



Increasing Productivity Through Implementation of 5S Methodology In A Manufacturing Industry: A Case Study

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Abstract— This paper deals with Implementation of 5S Methodology in one of the small-scale manufacturing industry Niraj Thermo Pvt. Ltd, D-63, MIDC Ambad, Nashik, Maharashtra, which is one of the leading manufacturer and exporter of thermocol products. 5S is a technique to arrange, order, clean, standardize and constantly enhance a work area. It specializes in five Japanese strategies particularly Seiri (Sorting), Seiton (Set in order), Seiso (Shine), Seiketsu (Standardize) and Shitsuke (Sustain). The objective of the Implementation of 5S in the company was to arrange the work area with better performance and effectiveness. The requirement for the implementation of 5S within the organization came into existence because of unorganized work-stations, uncomfortable operating environment and also the excessive wastes within the company. Thus, to get rid-off on the above factors, there was imperative demand for the consecutive implementation of 5S within the organization. The implementation resulted in increase in productivity upto 25%, increase in storage space upto 30% and reduction in cycle time upto 1.5hrs.

Keywords—5S, Productivity, 5S Implementation, Workplace management, Standards, 5S training, Safety

I. INTRODUCTION

The present need of any organization is to deliver high quality product within the stipulated time, through constant development. Each Organization aims to have productive production with continuous improvement. To fulfil these requirements, 5S methodology is emerged for better production in the industries. 5S stands for 5 Japanese words: Sort (Seiri), Set in order (Seiton), Shine (Seiso), Standardize (Seiketsu), Sustain (Shitsuke). 5S is a quality tool that turns out in a systematic workplace complete with visual controls and order. In order to implement 5S successfully, the top most important factor is the commitment, participation and contribution of each member of the organization and firm support from the higher authority of organization. The Niraj Thermo Pvt. Ltd., Nashik aims for building it to a world-class level organization. Thus, organization adopted the concept of 5S for increasing the profit, standard of the company, working conditions, etc, and implemented the 5S technique successfully. The organization have various sections such as Stores & Maintenance, Boiler Section, Production, Quality & Packing, Finish goods and Administration section where the implementation of 5S had resulted in an enhancement in productivity, proper and safe workplace condition, increased profits and motivation to employees.

Section I contains the introduction of implementation of 5S methodology, Section II contains the related work which describes the previous research works, Section III contains

description of the 5S processes, Section IV contains the case study and detailed methodology carried out, Section V contains the observations in the case study, Section VI contains results and discussion, Section VII concludes the 5S implementation.

II. RELATED WORK

The study report of Rayan Ezzeddine (2020), focuses on the importance of 5S in service sector industries. His research work shows the effect of 5S on employee performance [1]. The impact of 5S methodology in manufacturing firm studied by researcher Sangode (2018). Researcher identified the performance improvement in workplace after effective implementation of 5S methodology [2]. Agrahari (2015) implemented 5S methodology during a small-scale industry to understand housekeeping and productivity. A case study was presented using 5S methodology and questions were asked to workers and their feedback was implemented to increase the storing place [3]. Chakraborty (2011) considered the significant difficulties going through limited scope ventures simultaneously as advancing their item. SSE (Small Scale Enterprise) isn't having huge monetary reinforcement and thus they are relying on the deals eared subsequent to selling their item. The item deals can best be duplicated through diminishing the worth of the item [4]. Hudli and Inamdar (2010) described the event of key areas which might be went to assess the adoption and implementation of lean manufacturing practice also

presented a number of the key areas developed to gauge and reduce the foremost optimal project so on enhance their production efficiency [5]. Chauhan (2010) shows the matter to sustain within the global marketplace for a corporation. Lean manufacturing may be a hymn of survival and success of any organization. The goal of lean manufacturing is to attenuate all kinds of waste therefore the cost of the merchandise is often reduced [6]. Gheorghe (2008) presents endless improvement strategy getting to improve manufacturing at Auto car Exhaust. The implementation of 5S has an instantaneous and significant effect on the sequence of activities within the work post, thus influencing the performance of the method within the analysed company. Industry and also showed the benefits and benefits of 5S implementation [7]. Upadhye et al. (2010) studied the importance of small and medium scale industries within the Indian context. Medium size manufacturing industry plays a crucial role in Indian economy. Their contribution to the economic development of the state is indeed significant. But the productivity level of those industries is sort of low as compared to a different country [8]. Kumar and Kumar (2010) described the steps undertaken for the implementation of 5S emphasizing on the advantage of a corporation. Also described the initiation and advantage of implementing the 5S [9].

III. 5S PROCESSES

4.1 Sort: Sort or Seiri is the first step in 5S which focuses on eliminating unnecessary items in the workplace. It makes the working area easier and safer to work. In sorting stage, we decide what is needed and is to be kept, what is unneeded and is to be discarded. We have to differentiate between what items, materials, tools are needed and how much is the frequency of usage. Red tag process is commonly used in sorting. Red-tagging a visual method of organization which helps to identify unwanted items and their usefulness.

4.2 Set in order: Set in order or Seiton is the second step for practicing 5S in any organization or industry. Set in order is the method of creating proper designated locations for all necessary things needed in the workplace. This is the act of arranging what is necessary to be easily identified in a specified place. The objective of this step is to organize the workplace. Each item needs to be handy to find, use and return.

4.3 Shine: Shine or Seiso is the third step in the 5S which is related to cleanliness. In industries shine is closely related to turn out quality products. Cleanliness ensures a more comfortable and safer workplace, as well as better visibility, which reduces retrieval time and ensures high quality work, product or service [10,11]. Daily cleaning activity is absolutely necessary to maintain a clutter-free workplace. Cleanliness is the responsibility of each and every employee and worker. Everyone enjoys working in a clean environment which ultimately increases morale and productivity.

4.4 Standardize: Standardize or Seiketsu is the continual employment of 3S activities i.e., Sort, Set in Order and Shine. It ensures high standard of any workplace management. After practicing the 3S activities, the next important step is to standardize the best practices that will strictly follow the defined order/structure only. For creation of this step, we have to create the Standard Operating Procedures (SOPs), daily checklists which will be visible and displayed at every workplace or zone. The checklist must have to fulfil the factors that it will carry all the 3S activities habitually. This activity will determine the best practices and will ensure that everyone performs their activities in their area. It will be beneficial for improving operation and workflow, will have better visual controls, better workplace standards.

4.5 Sustain: Sustain or Shitsuke is the last step in 5S. it is to make it a habit of maintaining the momentum of previous four S to ensure sustainability of the system. Sustain requires self-discipline without which it is impossible to maintain consistent standards of quality, safety and cleanliness [10]. This stage can be achieved by training the employees and worker to do simple things right. To successfully sustain 5S technique audit is required, it is a process of evaluating the proper implementation of 5S at the workplace. Conducting audits helps to ensure that the workplace is consistently following the 5S principles. Rewards and recognition program for people in the organization is done which motivates them to work more efficiently.

IV. CASE STUDY

The study was carried out in the manufacturing company Niraj Thermo Pvt. Ltd. Nashik. The company is a leading manufacturer and exporter of Thermocol Products like thermocol sheets, thermocol packaging, thermocol disposable. Due to the improper workplace management, lack of awareness among the employees, wastage of time in nonvalue added activities, less morale of workers, which resulted in low productivity. So, there was a need of 5S implementation in the company. All the rules were followed and 5S was implemented successfully.

Problem Statement

During the implementation various problems occurred, which are as follows:

- i. Unwanted equipment, scrap, not required items were present at the work area which affected the moral of the worker while working.
- ii. Accepted, rejected and rework material were not separated.
- iii. It was found that there was no proper utilization of storage space for raw material, rejected items/products, semi-finished products and finished products.
- iv. There was no permanent location for storage of raw material which resulted in wastage of time in searching different types of raw materials.

- v. There was no labelling of the sections. Sign boards and indication boards were not present. No SOPs were made.
- vi. Stop switches and breakers of machines were not clearly visible and access to them was difficult in emergency case.
- vii. There was no proper maintenance schedule displayed. It was difficult to perform maintenance because there was no data of previous maintenance.
- viii. There was no periodic cleaning activity taking place at the workstation. Cleaning schedules were not displayed. No responsibility was given for the same.
- ix. There was improper workplace management due to which there was a wastage in searching of tools resulting in low productivity.
- x. Standard procedures were not followed in the organization. First-in First-out (FIFO) was not practised. Concept of audit was not seen.
- xi. There was lack of knowledge and awareness among the employees and workers regarding 5S.
- xii. There was lack of motivation which resulted in unequal participation of employees and workers in different activities/works.

V. METHODOLOGY

At the start of 5S: Step-by-Step Implementation, each phase was thoroughly analysed and addressed using the P-D-C-A cycle. The step-by-step methodology is as follows:

1) Formation of 5S council

The objective of this stage was to improve the total participation at all levels from bottom to top management. And to develop a continuous improvement culture and to increase the spirit among the team.

5S Council comprised of Managing Director as Advisor, coordinator and reviewer, Group leaders for each zone, zone members.

2) Setup 5S Zones

The layout of the entire work area was obtained which involved complete plant layout and accordingly different sections were converted into small zones. Different teams were made in which there was the zone leader and one of them was zone member.

3) 5S training

In this stage the different training programs were conducted to create awareness among the employees and workers. Basic knowledge of 5S was given to the workers. Step-by-step implementation was explained to each team.

4) 5S launch

In this stage the management endorsed the 5S plan. Targets were set, policies and goals were made for Step-by-step implementation of 5S.

After the launch of 5S Step-by-step implementation plan was carried out as follows:

Sort (Seiri)

Following sorting activities were carried out:

1. All the unneeded items from all the zones were removed.
2. Raw materials were separated according to their grades.
3. Accepted and rejected materials were separated.
4. Accepted and rework lots were separated.
5. Tools were separated according to frequency of usage.
6. Finish Products were separated according to their type.
7. Important files, paper works, documents were separated.



Figure 1. Before After Photographs of Sort (Seiri)

Set in order (Seiton)

1. Overall work station was divided into different zones.
2. Gangways were marked with visible lines (floor tape/floor paint).
3. Tool board was created; names were given to each tool and tools were separated according to frequency of usage.
4. Files were organized and stored by giving names and numbers to make it easy to identify.
5. Stop switches and breakers were made clearly visible and access to them was made easy.
6. The rejected material was kept in the right place.
7. To identify the raw material colors, numbers, names were provided.
8. Different finish products were stored in separate rows.
9. Labels were given to each area. Sign boards and indication boards were displayed.
10. Access for fire extinguisher was given.



Figure 2. Before After Photographs of Set in Order (Seiton)

Shine (Seiso)

1. The workplace was divided into distinct cleanliness areas and responsibility of cleanliness was given to each zone member.
2. All floors have been cleaned.
3. Gangways were cleared.
4. All storing shelves have been cleaned.
5. All tools, equipment's and machines have been washed and cleaned.
6. All boards have been cleaned.
7. The supply wiring has been redone.
8. All safety related warnings, signs, labels, floor lines etc. were made easy to read.
9. All safety equipment's such as hand gloves, safety shoes, glasses were maintained in sanitary condition and were properly stored in an easily accessible and labelled location.
10. SOPs were made visible.
11. Cleaning schedule were posted which showed the time, frequency, responsibilities to clean areas of workplace such as windows, corners, walls, doors, floor etc.



Figure 4. Before After Photographs of Shine (Seiso)

Standardize (Seiketsu)

1. Checklist were made for each zone separately which served as visual signpost to ensure that the daily 3S requirements are carried out habitually.
2. The specific procedure was followed due to which tools, equipment, paperwork, furniture etc. were stored neatly in

- designated areas and were returned to their proper homes immediately after use.
3. Formation of Rules and Standard Operating Procedure (SOP).
4. It was made sure that all obligatory rules in the company will be obeyed.
5. Result of previous audits were displayed which were visible to each team member.
6. Maintenance record was displayed which clearly stated when last maintenance occurred.
7. Areas for improvement were identified during the previous audit, had been addressed and completed.
8. Weekly audits followed by a monthly audit were taken.
9. All records were displayed on notice boards.



Checklist were made and displayed for each zone separately.



All records were displayed on notice boards



Weekly Audits followed by a monthly audit were conducted.

Figure 5. Before After Photographs of Standardize (Seiketsu)

5s Checklist		DATE: 2020 MONTH/YEAR		
Responsible	Zone 1 - STORE/MAINTENANCE			
	5s	5s Checklist	Yes	No
Zone Leader Kajal Akhri	SORT	1) Are unwanted items removed from the area?	0	1
		2) Are the floor material separated according to their grade?	0	1
		3) Are the maintenance tools kept in the right place?	1	0
	SET IN ORDER	4) Are the items kept in the right place?	1	0
		5) Are the rejected material kept in the right place?	1	0
		6) To identify like material is there any Name Color Numbers printed?	1	0
SHINE	7) Does the adhesive bases polythene bags/markers are kept in right place?	0	1	
	8) Are the gangways clear?	1	0	
Zone Member Mangal Garde	STANDARDISE	9) Is the result of previous audit displayed and is it visible to each team member?	1	0
		10) Did the team taken action in the work zone which was not identified in the previous audit?	0	1
	SUSTAIN	11) Is the time allotted for 5s activity?	1	0
		5S Score	0	10
	Comment: Overall score 84/100 = 73%	5S: 1) Better than previous audits 2) Satisfactory	4) Cleaning is done regularly 5) Satisfactory	5) Satisfactory

Figure 6. Sample of Checklist which was displayed in the case company. (The above checklist is of Stores/ Maintenance Zone only).

Sustain (Shitsuke)

1. Regular 5S training programs were conducted for awareness and imparting 5S knowledge to the employees and workers.
2. There was a scope for Worker’s participation in the decisions and activities in their zones which made them feel proud to be a part of this 5S activity.
3. Time was given to 5S activity as a result 5S became a part of the culture of the company.
4. 5S was sustained through regular 5S audits, internal competitions between the teams.
5. Rewards and recognition program for people were conducted.
6. Team spirit and discipline were developed by motivation to employees.
7. Photograph of each zone were taken during each audit for future reference.
8. 5S slogans and posters were introduced.
9. The teams took the initiative to make improvement to the workplace that were not identified during the last audits.



Figure 7. Before After Photographs of Sustain (Shitsuke)



Recognition was given for best practices.

5S posters were introduced.



Reward and Recognition Program.

Figure 8. Before After Photographs of Sustain (Shitsuke)

VI. OBSERVATIONS

1. There was a lack of awareness regarding 5S, lack of communication between the top management and employees and workers which lead to poor management. The success of implementation of 5S solely depends on, overall participation from the higher level of management to the lower working group. 5S implementation was not possible without training and awareness to the employees and workers. The different training programs helped to achieve the desired outcomes.

2. Initially there were many obstacles during the implementation of 5S as the employees and workers were not adaptive towards the 5S activity. Motivation in the form of rewards, recognition to the people in the organization helped to overcome many of such obstacles.

3. Periodic audits and surveys helped to ensure that the workplace was consistently following the 5S principles and also the progress of implementation of 5S. Checklist were important for audits which displayed the current scenario of the work area.

4. The First-in First-out (FIFO) was started to practice at the workplace. There was ample of storage space after this practice which ultimately resulted in high productivity, and reduction in time. The 5S implementation resulted in improvement of the case company in many ways for instance,

- Proper workplace management.
- Safe and clean environment.
- Reduction in time for searching tools, equipment's, material.
- Prevention of unnecessary of movement of material and resources within the industry.
- Morale of workers was substantially increased.
- Communication gap between the people of organization was reduced.
- Maintenance and cleaning activities started to take place as per the respective schedules.
- SOPs were made visible and were followed.

Finally, the implementation of 5S brought about a drastic change and increased the standards of the case company.

VII. RESULTS

Total productivity maintenance and its sub tools 5S play an important role any organization to improve productivity efficiency. The implementation of 5S is based on the time analysis. Time analysis mostly focuses on operation or process time. It makes comparison of operation or process time for before and after the implementation of 5S. It shows the time taken by the process, manufacturing of product, searching of tools and materials, etc. This work shows the effectiveness after implementation of 5S in studied industry. Author recorded and compared processes with previously available data and record. The effectiveness of 5S implementation for various activities are summarized in Table. 1. The process effectiveness has calculated in one point scale. The process effectiveness explanation is mentioned below. Since effectiveness reading is given out of 1, for example effectiveness of utilization of space is

taken 0.5 out of 1 before implementation of 5S now after it is 0.8 out of 1, similarly the effectiveness reading is given to other processes. The summaries result shows that the overall change is 80% and productivity has improved by 25% after effective implementation of 5S methodology. The calculated results are estimated from the regular audits been conducted by the industries. The values are sum of multiple checklists.

Table No.:1 Process Effectiveness Before and After Implementation of 5S

Sr. no.	Process Parameters	Before	After
1.	Utilization of Space.	0.50	0.80
2.	Elimination of waste.	0.45	0.80
3.	Material searching rate.	0.50	0.80
4.	Tool searching rate.	0.50	0.85
5.	Cleaning consistency.	0.40	0.70
6.	Manpower Utilization.	0.50	0.70
7.	Energy Consumption.	0.65	0.70
8.	Work efficiency.	0.55	0.75
9.	Safety.	0.75	0.80
10.	Rejection rate.	0.85	0.95
11.	Rate of Acceptance.	0.80	0.90
12.	Communication within the plant.	0.50	0.75
13.	Awareness/Importance of 5S within the plant.	0.20	0.90
	Overall Change in % (Productivity)	55%	80%

The before and after changes in each activity after 5S implementation is graphical represented in Figure 9. The various observation after completion of study is given in the next section.

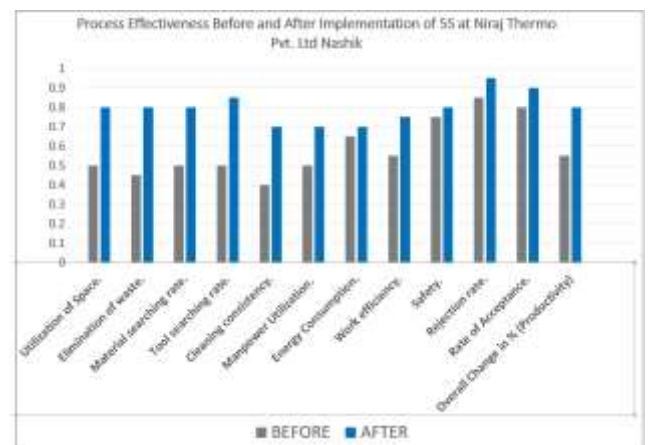


Figure 9. Bar Graph Showing Process Effectiveness

DISCUSSION

- Before sorting there was only 50% space for storing raw materials, finished products, etc. but after implementing sort the Storage area was increased upto 80%.
- Before set in order there was wastage of time in searching raw materials, tools, etc. which resulted in long cycle time and low productivity, but after implementation there was reduction in cycle time upto 12.5% i.e. 1.5hrs.

3. Before there were no cleaning schedules posted which resulted in low cleaning consistency. After implementation the cleaning consistency increased by 30%.
4. The rejection rate was lowered by 10%.
5. The 5S implementation resulted in increase in productivity upto 25%.

VII. CONCLUSION

The research study on packaging and manufacturing industry showed that 5S implementation has a remarkable impact on the workplace efficiency improvement. This study shows that process effectiveness after 5S implementation has been remarkably improved by 25%. Thus, it can conclude that sorting of things, set in order required item based on the frequency of requirement, proper maintaining of workplace directly contribute into productivity. Standardizing and sustaining results in ease for maintenance of machine and equipment and ultimately improve the productivity.

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