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Implementation of 5S in Scientific Equipment Company

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Abstract: ***The purpose of this paper is to demonstrate how an age-old Japanese manufacturing concept 5S can be helpful is bringing business excellence in the scientific equipment industry. The primary point of interest in this paper is to highlight the 5S approach and also the implementation part of it. The implementation steps help to identify the potential for improvement and the existing gaps as compared to a benchmark. The study was made in each section of the selected company by conducting Gemba i.e. physical exploration in order to identify the gaps. Once the gaps and the concerned areas were identified, the implementation phase begins and the result for the same was discussed using the two case studies implemented in the industry. Subsequently, the paper discusses how the implementation of 5S leads to the reduction of wastages such as searching time, improvement of workplace safety, health, and cleanliness. Since the entire activity i.e. identification of gaps and implementation are Gemba-based, the steps are easy and deterministic in nature and the improvement is clearly visible/ measurable. It was recognized, both from the case studies and from the industry knowledge that 5S activities not only improve workplace safety, health, and cleanliness but also lead to higher quality and productivity and hence market competitiveness. The success, however, depends on the chain of command and are top-driven at least at the beginning phase.***

Keywords: 5S, Approach, Problem Analysis, Root Cause Improvement Ideas.

I. INTRODUCTION

5S is the Japanese term used in manufacturing and production industries for implementing the best technique for production as well as 360-degree development of industry for making product almost defect free (Mali & Bhongade, 2018). 5S is a philosophy and a methodical approach to organize work and cultivate work practices in order to improve productivity and efficiency by keeping the workplace, clean, sorted and organized. It involves five steps, as the name suggests. These are named after Japanese terms Seiri, Seiton, Seiso, Seiketsu, and Shitsuke (Jaca, Viles, Paipa-Galeano, Santos & Mateo, 2014).

Each of these terms is explained below:

1. Seiri or Sort refers to the sorting of the items in the work area, keep the items that are needed and discard the unusable items. This will de-clutter the workplace and make more productive space to utilize.
2. Seiton or Straighten refers to the process of keeping the items in a particular order by using principles of ergonomics and ensuring the all items are placed at the correct place of use. With everything in a designated place, this will de-clutter the space and avoid wastage of movement and time in locating the items as per use.
3. Seiso or Sweep refers to a thorough cleaning of the workstation, tools, and equipment. This will make it easy for operators to easily identify any non-conformity such as oil leak, or any breakage of the machine. This will save precious time, which would otherwise be wasted in fixing breakdowns or preventive maintenance.
4. Seiketsu or standardize is the process of standardizing the activities carried out so far in the 5S methodology. Standardization facilitates everyone to follow the same standard operating procedures to keep their work area sorted, in order, well organized and clean.
5. Shitsuke or sustain refers to the practice of sustaining on a continuous improvement basis, all the activities discussed so far. This is done by conducting regular audits. The outcome of this step is that 5S becomes an organizational culture and responsibility of everyone in the organization.

1.1 Research Gaps

Following gaps are identified:

Gap 1: No literature is available on 5S practices in surgical equipment manufacturing industry.

Gap 2: 5S practices in surgical equipment's manufacturing industry are not explored and not much has been done in the Indian context.

II. LITERATURE REVIEW

To maintain the workplace in proper order, there are 5 keys, namely seiri (sort), seiton (set in order), seiso (shine), seiketsu (standardize), and shitsuke (sustain) (Bavo-Moriones, Bello-Pintado & Merino-Diaz de Cerio, 2010). These keys are expected to reduce waste, optimize performance & productivity, and increase cleanness. Sort refers to the elimination of inventories that are not required. After sorting the next key is set in order, which refers to the effective storing and placing of inventories. The reason for the set-in-order is to make the process of inventory identification easy and accessible for the workers through labelling. The third key, shine focuses on the cleanliness of the workplace. Standardize refers to the standardization of most effective and the best tasks in the working zone by considering sort, set in order, and shine. The last step is to sustain, which is considered to be the most difficult task as it mandates to stick the practices every time in the future.

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In Japan, this 5S is used as a philosophy while in the USA and the UK it is used as a technique.

5S was originally used as 3S in Japan, in the manufacturing firms during the 1950s, and developed in 5S, the current philosophy (Suárez-Barraza & Ramis-Pujol, 2012). The philosophy of 5S affects the process. Using the concept, the firms can maximize the efficiency of the process and can maintain a standardized, clean and high performing process which eventually reduces the cost of the final product. Now in this concept, 6^{th}S is evolved, which is safety. This philosophy now ensures the safety of the workplace in addition to cleanliness and efficiency. 5S creates a base for implementation of the TQM (Khanna, 2009), which provides the driving force for TQM. 5S can be seen as the fundamentals for the construction of process continuous improvements.

According to (Qsada & Qsada. 1991) 5S builds an environment in the companies and organizations that are quality friendly. Integration of 5S and ISO: 9001:2000 is also an achievement in the field of quality. According to (Khanna, 2009), 5S ensures the participation of every single employee present in the organization to achieve the expected results. The participation of the employees is a basic and essential need for 5S. In his paper, he presents the idea of the creation of quality focused environment by utilizing the expertise of 5S from the experts and commitment of the leaders to achieve it. Leading on the basis of the prior experience is the most important in implementing TQM. The less competitiveness of Indian industries is due to the absence of TQM. As TQM is directly related to 5S, implementing 5S ensures the way towards TQM. This will lead to higher competitiveness of the organization. 5S should not be considered as a single step, but it must be treated as the master key to exploring the opportunities for improvements. According to him, there are small scale, medium scale and large-scale firms exist in India. According to (Gapp, Fisher & Kobayashi, 2008), 5S can be immensely helpful in providing the employees with a conducive work environment by improving the workplace condition, elimination of non-value adding activities (wastes), leading to high efficiency. It also facilitates higher employee engagement, enhanced morale and motivation, which leads to positive energy in the workforce, leading to higher productivity.

(Kanta, Tripathy & Choudhary, 2005) and (Kumar, 2019) concludes that successful implementation of 5S (which also includes total employee involvement with management taking ownership of initiatives) might lead to greater employee participation, better performances leading to higher productivity and better quality of output, with a healthy and happy workforce in charge of the activities. (Ahuja & Randhawa, 2017).

According to (Withanachchi et al., 2007), 5S in a hospital setting in alignment with TQM, the results showed increment in employee efficiency and satisfaction level, which in turn reduced the readmission rates to 0.4% from 0.8%, while the average length of stay also reduced from 4.9% to 4.3%, which was a reflection of the inherent benefits of 5S.

III. APPROACH

To run a business successfully it is essential that the organization's performance is improved constantly. The most effective and simple approach for doing so is Plan, Do, Check and Act (P-D-C-A). The P-D-C-A cycle also helps in implementing 5S activities. Each phase is analyzed and addressed using the P-D-C-A cycle for effective implementation.

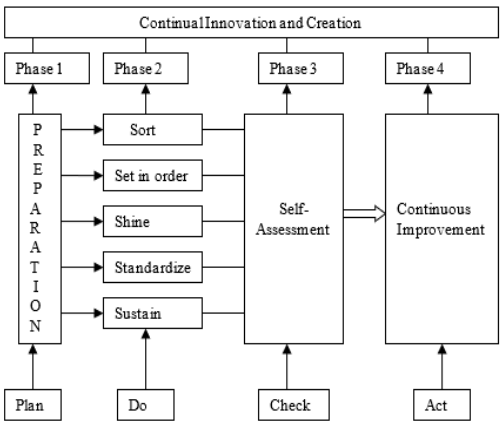

Figure 1: P-D-C-A Cycle

The plan and do phases are considered to be enablers and the check and act phases are considered as results that are achieved. These phases can be detailed as follows:

Plan phase: The plan phase also known as the preparation phase. The 5S process begins with this phase and forming the 5S council and setting the 5S council are the activities performed in this phase. A schedule for planning all the activities is prepared. The 5S council is formed in this phase for increased participation for constant improvement and developing environment at all levels. The members of this council are the chairman, coordinator, leaders, facilitators and employees. The responsibilities of each of the members are as follows: **Chairman** will communicate with the other members and provide the support needed for implementing the activities. The c**oordinator** provides information and motivates the employees. He promotes, supervises and coordinates with the team for the 5S implementation. **Facilitators**- ensure that the plan is effectively implemented and **leaders** monitor and guide the direction to implement the 5S activities. They train and conduct a meeting for analysing the progress of the implementation. **Employees** participate in the activities with full dedication and work with determination towards the 5S program implementation. The 5S training program is given to the members for ensuring a step by step implementation of the program. The policies, objectives and goals of the 5S program are explained in the 5S launch. (Jagusiak-Kocik, 2017, (Dudin, Frolova, Gryzunova & Shuvalova, 2014).

Do phase: It involves the implementation of the 5S activities by analyzing the problems lying in doing it, determining the solutions for those problems and evaluating the decisions taken by the management for the implementation. Brainstorming is also an activity of this phase which is done to identify all the possible problems.

The solutions for the problems are then proposed and decisions are taken from the top management to implement those solutions. These levels of implementation help in a healthy and progressive work environment. (Jagusiak-Kocik, 2017, (Dudin, Frolova, Gryzunova & Shuvalova, 2014).

Check phase: In this phase, the members involved in the 5S implementation go through the process of self-assessment. The activities performed for the implementation are checked if they are effectively implemented or not. Internal audits are held in this phase for this assessment and measures are taken to make improvements if required (Jagusiak-Kocik, 2017, (Dudin, Frolova, Gryzunova & Shuvalova, 2014).

Act phase: This phase involves the practising of 5S activities as work culture and bringing them into the habit of work. reward systems are implemented for employees who follow the 5S approach effectively and the 5S certification is registered. The goals achieved are compared with the actual goals and based on them the employees are rewarded. This creates a productive and developed work culture where employees understand what and how they have to perform in their tasks.

(Jagusiak-Kocik, 2017, (Dudin, Frolova, Gryzunova & Shuvalova, 2014).

IV. RESEARCH PROBLEM

The Company under survey is a leading scientific equipment manufacturing company of suction units, autoclaves, High Pressure, Aerosol Disinfector and all types of Surgical Scientific and Laboratory Equipment's in SAHA, Haryana, India. It was observed that the shop floor areas were severely plagued by poor working environment resulting in low organizational efficiency. The disorganized workplace resulted in high dissatisfaction to the workers, thereby resulting in increased cost of space used and increased searching time. The occurrences of mishaps and time taken to completed work was additionally high, which was likewise reason of misfortune to the benefits. The examination work has been intended to lessen dismissal and increment effectiveness by usage of the 5S procedure. A contextual analysis had been led at an assembling Plant concentrating on help critical upgrades in work environment and housekeeping.

V. RESEARCH METHODOLOGY

Beginning with a viable program to actualize 5S requires watchful arranging, plan and execution of the business changes expected to accomplish the ideal enhancement objectives. Usage ought not to start except if top administration is firmly supporting the exertion with an understanding that numerous business forms must be changed. Few aspects mentioned below need to be understood before starting the implementation process.

5.1 Misconceptions about 5S implementation

1. 5S is just a Japanese way of simplifying the thing but in real 5S is more of a problem-solving technique.
2. 5S is all about clearing but in reality, it is just a component of 5S.
3. 5S is just a tool, but it is not just a tool it emphasizes the practice of being proactive versus reactive.
4. Put up some safety signs and floor tapes and you have implemented 5S. But in reality, it is much more than this.

5.2 Making 5S a part of every employee daily routine

1. Employees must be involved in the process of red tagging the items.
2. Employees must be educated on the values of 5S as a "tool" instead of just as a philosophy.
3. Employees must engage in the processes happening on the work floor.

5.3 Barriers and Enablers

There are few barriers and enablers in implementing 5S in the organization.

Table 1: Barriers and enablers in implementing 5S

Barriers	Enablers
Improper planning	Proper planning
Lack of training	Quality workshops organizing regularly
Inability to change	Learning and accepting things
Top management apathy	Top management involvement
Lack of communication	Open talk regarding problems in firm
Inadequate attention to internal and external customer	Implement cross business

VI. CAST STUDIES, RESULTS AND DISCUSSIONS

6.1 Case study 1

Objective: To clear the path for movements and create a more organized and systemic inventory of material.

Analysis of Problem: There was not an obviously characterized way for developments of the parts from one station to other. Working region isn't sheltered moreover. There were odds of wounds to the specialists. It likewise required investment by the specialist to discover the parts in light of the fact that no appropriate checking was there as appeared in figure 2.

Root Cause: It was observed during the visit to the finish goods stock area that there was no standard defined for the finished goods material, many parts were mixed up with other, no proper segregation was done in the finished goods section area. Workers were not given any training regarding the benefits of keeping the working area a systematic place. Workers did not place the inventory's rack in their right position and also no identification marks were given to identify the different parts.

Improvement Idea: Lines on the floor with the help of paint can distinguish the walking area. Training can be provided to them about the improvements. Banners were made to segregate various finished goods and their respective area was allocated.

The system is to be followed regularly by the worker so to maximize and optimum utilization can be done of the stock and no parts are lost or damaged as shown in figure 3.

Figure 2: Conditions before implementing 5S

Figure 3: Conditions after implementing 5S

Results and Benefits:

1. There is not any difficulty in the movements of materials, walking of the workers because walking area is clearly defined now.
2. 15 square feet area was saved by arranging the inventories.
3. Cost Savings:

   Cost of 1 square foot area = Rs 2000/-

   Area saved = 15 square foot.

   Savings = Saved area (sq foot) × cost per square foot

   = 15 × 2000= Rs 30000 /-
4. Walking area is safe now and chances of injuries were reduced now.
5. Area is organized much more than before.
6. Inventories are prevented from corrosion and spoil.
7. Workers developed a habit to maintain this improved system on daily basis.
8. It increased the self-confidence and pleasure of the workers and employer.

6.2 Case study 2

Objective: Standardization of dummy parts and their proper storage to avoid damage.

Problem Analysis: Dummy parts were found misplaced and damaged, workers were wasting time in looking for parts required for processing, ill-advised conditions were driving the parts to harm, extra expenses were paid for making new dummy parts as shown in figure 4.

Root Cause: It was observed on the line that there was no standardized place to keep the dummy sample parts and they were kept in the plastic bin on the table and no segregation and marking of these dummy parts was done as if not stored properly. These dummy parts could fall and get damaged or broken resulting in a loss.

Improvement Idea: Two unused steel baskets were arranged to keep the dummy parts. These dummy parts were properly cleaned and painted and properly kept in the steel baskets. Workers needed to be told to place the parts at the provided place after use. So, to avoid the misplace or damage of the parts as shown in figure 5.

Figure 4: Dummy parts in unorganized manner

Figure 5: Dummy parts in organized manner

Results and Benefits

1. Now workers do not need to waste the productive time searching for dummy parts.
2. Dummy parts are prevented from damage now, misplacing of dummy parts is eliminated.
3. Area is organized much more than before.
4. Inventories are prevented from rust and destroy.
5. Workers developed a habit to maintain this enhanced system on daily basis.
6. It increased the confidence and pleasure of the workers and employer.

Below is the Summary showing Improved and reduced parameters after implementation of 5S.

Table 2: Results of 5S Implementation

Improved	Reduced
Efficiency of the plant	Delays
Morale	Set ups
Quality	Bad habits of workers
Safety	Wastes
Space utilization	Searching time
Visibility of the process	Dangerous conditions

VII. OUTCOME OF 5S IMPLEMENTATION

With the implementation of 5S, the organization saw increased productivity and minimal wastage in and around the workplace. This increases the overall investment returns. Removal of unnecessary items and efficient workplace are two main factors which lead to increased productivity. Further its implementation improved workplace safety with all the things assigned to their designated places reducing accidents or injuries at the workplace. The wastage in every aspect is reduced as the workplace is clean and clear and more organized workplace. There was a sudden increase in worker's productivity as their work is streamlined; there are productive changes in the overall design of the workplace and encourages worker involvement for long-term workplace maintenance. Organization have now bigger and organized storage places and capacity. This further resulted in increase of overall morale of all employees.

VIII. CONCLUSION

The 5S technique is a very precious technique for any organization because it facilitates the realization of motivation for employees, self-working environment, the safety of employees and good quality for customers. This technique is very useful and effective for such a highly developing world, which requires quality improvement continuously. Past experience of successful implementation of this methodology in the Japanese industry gives the best inspiration to all over the world for the necessity of continuous improvement. The case study discussed in the paper shows that best result outcome only from good practices. Toyota manufacturing company is a well role model for inspiration for results of Best 5S methodology. The study has shown, how to organize things in a way such that everything has a place and everything is kept at the right place. Secondly, you will know where the problem lies. When everything is in place, in a systematic way then you need not to search for the things. Things will run smoothly even in case of an emergency. Everyone in the scientific manufacturing company must believe that the 5S practises is here to stay and is a way to sure success.

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Shaman Gupta holds a bachelor's and master's degree in mechanical engineering from Kurukshetra University, Kurukshetra, Haryana, India. Presently, he is research scholar at National Institute of Technology, Kurukshetra, Haryana (India) and working as an Assistant Professor in the Department of Mechanical Engineering at Maharishi Markandeshwar Deemed to be University, Mullana, Haryana (India). His main research area is lean manufacturing. Shaman Gupta is the corresponding author and can be contacted at shamangupta9@gmail.com.

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