Lean Manufacturing: An Approach for Waste Elimination

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Abstract- **Lean Manufacturing (LM), a manufacturing system and philosophy, was originally developed by Toyota, Japan and is now widely practiced by many manufacturers throughout the world. Lean manufacturing is a systematic approach to identifying and reducing waste (non value-added activities) through continuous improvement by flowing the product at the pull of the customer in pursuit of perfection. LM is important, primarily because of waste reduction and reduction in lead time. The objective of this paper is to identify Lean manufacturing practices in small scale industries. For this purpose some case studies were chosen and critical observations are identified. Some of these annotations are improper utilization of resources, quality tools for improvements and improper plan for location and layout. This paper includes one case study with the initiatives, observations, results and conclusions of the study carried out in a small scale industry.**

I. WHAT IS LEAN MANUFACTURING: A PERSPECTIVE

To understand the Lean Manufacturing it is an essential requirement to know about the Lean, in fact "What is Lean". Lean means "Reduce the Waste". Waste in terms of industry is "defined as anything that does not add any value to the end product from customer's perspective". In manufacturing industries basically two types of waste generate, these are:-
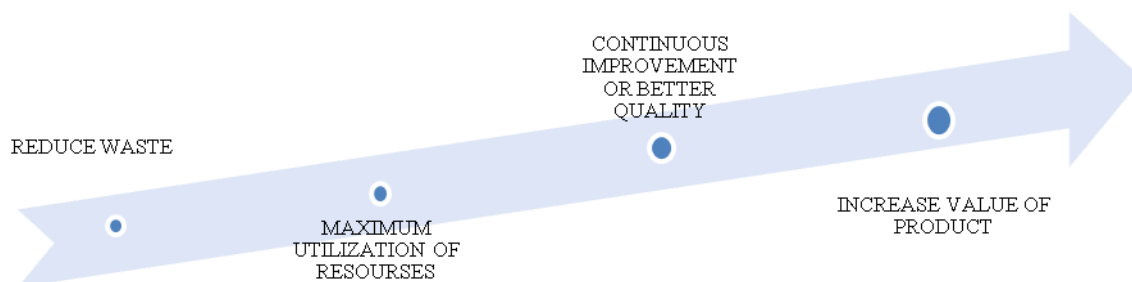

Fig:-1 Objectives of Lean Manufacturing

- Waste which are seen or calculated
- Waste which are not seen or not calculated in terms of waste.

In first type we put all defects produced or breakdowns.
So to detect or solve above defects Lean Manufacturing is a technique subsequently.

III. SEVEN WASTES IN AN INDUSTRY:-

Typically waste in an industry is generated by 7M (man, machine, material, management, market, method and Maule), these are shown in the upcoming figure:-

- *Transportation*:-It does not add value to the end product. Therefore simply

In second type we put waste due to improper transportation of material or men. Minor wastes are papers in management work, due to improper working environment or less education of process.

transportation is one of the wastes that has to be eliminated from the production system. This accounts for quality defects, maintenance of higher WIP and additional cost of transporting the goods. Transportation is often caused by poor workplace organization.

- *Inventory*:-It is a monetary term which is utilized to earn more money. Due to excess limit of inventories monetary term is blocked which is not used in any other work, as a result it is a waste in an industry.

- *Motion*:-In an industry the more often than not, time and process is spent in transportation between workstations. Only 5% motion is useful for processing on work piece.
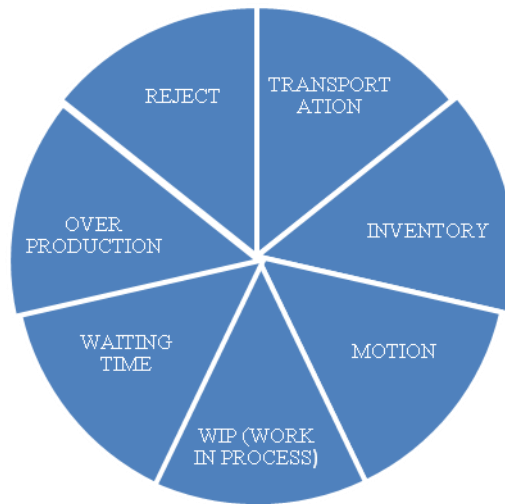

Fig 2:- 7(seven) waste

- *WIP (work in process):-*Work in process or WIP is a direct result of over production and waiting. Every imperfection in the system creates a requirement for the WIP. Therefore WIP is also known as the mirror of the waste the system has. But WIP itself becomes a waste due to many consequences.

- *Waiting time***:-**In conventional batch processing, some studies show that 90% of the time goods are waiting to be processed. Some even say that it is higher as 99%. Even a single minute lost in waiting cannot be recovered in the process there after.

- *Over-production:-*The over production can be used to describe a type of waste which is in most of the places and we never think this is a waste. This is producing something before it is actually required. Lean Manufacturing always trusts on the pulling rather than pushing process.

  ➢ Processing itself
  ➢ Defective product (scrap in manufactured products or any type of business).

IV.   PROCESS OF LEAN MANUFACTURING:-

The process of Lean Manufacturing starts from identification of roots of the place thereafter applying different tools regarding improvements, cracking the solution and lastly analyzing the roots of failure, this process can be explained with the help of following figure:-
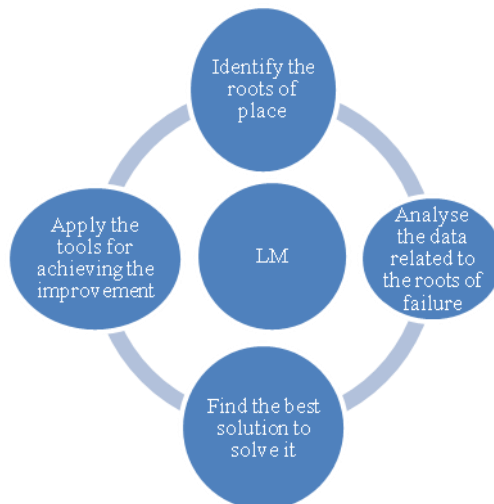

Fig3: Process of Lean Manufacturing

a. *Lean Manufacturing tools and techniques:-*

Lean Manufacturing is based on continuous finding and removal of waste. Value is defined from the customer's point of view. Therefore all the tools in Lean Manufacturing aim to identify and remove waste from the system continuously. There are four steps in implementing Lean Manufacturing. They are:-

- Identifying the fact that there is waste to be removed
- Analyzing the waste and finding the root causes for these waste.
- Finding the solution for these root causes.
- Application of these solutions and achieving the objectives.

When this is achieved go back to the stage 1 and continue this loop over and over again.

For the purpose of identifying the problem of waste, the place where it exist, the root causes of the problem and to come up with a way to solve it, following tools and techniques are used.

✓ *Total Quality Management (TQM):-* TQM is no longer thought as a concept. It is a philosophy which is totally based on customer approach. The evolution of TQM, as it has emerged in industries, is shown in figure. TQM means "SATISFYING CUSTOMER FIRST TIME EVERY TIME"
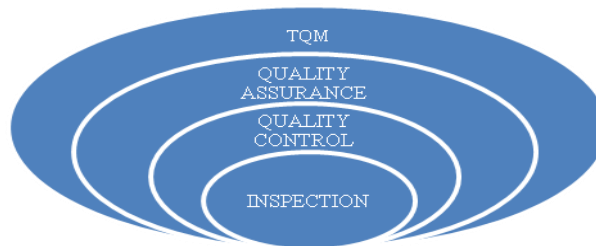

Fig:-4 TQM Evolution

✓ *7-QC (Quality Control) tools:-* In an industry, to solve the problems seven Quality Control tools are used. These tools are alienated in four stages

Stage I:-Identify the problem, Stage II:-Development of strategies and planning, Stage III:-formulation of action plans, Stage IV:-Continuous small improvements

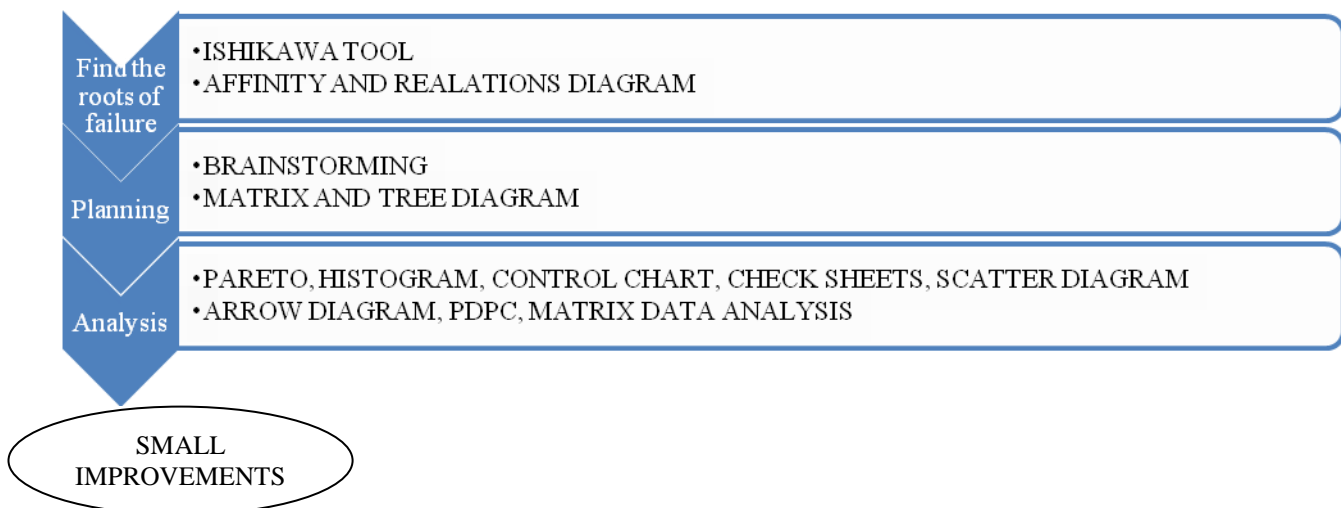All the "7 new and old QC tools" are divided in stages in following terms:-

Fig:-5 Quality Control tools in four stages

✓ *POKA YOKE:-*It is a Japanese technique which means mistake proofing. This is a concept developed by Mr. Shingo of Japan to provide 100% product quality. It is one of the acknowledged preventive techniques. Innovation is the key for POKA YOKE.

✓ *JIT (JUST IN TIME):-* JIT is the backbone of Lean Manufacturing. The concept first grew with the Toyota system than it developed to Lean Manufacturing. JIT concepts are based on pull demand model. Everything

is done when they are actually needed. It has three main areas:- (i) JIT purchasing (ii) JIT production and (iii) JIT distribution.

✓ *Failure Mode and Effect Analysis (FMEA):-* It is one of the tools of TQM which helps in finding out the possible failure modes of design, process or service and setting up ways to prevent their occurrence.

✓ *Kaizen*:-Kaizen means small continuous improvements. It is a Japanese philosophy, it decrease the higher risk which is involved in a big improvement. It is basically dependent on PDCA cycle which is also called Deming cycle, this cycle is:-
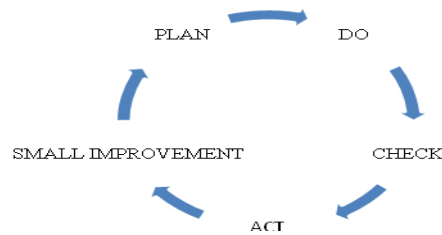

Fig 6:- kaizen (A small continuous improvement)

✓ *FIVE S for quality ambience:* - "A place for everything and everything in its place" is the slogan that is usually focused while following the 5S procedure for keeping the ambience neat. It is a common knowledge that, a dirty factory can not produce quality product.

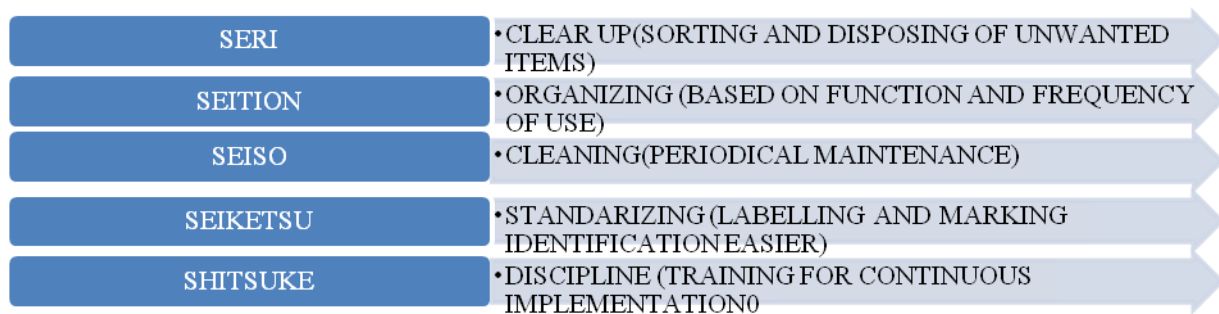| SERI	• CLEAR UP(SORTING AND DISPOSING OF UNWANTED ITEMS)
SEITION	• ORGANIZING (BASED ON FUNCTION AND FREQUENCY OF USE)
SEISO	• CLEANING(PERIODICAL MAINTENANCE)
SEIKETSU	• STANDARIZING (LABELLING AND MARKING IDENTIFICATION EASIER)
SHITSUKE	• DISCIPLINE (TRAINING FOR CONTINUOUS IMPLEMENTATION0

Fig 7:- 5 S Definition

There are other important techniques and tools too which includes Benchmarking, KANBAN tooling, Total Productive Maintenance (TPM), Quality circles philosophy etc.

V. CASE STUDY

As per the study carried out in Company 'A' (Secrecy), (a small scale industrial sector in Jodhpur) which manufactures fasteners, spares, refrigeration components, controllers etc. A lot of problems were analyzed and provided. The research carried out based on different parameters is in brief illustrated.

• *Location or layout:* - The Company comes in RIICO industrial area. It basically products are basically medical and surgical equipments, which do not require higher requirement of water, so Jodhpur is beat location. Medical colleges, government hospitals and pharmaceutical shops are nearer so location is compatible to its vendors. Due to some reasons there are some troublesome in process as unbalanced arrangement of machines, improper material flow, right material is not available at right time.

If a better layout design is provided in terms of improvement or job type layout is better arranged by utilizing the area space and time management techniques , results could be far more better relating to the production and productivity.

• *Process analysis:-* in some terms the waste are generated for example material flow is continuous but not defined, cycle time is very highline balancing is not managed properly, due to this delay is generated, preventive maintenance is not in use, improper utilization for scrap. As a result of these above mention factors work obtained is better but due to higher WIP proper results are not obtained.

• *Material management:-* Basically WIP is very high so if KANBAN tooling and 5S is implemented the productivity of the company will rise at quiet a faster pace.

• *Quality*:- 100% inspection is done to improve quality, it believes in customer satisfaction so can go for customer enhancement, precise instruments are used but waste are generated due to undesired material and human resource movement, WIP, lack of extra training to workers, lack of statistical data analysis, some processes consume time more than originally required. As a result the analysis shows that policy is good to control quality but not much focus on improvement of quality.

There are many other parameters which need improvement including automation, maintenance, productivity, effectiveness, which if properly controlled by LM techniques the growth and profit will grow like not even expected.

VI.   CONCLUSIONS:-

LM is an effective tool for continuous improvement in an organization. It believes in using small continuous improvements rather than rapid improvement. In this era of modernization and competition all the industries are running towards to get a high quality product for fulfilling the customer needs. LM may be helpful to achieve the motto.

While doing this work it's been analyzed that how much difficulty is faced in the implementation of LM in small scale industries like over production, money, relationship between customers and managers. In order to eliminate waste different techniques can be applied such as TQM, POKA YOKE, TPM, 5S, JIT, FMEA etc which are explained earlier in different sections.

VII.   REFERENCES

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