

# Competency Enhancement: Intangible Benefits of TPM Implementation

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**ABSTRACT**— Total Productive Maintenance (TPM) is practical technique aimed at maximizing the effectiveness of facility that we use within our organization. TPM establishes a system of productive maintenance, covering the entire life cycle of equipment, covers all departments, involves participation of all employees from top to bottom and promotes small group autonomous activities. This research paper addresses the TPM implementation how it improves the competency level for employees at the Leading belt manufacturing company located in Madurai. A literature survey was undertaken into the elements and Tangible and intangible benefits of TPM implementation. Role competency gap for the employees, an intangible benefit of TPM for employees were discovered and the questionnaires were formulated. Based on the questionnaire, competency level for the employees assessed together with industrial people. From that survey information the role competency gap of each employee has been calculated by using Analytic Hierarchy Process (AHP) & Role Competency Matrix (RCM).

**KEYWORDS**— Total productive maintenance, Implementation, Intangible benefits, Analytic Hierarchy Process, Role Competency Matrix.

## I. INTRODUCTION

This TPM is known as Total Productive Maintenance where the word Total = Total employee involvement, Total number of manufacturing equipment in the service sector, Total processes of the service sector. Productive means generating and getting the most out of any set of inputs and Maintenance meaning the careful management and upkeep of the assets and equipment of the service sector. 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 [19].

This paper aims to shows the TPM implementation will

have major impact on increasing the competency level of the employees, for that a leading belt manufacturing company located in Madurai has been chosen, their employees competency level assessed using role competency matrix.

## II. LITERATURE REVIEW

### A. Total Productive Maintenance

TPM is defined by Nakajima [19] as the combination between the involvement of total employee and Japanese thought of managing total quality and “American preventive maintenance”. This shows the importance and the role of employees in TPM implementation and its success.

Total productive maintenance (TPM) is a maintenance program which involves a newly defined concept for maintaining plants and equipment. The goal of the TPM program is markedly increase production while, at the same time, increasing employee morale and job satisfaction. The TPM Program closely resembles the popular total quality management (TQM) Program. Many of the same tools such as employee empowerment, bench marking, documentation etc. are used to implement and optimize TPM [14].

### B. Competency

United Engineers Malaysia [22] defined individual ability based on several important criteria crucial in planning and organizing, communication, analysis and solving problems, customer orientation focus, staff development, leadership, achievement orientation, decision making and working as a team to achieve an organization's goals. Le Deist and Winterton [18] explain that ability is competence that is an unclear concept that touches on knowledge and skills and various elements that are important.

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## C. Analytic Hierarchy Process

The Analytic Hierarchy Process (AHP) is a multi-criteria decision-making approach and was introduced by Saaty. The AHP has attracted the interest of many researchers mainly due to the nice mathematical properties of the method and the fact that the required input data are rather easy to obtain. The AHP is a decision support tool which can be used to solve complex decision problems. It uses a multi-level hierarchical structure of objectives, criteria, sub criteria, and alternatives. The pertinent data are derived by using a set of pair wise comparisons. These comparisons are used to obtain the weights of importance of the decision criteria, and the relative performance measures of the alternatives in terms of each individual decision criterion. If the comparisons are not perfectly consistent, then it provides a mechanism for improving consistency [20], [21].

## D. Role Competency Matrix

Gargi Keeni [9] states that role competency matrix is a tool used to document and compare the required competencies for a position with the current skill level of the employees performing the roles. It is used in a gap analysis for determining where you have critical training needs and as a tool for managing people development. It can also be used in succession planning as a means of identifying employees who have critical skills needed for promotion. The following are the steps in role competency matrix:

Step 1: Identify skills and knowledge areas.

Step 2: Identify roles in the organization.

Step 3: Mapping of competencies to roles.

Step 4: Provide weightage for competencies based on role using AHP

Step 5: Provide and gather competency level of employees.

Step 6: Compute competency gap of employees.

## E. Competency Gap Calculation

Competency gap for a role,

$$\delta CI_R = \sum_{i=1}^p \left[ \left( \frac{C_{EL} - C_{RL}}{4} \right)_i * (C_W)_i \right]$$

Where

$C_{EL}$  is competency level of an employee, which is rated on a scale of 0-4.

$C_{RL}$  is required competency level for a role, which is rated on a scale of 0-4.

$C_W$  is the competency weightage, which is computed using AHP.

$p$  is the number of competencies.

## III. METHODOLOGY

The study comprises of literature study and survey methodology. From The literature study 15 intangible benefits of TPM implementation for employee's

competency enhancement are formulated as questionnaires.

The survey based on questionnaires done for five levels of peoples at Leading belt manufacturing company located in Madurai and data was collected from 10 production operators, 15 production executives, 10 maintenance foreman, 10 maintenance engineers and 5 managers. After that the collected data was used to calculate the competency level of each employee by using role competency matrix.

In role competency matrix the weightage for each competency will calculate by using AHP, based on the required competency level. Each employee's competency level will be rated in the scale of 0 to 4 based on their level. In the first step the required competency level for different role was fixed in the scale of 0 to 4. The actual competency level of each employee has been attained from the survey questionnaire, after that the role competency gaps for all 50 employees were calculated and the results were analyzed.

## A. Model Calculation

Role competency gap for production operator 1,

$$\delta CI_R = \sum_{i=1}^p \left[ \left( \frac{C_{EL} - C_{RL}}{4} \right)_i * (C_W)_i \right]$$

$C_{EL} = 4,4,1,4,3,4,2,4,3,3,3,2,3,3,4.$

$C_{RL} = 3,1,2,1,2,2,2,1,1,1,2,2,3,1,2.$

$C_W = 0.21639, 0.10483, 0.06907, 0.05011, 0.05504, 0.07711, 0.03399, 0.05934, 0.05144, 0.05699, 0.05136, 0.05252, 0.04913, 0.04299, 0.02969.$

Role competency gap for operator 1:

$$\begin{aligned} & \left[ \left( \frac{4-3}{4} \right)_1 * (0.21639)_1 \right] + \\ & \left[ \left( \frac{4-1}{4} \right)_2 * (0.10483)_2 \right] + \\ & \left[ \left( \frac{1-2}{4} \right)_3 * (0.06907)_3 \right] + \\ & \left[ \left( \frac{4-1}{4} \right)_4 * (0.05011)_4 \right] + \\ & \left[ \left( \frac{3-2}{4} \right)_5 * (0.05504)_5 \right] + \\ & \left[ \left( \frac{4-2}{4} \right)_6 * (0.07711)_6 \right] + \\ & \left[ \left( \frac{2-2}{4} \right)_7 * (0.03399)_7 \right] + \\ & \left[ \left( \frac{4-1}{4} \right)_8 * (0.05934)_8 \right] + \\ & \left[ \left( \frac{3-1}{4} \right)_9 * (0.05144)_9 \right] + \\ & \left[ \left( \frac{3-1}{4} \right)_{10} * (0.05699)_{10} \right] + \left[ \left( \frac{3-2}{4} \right)_{11} * \right. \\ & \left. 0.0513611 + 2 - 2412 * 0.0525212 + 3 - \right. \\ & \left. 3413 * 0.0491313 + 3 - 1414 * 0.0429914 + 4 - \right. \\ & \left. 2415 * 0.0296915 \right] \end{aligned} \quad (1) \quad (1)$$

Role competency gap for operator 1:

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$$(0.054097512 + 0.078620624 - 0.017267004 + 0.037579589 + 0.013759097 + 0.038553465 + 0 + 0.044501604 + 0.02572096 + 0.02849892 + 0.012839731 + 0 + 0 + 0.021499792 + 0.014847878) = 0.35325$$

Role competency gap for operator 1 : 0.35325.

### IV. ANALYSIS AND DISCUSSION

Competency assessment is essential in the process of building an employee's career development plan. One of the critical elements of performance management is coaching people to develop the skills that may be holding them back from realizing success and eventually moving up the corporate ladder. This development planning process is traditionally tied to an assessment of the individual's skills gaps – assessed against specific competencies, that the organization believes are valuable. During the process of TPM implementation gaps against the employees potential competencies have been bridged with the required level of competencies.

The assessment gives the employee a sense of what is necessary to perform at a higher level, and specifically what skills and competencies are necessary to develop for success. The organization, in turn, gains a sense of the employee's fit and potential within the company as well as a clearer understanding of which competencies result in higher performance

If the competency gap will be in above then zero that means employee have the higher competency level then required competency level. If the competency gap is zero that means the required competency level and actual competency level is same for employee. If the competency gap will be minus or less than zero that means the employee have the lower competency level then required level and that employee need to improve their competency level by some training.

The required competency level, the actual competency level and the role competency gap for the 10 productions operators are shown in fig.1, from that the 9 operators have the higher competency level then required level the one operator have the minus value in role competency gap that denotes these operator have the lower competency level then required level and that operator need to improve their competency.

The required competency level, the actual competency level and the role competency gap for the 15 productions executives are shown in fig.2, from that the 15 production executives have the higher competency level then required level.

The required competency level, the actual competency level and the role competency gap for the 5 managers are shown in fig.3, from that the 5 managers have the higher competency level then required level.

The required competency level, the actual competency level and the role competency gap for the 10 maintenance engineers are shown in fig.4, from that the 10 maintenance engineers have the higher competency level then required level.

The required competency level, the actual competency level and the role competency gap for the 10 maintenance foreman are shown in fig.5, from that the 10 maintenance foreman has the higher competency level then required level.

Weightage	Required Competency Level	Competency	Competency Level of Each Employees										
			GIYANAR	G.BENGARAJ	S.SELVARAJ	P.DHARMARAJ	GLAKSHMANAN	A.MURUGAN	M.VINIKATESAN	M.SRIVANANA	R.SRETHU	A.MOHAMED ALI	
0.216304048	3	Job knowledge & its utilization	4	2	2	2	2	2	3	3	3	4	
0.104827499	1	Planning Skills	4	3	2	3	2	4	1	2	2	3	
0.069068017	2	Ability to work under stress/pressure	1	1	1	1	1	2	3	3	3	1	
0.050106118	1	Computer literacy	4	2	1	1	2	3	1	1	1	2	
0.053036386	2	Willingness to shoulder additional responsibility	3	1	2	2	2	1	3	2	3	3	
0.07710693	2	Time Management	4	3	3	4	4	2	2	3	2	1	
0.033985286	2	Integrity	2	1	1	1	1	3	3	1	4	2	
0.059334472	1	Communication skills	4	2	1	1	1	2	2	2	2	1	
0.051441919	1	Decision making skills	3	2	2	2	2	2	1	2	1	3	
0.056997839	1	Leadership qualities/motivational skills	3	1	1	2	2	3	3	3	3	1	
0.051358922	2	Team building skills	3	2	2	2	2	2	2	2	2	2	
0.052518113	2	Reliability/Dependability	2	1	1	1	1	1	1	1	1	4	2
0.04913211	3	Result orientation	3	2	2	2	2	2	2	2	2	3	
0.042999584	1	Innovativeness/Creativity	3	3	3	3	3	3	3	1	1	4	
0.029695756	2	Adaptability to change	4	3	3	2	2	1	2	2	3	2	
0.35325													
0.0218													
-0.018													
0.0343													
0.02062													
0.14327													
0.07894													
0.08504													
0.13806													
0.15423798													
			Competency Gap for a Role(operators)										

Fig. 1 Role Competency Matrix for operators



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From that role competency matrix the 49 employees have the higher competency level than required competency level that means the 98% employees have the higher competency level because of working under the TPM implemented company. Thus the TPM improve the competency level of each employee.

### V. CONCLUSION

Successful organizations focus on the competencies required for their industry at their level of maturity. When desired competencies are clearly articulated, employees can be expected to bear more responsibility for developing those competencies. Ultimately, TPM can help the organization's core competency improvement and sustain their position and reputation in your industry. Measuring competency is critical for assessing any gaps that may exist between your current workforce and the current and future needs. Competency assessments provide critical information for management to put in place the necessary training and development programs to cultivate sustainable talent pools for the future. During the process of TPM implementation the almost all the employees competency has been improved to a new height, it provides organizations with a means of upgrading and retaining their valuable workforce, and employees recognize that development programs enhance their job security and prospects for career growth. Also inspire the companies to adopt or go for the new improvement initiatives. From the study it's clear that the TPM implementations improve the plant performance and productivity to world class level and also gains a sense of the employee's fit and potential within the company as well as a clearer understanding of which competencies result in higher performance.

### VI. FUTURE WORK

The competency gap analysis can be done periodically to assess the competency enhancement to the employees. It also can be incorporated with Training need analysis (TNA) and training plan for the employees. The performance of complex competencies that cannot be broken down into simple parts, we need to make a shift from individual methods to an integral program, intertwined with the education program.

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