the applicable improvement techniques to the sources of major losses will positively impact the performance of that equipment.
- * Using a criticality analysis across the factory should identify which equipment should be improved first, also to gain the quickest overall factory performance.
- * The use of Cost Deployment is quite rare, but can be very useful in identifying the priority for selective TPM deployment.

Starting a TPM Process

- * Implementing TPM Begins with Identifying the Key People
- *
- * Management should learn the philosophy
- * Management must promote the philosophy
- * Training needs to be provided for all the employees
- * Identify areas where improvement is needed
- * Make an implementation plan
- * Form an autonomous group

Related Topics

[Lean Manufacturing](#)

[Six Sigma](#)

[Statistical Process Control](#)

[Total Quality Management](#)

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