

# DEVELOPMENT OF THE PERFORMANCE BY IMPLEMENTATION AND INTEGRATION OF NEW TECHNIQUES

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## Abstract

*This work aims to develop the performance and decrease the waste. It uses analytical tool (Root Cause - Analysis) which identify the barriers to know the root causes of it. Lean manufacturing, Total Productive Maintenance (TPM), 5S, and Lean Six-Sigma (LSS) represent as the techniques which using to develop performance, and decrease lead time, and waste. The methodology of this work depends on the integration among lean manufacturing, TPM, 5S, and LSS. Successful implementations of techniques start with training of all members to increase the opportunities for development. Indicators of successful implementation rely on production leveling before and after applying of new concepts. A key element of production leveling is the manpower responsible that placing orders to avoid undisciplined behavior, so it's easy to allocate the necessary manpower and machine. The results indicate the impact of techniques on elements (resources) in working areas (Manpower, Machine, Method, Raw material, and environmental condition).*

**Keywords:** Lean manufacturing, Total Productive Maintenance (TPM), Overall Equipment Effectiveness (OEE), 5S, and Lean Six-Sigma (LSS).

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## 1. INTRODUCTION

Nowadays, it is necessary for any company or organization to implement new technique such as: 5S, Lean manufacturing, TPM, and LSS, to Increase of performance and decrease the waste. Most of companies depend upon internal challenges to improve the material handling and minimize wastes. TPM supports maintenance job to reduce time of break down, and operational efficiency of machine [1-3]. The integration of techniques will achieve competitive edge that have a great impact on the performance and elimination the waste. Good implementation of techniques are achieved by training and education of all members in the organization or company [4-5].

The main features of techniques are: customer satisfaction, lead time, performance, and continual improvement. The aim of this paper is to increase the performance and decrease the waste by using new methodologies.

## 2. IMPLEMENTATION AND INTEGRATION OF TECHNIQUES

Implementation of any technique (5S, Lean manufacturing, TPM, and/or LSS,) requires commitment of all members in the organization or company. Some companies implement one technique or more which require coordination between them (it is strategy).

This work uses the four techniques as one package for improving the environmental working area; they help processes (technical, administration) and products such as: qualities issues, reduction of standard time, and reduce operating costs and enhancement the performance.

### 2.1 Lean Manufacturing

Common understanding about lean manufacturing is waste reduction, process improvement and reducing lead time by improving relationship between supplier & customer [3]. It is new technique which implemented to decrease or eliminate wastes, which achieve successful factors such as: performance, profit, and productivity. Waste is obstacle to continuous improvement [6].

### 2.2 Total Productive Maintenance (TPM)

TPM is considered as a methodology that concentrated on keeping all machines in a accepted condition to avoid any barrier in the production system. OEE is affected by TPM technique which reduces or eliminates any losses in performance, quality, and availability.

$$OEE = \text{Performance} \times \text{Availability} \times \text{Quality} \quad (1)$$

### 2.3 5S

5S is a Japanese technique used by organizations. [7], indicates, that 5S is main element of the Japanese Production Management (TPS). [8], shows details of 5S in table 1.

**Table 1:** Details of 5S

Japanese	English	Japanese meaning	English meaning
Seiri	Structure	To clearly separate necessary things from unnecessary ones and abandon the latter	Organization
Seiton	Systematize	To neatly arrange and identify things for ease of use	Neatness
Seiso	Sanitize	To always clean up: to maintain tidiness and cleanliness	Cleaning
Seiketsu	Standardize	To constantly maintain the three Ss mentioned above (seiri, seiton, seiso). Includes the individual wellbeing and physical cleanliness of each person	Standardization
Shitsuke	Self-discipline	To have workers make a habit of always conforming to rules	Discipline

Success of TPM depends on various pillars like 5S [9].

**2.4 Lean Six-Sigma (LSS) Approach**

It focuses on customer satisfaction and searches on the causes of improvement through monitoring and evaluation of daily work improvement. Successful implementation LSS will change of culture of people in the organization, and it can effect on performance, [10].

**3. PRODUCTION LEVELING**

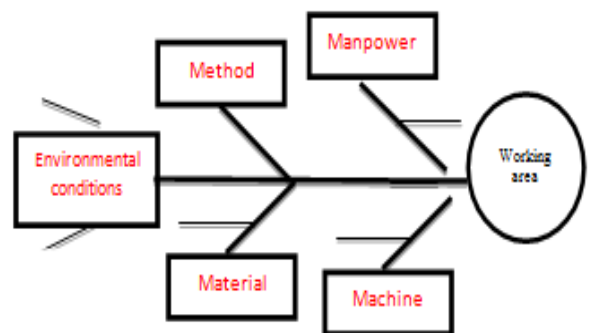
In this work, the integration among techniques leads to good production leveling, (to minimize peaks and valleys in the workload). Consequently, the company operates with accepted utilization while also minimizing changeovers. Indicator of successful implementation relies on production leveling before and after applying of new concepts. A key element of production leveling is the manpower responsible that placing orders to avoid undisciplined behavior, so it’s easy to allocate the necessary manpower and machine.

**4. RESEARCH DESIGN AND METHODOLOGY**

**4.1 Research Outline**

This work studies the techniques (Lean manufacturing, 5S, TPM, and LSS) and implements of new methodology that depends the integration among them. Also, it uses analytical tool (Root Cause - Analysis) which identify the barriers to know the root causes of it.

Root – Cause Effect represents as analytical tool to study, and analyze the causes which should be eliminated to avoid the problems [11]. Figure 1, indicates main factor of the working areas as shown.



**Fig 1:** Root – cause effect diagram

This study depicts main elements (resources) in working areas: manpower (people), machines, method, raw materials, and environmental conditions. Evaluation of performance of working areas was done before and after applying new techniques.

**4.2 Research Area**

This study was conducted in manufacturing company which researching about increases performance and decreases the waste in the production system. The company produces 600 automotive engines per month through six lines (patrol engines and diesel engines). The company implemented four techniques to improve the performance and decrease the waste. The company made a plan, that starting with training of all members in the company.

**5. RESULTS AND DISCUSSION**

The performance of the company is measured before and after implementation of techniques. Depending on the analytical tool, Table 2 indicates the impact degree of techniques on elements (resources) in working areas. The impact of technique takes three degrees: H (high), M (medium), and L (low).

**Table 2: Impact of techniques on the elements**

Technique	Man Power	Machine	Method	Raw Material
LSS	H	L	L	L
TPM	H	H	M	M
5S	H	M	L	M
Lean Manufacturing	H	M	M	L

From table 2, the degree of impact of manpower is higher than other elements (the manpower is cornerstone of progress). The degree of impact of TPM is higher than other technique. Maintenance is an indispensable part of the business process and plays an important role in an organization's success and survival and to ensure the machine functions at its original optimal level [12]. Implementation of any technique focuses on added value activities or waste removal processes with the aim of better responding to customer needs [13].

Also, performance of the company is measured before and after implementation of techniques, and the obtained results showed that the performance of (people - machines), Average time for Material transportation, rejected items, waste of spare parts, customer satisfaction (internally, externally) as shown in table 3.

**Table 3: The results due to apply new techniques**

The Results	Before	After
Performance of people (%)	65	92
Machine breakdown (%/month)	23	2
Time of machine breakdown (day)	10	2
Average time for Material transportation (minutes)	19	11
Rejected items (every 100 items )	19	1-2
Waste of spare parts (%)	13	1.5
Internal Customer satisfaction (%)	79	93
External Customer satisfaction (%)	69	91

Stability of production leveling and OEE are the main indicators for successful of integration and implementation of techniques. This work presents platform for any organization or company to implement the techniques as the following:

- Applying any technique must start with training and education of all members.
- Top management must support the action taken to apply any technique and achieve the goals and extent to customers and suppliers.
- Monitoring and evaluation the production leveling, time, waste, and other discipline.
- The progress to achieve the goals must keep it and aware the all members.

## 6. CONCLUSION

The main strategy of any company is to develop of performance and decrease the waste throughout applying certain techniques. Successful implementation any technique must start with training and education of all members with support of top management. This work uses four techniques (lean manufacturing, TPM, 5S, and LSS) and the integration among the techniques enhances to achieve competitive edge that have a positive impact on the performance and elimination the waste. Accepted of production leveling and OEE are represented the main indicators for successful of integration and implementation of techniques. From the results, the degree of impact of manpower is higher than other elements (the manpower is cornerstone of progress), also, the degree of impact of TPM is higher than other technique.

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