9. Zero Defects Review and Total productive maintenance

One of the main objectives of TPM is to increase the productivity of plant and equipment with a modest investment in maintenance Total Quality management (TQM) and Total Productive Maintenance (TPM) are considered as the key operational activities of the quality management system. In order for TPM to be effective, the full support of the total workforce is required. This should result in accomplishing the goal of TPM: "Enhance the volume of the production, employee morale and job satisfaction."

Implementation of Total Productive Maintenance

Following are the steps involved by the implementation of TPM in an organization: Initial evaluation of TPM level, Introductory Education and Propaganda (IEP) for TPM, formation of TPM committee, development of master plan for TPM implementation, stage by stage training to the employees and stakeholders on all eight pillars of TPM, implementation preparation process, establishing the TPM policies and goals and development of a road map for TPM implementation.

According to Nicholas, the steering committee should consist of production managers, maintenance managers, and engineering managers. The committee should formulate TPM policies and strategies and give advice. This committee should be leaded by a top-level executive. Also a TPM program team must rise, this program team has oversight and coordination of implementation activities. As well, it's lacking some crucial activities, like starting with partial implementation. Choose the first target area as a pilot area, this area will demonstrate the TPM concepts. Lessons learned from early target areas/the pilot area can be applied further in the implementation process.

Management

Another factor, that is crucial for the succeeding of TPM, is the support of top management: "Lack of top management commitment, lack of middle management support and employee resistance to change, as well for the status-conscious and hierarchy-bound middle level executives lacking initiatives" are the main barriers against succeeding.

Objectives of Total productive maintenance

One of the main objectives of TPM is to increase the productivity of plant and equipment with a modest investment in maintenance. By investing in, for example, equipment maintenance, equipment losses can be prevented. There are six preventable losses:

1.Breakdown losses caused by the equipment

2.Set-up and adjustment losses

3.Minor stoppage losses

4.Speed losses

5.Quality defect and rework losses

6.Yield losses

Those losses could use further explanation. The first two losses affect the availability of a piece of equipment, the third and fourth losses affect equipment efficiency, and the fifth loss results in reduced quality from output.

Measuring effectiveness of Total Productive maintenance

A tool for measuring and evaluating the effectiveness of TPM can be found in "Overall Equipment Effectiveness" (OEE). Measuring the effectiveness of TPM is a crucial activity in TPM, but also a very time consuming and costly process. The mathematical formula is as follows:

OEE=Availability*Performance Rate*Total Yield Rate

The possible benefits -or costs- of TPM are tested by a statistical analyses. OEE is used as a parameter of TPM effectiveness:

H0: There is no significant difference in the percentage of defectives produced before and after the implementation of TPM (TPM implementation has no positive effect).

Ha: There is a significant difference in the percentage of defectives produced before and after the implementation of TPM (TPM implementation has positive effect).

This test resulted in a rejection of the null hypothesis. So, it may be concluded TPM brings positive changes to the process development. Reliable proof, could help convince people of the benefits TPM brings, and on what scale these benefits will operate. It could also be used as an argument criticasters cant disprove. Before being able to use TPM, additional theory should be consulted.

Definition of Total Productive Maintenance

Total Productive Maintenance (TPM) is a system of maintaining and improving the integrity of production and quality systems through the machines, equipments, processes and employees that add business value to the organization.

TPM focuses on keeping all equipment in top condition to avoid breakdowns and delays in the manufacturing process.

Difference between TQM & TPM

Total quality management and total productive maintenance are often used interchangeably. However, TQM and TPM share a lot of similarities, but are considered as two different approaches in the official literature. TQM attempts to increase the quality of goods, services and concomitant customer satisfaction by raising awareness of quality concerns across the organization.

TQM is based on five cornerstones: The product, the process that allows the product to be produced, the organization that provides the proper environment needed for the process to work, the leadership that guides the organization, and commitment to excellence throughout the organization.

In other words, TQM focuses on the quality of the product. While TPM focuses on the equipment used, to produce the products. By preventing equipment to break down, improving the quality of the equipment and by standardizing the equipment (results in less variety, so better quality), the quality of the products increases. TQM and TPM can both result in an increase of quality. However, the way of

going there is different. TPM can be seen as a way to help achieving the goal of TQM.

(or **ZD**) was a management-led program to eliminate defects in industrial production that enjoyed brief popularity in American industry in the late 1960s and early 1970s. Quality expert Philip Crosby later incorporated it into his "Absolutes of Quality Management" and it enjoyed a renaissance in the American automobile industry—as a performance goal more than as a program—in the 1990s. Although applicable to any type of enterprise, it has been primarily adopted within supply chains wherever large volumes of components are being purchased (common items such as nuts and bolts are good examples).

9.1 Definition

"[...] Zero Defects [is] a management tool aimed at the reduction of defects through prevention. It is directed at motivating people to prevent mistakes by developing a constant, conscious desire to do their job right the first time.

Zero Defects seeks to directly reverse the attitude that the amount of mistakes a worker makes doesn't matter since inspectors will catch them before they reach the customer. This stands in contrast to activities that affect the worker directly, such as receiving a paycheck in the correct amount. Zero Defects involves reconditioning the worker "to take a personal interest in everything he does[,] by convincing him that his job is just as important as the task of the doctor or the dentist."

9.2 History

The development of Zero Defects is credited to Philip B. Crosby, a quality control department manager on the Pershing missile program at the Martin Company, though at least one contemporary reference credits an small, unnamed group of Martin employees.

The Cold War resulted in increased spending on the development of defense technology in the 1950s and 1960s. Because of the safety-critical nature of such technology, particularly weapons systems, the government and defense firms came to employ hundreds of thousands of people in inspection and monitoring of highly-complex products assembled from hundreds of thousands of individual parts. This activity routinely uncovered defects in design, manufacture, and assembly and

resulted in an expensive, drawn out cycle of inspection, rework, reinspection, and retest.

In 1961, the Martin Company's Orlando Florida facility embarked on an effort to increase quality awareness and specifically launched a program to drive down the number of defects in the Pershing missile to one half of the acceptable quality level in half a year's time. Subsequently, the Army asked that the missile be delivered a month earlier than the contract date in 1962. Martin marshaled all of its resources to meet this challenge and delivered the system with no discrepancies in hardware and documentation and were able to demonstrate operation within a day of the start of setup. After reviewing how Martin was able to overachieve, its management came to the conclusion that while it had not insisted on perfection in the past, it had in this instance, and that was all that was needed to attain outstanding product quality. Management commissioned a team to examine the phenomenon and come up with an action plan, which became the organizing, motivating, and initiating elements of Zero Defects. Interest in the program from outside firms, including Litton Industries, Thiokol, Westinghouse, and Bendix Corporation, was keen and many made visits to Martin to learn about it. Their feedback was incorporated and rounded out the program. In particular, General Electric suggested that error cause removal be included in the program.

Martin claimed a 54% defect reduction in defects in hardware under government audit during the first two years of the program. General Electric reported a $2 million reduction in rework and scrap costs, RCA reported 75% of its departments in one division were achieving Zero Defects, and Sperry Corporation reported a 54% defect reduction over a single year.

During its heyday, it was adopted by General Electric, ITT Corporation, Montgomery Ward, Rolls-Royce Limited, and the United States Army among other organizations.

While Zero Defects began in the aerospace and defense industry, thirty years later it was regenerated in the automotive world. During the 1990s, large companies in the automotive industry tried to cut costs by reducing their quality inspection processes and demanding that their suppliers dramatically improve the quality of their supplies. This eventually resulted in demands for the "Zero Defects" standard. It is implemented all over the world.

9.3 Philip Crosby Associates and Zero Defects

In 1979, Crosby penned *Quality Is Free: The Art of Making Quality Certain* which preserved the idea of Zero Defects in the concept of the "Absolutes of Quality Management" and in a 14-step quality improvement program.

Absolutes of Quality Management

According to Crosby, there are four Absolutes:

1. Quality is conformance to requirements

Every product or service has a requirement: a description of what the customer needs. When a particular product meets that requirement, it has achieved quality, provided that the requirement accurately describes what the enterprise and the customer actually need. This technical sense should not be confused with more common usages that indicate weight or goodness or precious materials or some absolute idealized standard. In common parlance, an inexpensive disposable pen is a lower-quality item than a gold-plated fountain pen. In the technical sense of Zero Defects, the inexpensive disposable pen is a quality product if it meets requirements: it writes, does not skip or clog under normal use, and lasts the time specified.

2. Defect prevention is preferable to quality inspection and correction

The second principle is based on the observation that it is nearly always less troublesome, more certain and less expensive to prevent defects than to discover and correct them. It saves lot of human power and cost of inspection and correction. For example If a person changes the poor condition brake shoes of his bike before next riding then it will prevent lot of energy of the rider and reduce the risk of accident on the road and generation of new defect in the bike due to poor condition brake shoes which observed later and needs the correction and in turn of high cost of repair.

3. Zero Defects is the quality standard

The third is based on the normative nature of requirements: if a requirement expresses what is genuinely needed, then any unit that does not meet requirements will not satisfy the need and is no good. If units that do not meet requirements actually do satisfy the need, then the requirement should be changed to reflect reality.

Further, the idea that mistakes are inevitable is rejected out of hand. Just as the CEO wouldn't accept 'mistakenly' not getting paid occasionally, his/her chauffeur 'mistakenly' driving them to the wrong business, or their spouse 'mistakenly' sleeping with someone else, so the company shouldn't take the attitude that they'll 'inevitably' fail to deliver what was promised from time to time. Aiming at an "acceptable" defect level encourages and causes defects.

4. Quality is measured in monetary terms – the Price of Nonconformance (PONC)

The fourth principle is key to the methodology. Phil Crosby believes that every defect represents a cost, which is often hidden. These costs include inspection time, rework, wasted material and labor, lost revenue and the cost of customer dissatisfaction. When properly identified and accounted for, the magnitude of these costs can be made apparent, which has three advantages. First, it provides a cost-justification for steps to improve quality. The title of the book, "Quality is Free," expresses the belief that improvements in quality will return savings more than equal to the costs. Second, it provides a way to measure progress, which is essential to maintaining management commitment and to rewarding employees. Third, by making the goal measurable, actions can be made concrete and decisions can be made on the basis of relative return.

9.4 Criticisms

Criticism of "Zero Defects" frequently centers around allegations of extreme cost in meeting the standard. Proponents say that it is an entirely reachable ideal and that claims of extreme cost result from misapplication of the principles. Technical author David Salsburg claims that W. Edwards Deming was critical of this approach and terms it a fad.

Another criticism was that Zero Defects was a motivational program aimed at encouraging employees to do better. Crosby denied ever having said any such thing under any circumstances. He stated repeatedly that defects occur because of management actions and attitudes.