



PRODUCTIVITY IMPROVEMENT IN INDUSTRY USING 5S TECHNIQUE AND PLANT LAYOUT

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Abstract:

This paper consists of literature survey on the implementation of 5S in manufacturing industry. It involves the study and change in the workshop floor of a manufacturing industry before implementation of 5S. This paper helps in minimizing the waste time and increases the area of work place, which is not inspected properly. An inspection process has been executed based on 5S methods and the result obtained confirms to changes like increasing efficiency in production and quality and improves safety. This paper aims to improve the plant layout to eliminate obstructions in material, tool, and product flow and thus achieve maximum productivity. The present plant layout and the operation process of each section have been inspected. The problem of material flow of each section was identified. The result showed that the proper placement of each section should be done to make the good material flow. The enhancement in layout of plant can decrease the distance of material flow, which increases production.

Key Words: 5S, Waste Time, Efficiency, Quality, Plant Layout, Material Flow & Production

1. Introduction:

5S One of the most important issues of traditional manufacturing factories in India is to try to have employees work in a better environment in order to make them feel good and get more energy to do their job. By doing so, the company can minimize the production time and maximize the profits at the same time. In India, there is a large number of employees in small traditional industrial companies' with employees working in uncomfortable, dirty; messy environments, which are usually, full of unused materials. Because of this situation, it is hard to find the appropriate tools, which are needed. Difficulties are met when the company is doing the demand which has a scheduled due date. To change this bad situation, 5S is implement within the factory. What is 5S? 5S may be the first step for the company to embrace Lean; this study will focus on 5S. 5S stands for five different characters, which are sort, set in order, shine, standardize, and sustain. The 5S system is a tool, or system that supports a philosophy of operating in an organized manner. The philosophy that this system consist of is discipline, efficiency, and attention to detail. The idea behind 5S is that if a workplace is clean and well maintained out, the identification of waste is much easier. Most of the manufacturing companies in India do not run 5S, or they do not even know what 5S is. 5S is a way to help the company to reduce the waste and enhance possible profits.

Plant layout in industry sectors, it is important to manufacture the products which have good quality and meet customer's demand. This action could be conducted under existing resources such as employees, machines and other facilities. However, plant layout improvement, could be one of the tools to response to increasing industrial productivity. Plant layout design has become a fundamental basis of today's industrial plants which can influence parts of work efficiency. It is needed to appropriately plan and position employees, materials, machines, equipment, and other manufacturing supports and facilities to create the effective plant layout. Plant layout design is complicated due to many related factors such as employees, workflow, machine positions, and the relationship between machines and work. These factors result in plant layout improvement planning. Also, investment is required for machine positioning and employees awareness. Hence, the primary step for plant layout improvement should be started with identifying the problems of the current plant layout in order to maximize the productivity at the minimized investment. This paper thus aims to find out the causes of discontinuous work flow in plant resulting from the plant layout.

5S Technique: 5S is a philosophy rooted from Japan and branched into other countries. 5S is an acronym for the following Japanese terms:

- ✓ SEIRI [Sort]
- ✓ SEIRON [Set in order]
- ✓ SEISO [Shine]
- ✓ SEIKETSU [Standardize]

✓ SHITSUKE [Sustain]

5S Systematization: Implementing 5S should begin from educating the workers about 5S and its importance. It is Mandatory that every worker should understand the need of 5S and its advantages. Workers should be provided with an example for all the 5S's, which makes it easy to understand. It is very important to understand the fact that this methodology do not refer only for the production team but also refers to stores (warehouse) and other office teams. It is better to supply a 5S pocket guide to the workers such that they could clarify their doubts by reading it.

1S – Sort: Eliminate all unnecessary materials, tools, parts, equipment's. Sorting identifies necessary information for the realization of tasks. Sorting eliminates the waste raw materials, nonconforming stock, and damaged tools. Keep only necessary items and eliminate what is not required. It improves the efficiency of searching and collecting items reduce the running time of operation. [2] Implementing 1S rule:

On the first stage one should be able to answer the Control questions:

- ✓ Does unnecessary things create the problem in work area?
- ✓ Does unnecessary odds and ends of materials thrown anywhere in the work area?
- ✓ Do tools and rest of materials of production are placed on the shop floor?
- ✓ Are all necessary things sorted, ordered and retain at their own place?
- ✓ Are all measuring tools sequentially kept?

Based on answers to the above questions it is possible for the assessment of work area in terms of the 1S rule. If any question answer is yes, it should carry out sorting of items, which are in work area.

On the second stage one should carry out the paper of all things, which are in the work area and arrange them. According to established sorting, it should execute the elimination of items from work area, which were unnecessary.

2S – Set in Order:

The important thing is visualization of work area the painting of the floor helps to identify the storage places of each material or transport ways. The place for each item should be labeled. Each tool, material, supply, or piece of equipment should be kept close to where it will be used - in other words, aligning the flow path. Implementing the 2S rule:

It means items must be placed in fixed locations so that they are easily attainable and can be easily used.

2S Rule Proceedings:

Make sure that items can be identified by labeling them properly. Every working method has particular type of order. Identify and filter it. Use lean thinking to make things faster.

- ✓ Reduce preparation time for tool setting.
- ✓ Reduce waiting time for parts, materials, papers and files.
- ✓ Reducing processing time and cycle time by improving the plant layout of work area.
- ✓ Time and strength spent on looking for jigs, fixture tools etc.
- ✓ Run down for parts in stores.
- ✓ Searching for files and information in computers.
- ✓ Labels are attached so that items can be recognized.
- ✓ At a glance and clear. [2]

3S – Shine: Regular cleaning permits to identify and to eliminate sources of mess and to maintain the clean workplaces. During cleaning machine, work area and shop floor, sources of light, current information, cleanliness of path are checked. Operator should take care about personal maintenance and tidiness.

Implementing 3S rule:

The first step of 3S rule is improving the workplace, daily follow-up cleaning is necessary in order to sustain this improvement. Cleanliness is helpful to notice damages on equipment such as cracks, breakage and misalignment [2]

4S – Standardize: Standards should be worked out and implemented in the work place. Management should pass instructions in order to set the work place in order. The Instructions should be clear and easily understandable to workers. All the workers in the shop floor should be involved in this activity; the workers group knows specificity of their own activities and process of elaboration along with the usage gives them the possibility of understanding the importance of each aspect of the operation. The aim of the easy access of the obligatory standards for constant and visible places should be assured. It should be assumed that standards are not only being implemented in typical operational processes like movement of materials, production, maintenance and sorting, but also in administrative processes like Book-keeping, HRM (human resource management), customer service and any other services. [2]

5S – Sustain: The principle is to establish the maintenance of a clean environment as an ongoing process for ever. This increases the consciousness if the workers and decreases the number of non-confirming products and defective products. This process also increases the internal communication and human relations in the organization. It is also essential to understand the need and importance of the inspections for 5S. The inspections

are executed with the help of Check list prepared on the basis of the radar charts of 5S. This also helps in estimating the work place. The inspection of the realization of 5S standards is executed once in a month by the team.

Before 5S Implementation:



Figure 1



Figure 2



Figure 3



Figure 4

After 5S Implementation:



Figure 5



Figure 6



Figure 7

The advantages from implementing 5S rules:

1S:

- ✓ Process development by cost reduction
- ✓ Stock confinement
- ✓ Better usage of work place
- ✓ Prevention of losing tools

2S:

- ✓ Process growth
- ✓ Increasing efficiency
- ✓ Shortening of time required for searching necessary things
- ✓ Safety enhancement

3S: Improvised working conditions for workers. The number of customers has been increased after maintaining a clean and neat layout. Machine maintenance cost has been reduced.

4S: The standards of the company came to next Level, Improvement in safety has supported in reducing the injuries of workers, Slips and falls of the material have been reduced. Travel time of materials is reduced which led to reduction of work hazards.

2. Plant Layout:

Genesis of Problem: The plant layout redesign for increase in efficiency was considered necessary because of the following reasons:

- ✓ Improper material flow through the shop floor i.e., the current plant layout was not designed according to the process flow given by DGCA [2].
- ✓ Extended transportation time for material transfer. The sheet metal section had issues to be handled. Based on the discussion with the manager and supervisors and direct observation by the team, the following problem surface was about non value added operations in the process.

Constraints:

- ✓ Stores and heat treatment sections should not be interchanged or changed.
- ✓ Dimensions of current departments and aisle should not be changed. [1]

Objectives: The problem genesis led to the formulation of the following objectives:

- ✓ To study the current flow pattern and relation of overall plant layout and develop a new plant layout.
- ✓ Relocating the workstations for simpler flow and reduction in check points.
- ✓ To improve the efficiency of the plant layout using simulation. [1]



Figure 8

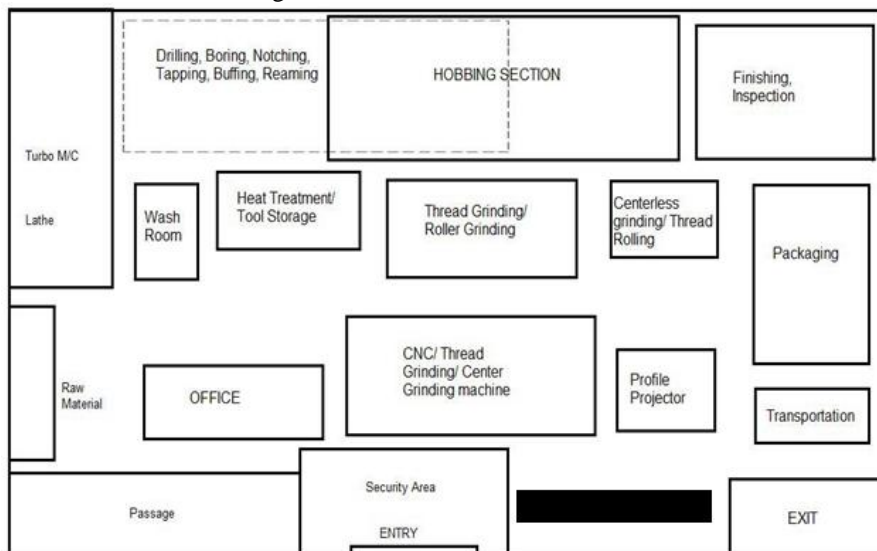
Tools and Techniques: The various tools and techniques used for plant layout redesign are:

- ✓ Checklist: The layout evaluation checklist is used to identify the key problem areas in the present layout.
- ✓ String Diagram: The string diagram is one of the simplest techniques of method study for recording and examining movement of workers and materials. It is a tool for analyzing and designing work spaces in such a way that the movement of material, men, equipment etc... During a specified sequence of events. The string diagram is thus a form of flow diagram. In this a thread is used to measure distance. Hence, it is necessary that the string diagram be drawn correctly to scale. It is most often used to supplement the flow process chart. A string diagram can be used to plot the movement of material and this is done especially when a work study person wants to find out easily just how far the materials travel. The complete plan containing all the equipment's and doorways, pillars and partitions, which affect path of movement, are drawn to scale. A measured length of thread is then taken and tied round the pins at the string points of movement. Thus the string diagram is a useful aid in explaining proposed changes to company management, production supervisors and employees. [1]

Data Collection:

- ✓ Existing layout: The area occupied by the machines, aisles, work-in-progress, storage areas, raw material areas and finished goods area, etc. was measured and scaled drawings of the floor plans for the building were made. MS office and Auto cad was used for the purpose.
- ✓ Outline Process Chart: Outline process chart (OPC) was used to get an overall picture of primary activities
- ✓ OPC for the studied process.
- ✓ Flow Process Chart: Flow Process Chart was used to document the detailed sequence of operations.
- ✓ String Diagrams: String Diagrams were used to trace and measure the path of material. String diagrams were made both by hand and by software, MS office using Auto cad.
- ✓ Simulation: Time taken by each machine to process the component is collected and recorded. The standard time for each process is also recorded. These data are used in simulation in order to find out the overall utilization of the plant.

The simulation model is shown in the figure below.



Example of Layout of a gear manufacturing Industry

$$\text{Efficiency of the current Plant Layout (A)} = \frac{\text{prescribed travel length by (DGCA)}}{\text{current travel length}} \times 100$$

$$\text{Efficiency of the proposed Plant Layout (B)} = \frac{\text{prescribed travel length}}{\text{current travel length}} \times 100$$

$$\text{Percentage improvement} = \frac{(B-A)}{A} \times 100$$

3. Conclusions:

5S:

- ✓ It gives a scope for Workers participation in the work area design and maintenance.
- ✓ Workers absenteeism has been lowered down.

Plant Layout:

- ✓ This paper has provided a good exposure to facility planning and layout designs for the improvement of the efficiency.

- ✓ The choice of which type of facility layout to adopt can have a significant impact on the long-term success of a firm.
- ✓ This should not be considered lightly. A major issue to be addressed in facility layout decisions in manufacturing is: How flexible should the layout be in order to adjust to future changes in product demand and product mix.
- ✓ The study of layout has become extremely important. The most common objective of layout design, that is to minimize distance travelled, is not always suitable for all the manufacturing industries. Instead of criterion of minimizing total distance travelled, one may wish to minimize the total distance of the material travelled. This may indirectly add to profits of the company.

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