An Extension of 5S to 6S – A Lean Six Sigma Tool For Design of Workplace

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Abstract

With an increasing market competition for better quality product with lower operating cost, safety of worker is getting crucial, prompting the need to extend 5S to 6S, Safety. Lean Production and Six Sigma are commonly and widely used business improving techniques where most of the organizations struggle on identifying the starting point during implementation. This is where 6S becomes the true solution. 6S is a basic and easy tool to implement for an approach to create an orderly and safe workplace. This paper undertakes a detail study of 6S and its successful implementation in workplaces like in production line and its extension to other work environments such as health care, construction, etc.

Keywords: 5S, 6S, Extension, Work Place

1. Introduction

In this twentieth first century of globalization, competition has become an inevitable factor. In any kinds of organization, the key to existence is to provide better products or services, which is only possible through continuous improvement. Change is the only constant factor in this world. In this highly competitive global market, we are expected to give more than 100% with same effort resulting in better yield and better efficiency without hurting anyone and with lower operating cost and lower scrap. In the race of making more profit and deliver quality services, there is always a challenge to create better work environment and keep employees satisfied and motivated. To produce lower waste and lower operating cost along with reliable products and services, there are two important tools, Lean and Six Sigma. These tools are by far the best to implement easily and effectively. On the other hand, the implementers, also called managers of the organization always have hard time to find the initiating or starting point of change. Most of the companies fail to implement Lean Six Sigma at early phase because they simply do not understand where, when and how to implement those tools. This is the time when 6S becomes the powerful tool to provide a starting point. 6S allows managers to better understand the work environment using different Visual signs and also set the starting baseline for Lean Six Sigma. [2, 4, 5, 9]

1.1 What is 6S?

6S is the fundamental pillar to the success of Lean and Six Sigma. 6S is a culture, not just a methodology in any organizations involving all the employees of the organization to create efficient and effective workplace with appropriate safety considerations. It was first originated in Japan to create the organization clean and standardized workplace. A better and well organization means a safe, efficient and productive operation which will boost the morale of employees and motivate employees to perform task safely and take ownerships on their task. Japanese invented 5 Japanese words with the first letter ‘S’, which was later adopted as 5 English words that also starts with letter ‘S’. Later, in industry, managers started using Safety as 6th S. [1, 2, 4, 9]

1. Seiri (Sort) – Segregate and Red Tag
2. Seiton (Set in Order/ Straighten) – Arrange and Identify
3. Seiso (Shine) – Clean
4. Seiketsu (Standardize) – Outline and Label
5. Shitsuke (Sustain) – Self – Discipline
6. Safety – Ensure and Effect Safety
1.2 Objectives of 6S
- Create safer and better work environment
- Boost employee morale and motivate to take ownership of responsibilities
- Create fundamental pillar for Lean and Six Sigma
- Reduce Inventory by not using unnecessary items and better resource utilization
- Reduce set – up time as workplace is organized better and orderly
- Improve communication between workers using Visual Signs

2. History of 6S
It has been found in the literature that Japan was the first place to invent and utilize 5S around 1970s. However some do believe that the method might have been invented earlier. From many literatures, it is found in common that after World War II, Toyota founder, Sakichi Toyoda, his son Kiichiro and Chief Engineer Taiichi Ohno developed Toyota’s Production System (TPS). On their visit to assembly line at Ford, they realized the excess waste, over production and over waiting that led to layoffs and rehires. Also, Toyoda visited supermarket chain Piggly Wiggly and noticed that the inventory ordering and stocking was based on the demand which helped them to understand and implement the Just – In – Time process into 5S methodology. The 5S tools formed by Toyota gave each employee a feeling of ownership of process which led them to feel the level of importance and encouragement that each job was important to the process and end product. The 6th S is then added mainly by manufacturing industry, which is Safety. [8]

3. The 5 S’s
The 5S’s are Sort, Set in Order, Shine, Standardize and Sustain. [1, 2, 4, 5]

3.1 Seiri (Sort)
It is the first step of 5S and the important one because this process helps to distinguish the necessary items among unnecessary items. This is the process of sorting and keeping all the essential items through all the available materials, tools, equipment, etc., in the workplace. After performing this step, it can be known that which items are needed and which are not. It also helps to reduce the waste material, damaged parts and tools, and unwanted products in the workplace. Likewise, it creates the workplace organized, safe and clean which lead to better efficiency on finding needed tools or searching any items, hence reduce the setup time and operation time.

In many manufacturing operations, it has been found that a program called Red Tag is used to sort efficiently.
3.1.1 Red Tagging
It is a system of assigning a red label to those items that are distinguished as unwanted or unnecessary in the workplace. The goal of using Red Tag is to label and remove unwanted items from workplace and also to find the alternate use of the item if it is possible, if not dispose safely. Red Tagging is simply a label that has date, location, item name and reason to be tagged as shown in Figure 2, which was used in Longview Fibre Paper and Packaging Inc. during the 6S project conducted.

![Red Tagging Sample](image)

Figure 2: Red Tagging Sample used in Longview Fibre for 6S Project

Before performing Red Tagging, there are list of questions to be asked; questions may vary depending upon the workplace but here are some questions that can be asked in any workplace.
- Are items needed to perform daily task? If no, tag it.
- Are items just left around in the workplace? If yes, tag it.
- If there is doubt on items, tag it.

3.2 Seiton (Set in Order/Straighten)
This is the second step of 5S. Once the unwanted items are taken away, it is the process of creating place for everything remaining; “Place for everything and everything in place”. This step focuses on arranging tools, equipment, materials, etc. in proper order for the easy and efficient access. Those items can be arranged by using different types of visual signs like tapes, labels, using designated location, shelves; making sure everything is at “point of use”. To support this theory, many organizations use the time rule like 10 seconds or 5 seconds rule to make sure items are easily accessible. At Longview Fibre, 5 second rule was applied to make sure all needed items are accessible within 5 seconds in production line by operators. This step also provides opportunity to address the safety improvement and make sure all the safety precautions are followed to access items. [7, 11]

3.3 Seiso (Shine)
This is the third step of 5S that focus on cleaning the waste, dust and keep workplace neat and clean. During the process of shining or cleaning, machine, floor and workplace environment is swept, sanitized and cleaned. Depending upon the workplace, cleaning jobs can be different. There will be two phases of shining or cleaning. First phase is to check the immediate cleanliness on workplace or machine, check for leaks, dusts, paints, or anything that can be taken as dirty. Second phase is ongoing commitment; this is creating a culture of cleaning by cleaning and restoring the items at the end of the shift. In most of the Japanese companies, cleaning is the part of their regular job in manufacturing industries. At Longview Fibre as well, cleaning was done at the end of the day for all the production lines. [6, 11]

3.4 Seiketsu (Standardize)
This is the fourth step of 5S and the important and critical one because this step determines the control and consistency of above 3 S’s. The goal of this “S” is to create the standard rules in organization so that the above 3S’s can be performed constantly and consistently. Standardizing can be done by creating checklist or housekeeping
schedules in the workplace. By creating standard processes, it also helps to create the sense of awareness and responsibility among the employees in the organization.

3.5 Shitsuke (Sustain)

This is the last step of 5S and the most important one. The word itself has its meaning; it is to sustain the above mentioned 4S’s. Sustain means to maintain standards and keep performing the 4S’s in safe and efficient manner day after day and year after year making the culture rather than just a methodology. This requires the team effort to support the continuous and ongoing improvement in the workplace. At the same time, it is also very essential for everyone in the organization to understand why they are following the standards and processes; otherwise there might be huge resistance in the process. The check list is created in earlier step which will help employees to perform their daily duties every day and all the time. It will increase the employee morale and make them aware of their contribution to the safer workplace leading them feel pride on their work and organization.

4. 6th S: Safety

Safety is an inevitable and crucial value within any organization. From house to financial institution to manufacturing facility, it is very important to perform one’s task safely. Now days, companies are realizing Safety as major concern. From first step of 5S’s to the end, it is very important to stay safe, that is the reason sometimes 6th S, safety is taken at the beginning as well. During this step, it is employee’s responsible to look after hazard and report correctly so that it can be taken care in right way. It is the duty of employee in any organization to work safe and let other employees to stay and perform the task safely. Along the way, the top management should initiate and support safety program for the long lasting culture and discipline in the organization. [6, 11]

5. Implementation of 6S


Longview Fibre Paper and Packaging, Inc. is one of the larger paper and corrugated box producing industries in US West Coast region. The 6S project was implemented in one of the production lines of a plant during 2012. Following are the methodologies and findings of the implementation of 6S project.

1. **Sort**: In the production line, only essential items were kept. Three laws were applied; If it’s trash, **discard it**, If it’s needed, **sort it**, and If it’s not needed, **red tag it**. The workplace looked like in Figure 3 and 4 before and after the sorting and Red Tagging.

![Figure 3: Before Sorting and Red Tagging](image)
2. **Set In Order**: Everything after red tagging was arranged properly and in organized manner. **5 second rule** was applied to access tools easily and safely. Visual Controls were also used such as marks and labels and designated locations for tools. Figure 5 and 6 are the results of Set In Order step.

![Figure 4: After Sorting and Red Tagging](image1)

**Figure 5: Before Set In Order**

![Figure 6: After Set In Order](image2)
3. **Shine**: Cleaning was performed by the crew on the production line. Figure 7 and 8 gives the before and after view.

![Figure 7: Before Shining (Cleaning)](image)

![Figure 8: After Shining (Cleaning)](image)

4. **Standardize**: A Standard checklist was created for an operator in production line so that he can go over the checklist at the end of his shift. The 3 Hirano’s “NO Principle” were applied;
   - NO unnecessary items
   - NO Mess
   - NO dirt

Everyone was provided with their duties and responsibilities for the above 4S’s. The housekeeping routines were prepared for the production line and each operator was to follow the routine and perform the task. Figure 9 is the model of the draft of housekeeping routine.
5. **Sustain**: This is the method of reviewing the standards of the 6S program. The standard scorecard was used to review the program. The required 6S audit program was devised as:

- Work Team Leaders 1/week
- Area Supervisors 1/ month
- Plant Manager 1/ quarter

This is the ongoing step mainly to create the good habits and discipline of performing other 5S’s.

6. **Safety**: Safety being the company’s value, safety is taken as the prime factor to perform any task. The main and first question asked is “Are the areas safe?” The company has the safety program to look out and report if any safety issues are seen in the workplace. Top management supported the program by providing incentive every month for best safety issue and measures taken. This encourages employee not only to look out for safety issues but also to think towards the improvement of the workplace by applying proper measures. During 6S project, the first and important part is PPE (Personal Protective Equipment) and make sure the people performing 6S project have proper gloves on, safety glasses, hard hats and other necessary PPE as needed. Then, the production line was visually inspected to make sure there are no hazards or hazard areas. If there is any chemical unmarked then safety team was reported to take necessary actions. The plant had really good safety records after adding Safety in the 5S project.

6. **Advantages of 6S** [1 – 5, 11]

Following are the advantages of 6S.

**1st S: Sort**
- Organized and better identification and arrangement of right tools
- Cost Reduction on unnecessary items (tools, equipment, raw materials, etc.)
- Reduce the stocking cost
- Better use of the working area
- Reduce loosing tools
- Identification of Resource Utilization

**2nd S: Set In Order**
- Increase in efficiency and effectiveness
- Decrease the time to find needed items (tools, equipment, raw materials, etc.)
- Improve the safety in the workplace

**3rd S: Shine**
- Better cleanliness of workplace lead to safety improvement
- Reduction in accidents, trips or any kinds of workplace hazards
- In manufacturing workplace, better maintenance for machine

**Housekeeping Routines**

<table>
<thead>
<tr>
<th>Packaging Table</th>
<th>Responsible:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily Activities</td>
<td>Weekly Activities</td>
</tr>
<tr>
<td>Cleaning Articles</td>
<td>Day:</td>
</tr>
</tbody>
</table>

Figure 9: Draft of Housekeeping Routine
4th S: Standardize
- Better understanding of duties and responsibilities among employees
- Create the habit of performing 3S’s timely and in correct way; creating culture

5th S: Sustain
- Increase awareness and employee morale
- Motivate the employee to keep workplace safe and efficient
- Improve the employee and management communication

6th S: Safety
- One of the crucial factor in any workplace
- Without being safe, there is no any efficiency and production
- Being safe, improves productivity and employee satisfaction

7. Challenges of implementing 6S
Following are the challenges of implementing 6S project in workplace: [1 – 4, 6, 11, 12]
- Resistance to change (I have done this from last 20 years, its working, Why to change?)
- 6S is the slow and steady process of implementation; many cannot take it to end
- Leadership is the key; constant monitor from Work Leaders/ Managers/ Management, sometimes commitment issue might come from Management
- Lack of creating standard process on assigning responsibilities and schedules
- Lack of understanding about 6S as culture and discipline than only methodology
- Environmental issue might arise due to use of paints/solvents to clean and also disposing of unwanted items can create issue on waste management

8. Conclusions and Future Work

8.1 Conclusions
6S system is simple and easy to implement; however many organizations have not noticed the benefits of implementation of 6S. In the global competitive market, organizations are racing towards making larger profit which is only possible by lowering operations cost, waste and increasing productivity and efficiency. As to achieve those goals, many organizations experiment many process improvement techniques, Lean and Six Sigma are the widest and commonly used. However, implementers fail to give a good jumpstart for implementing these tools, where 6S plays a significant role. Implement 6S system not only provides organization a safer, effective and efficient workplace but also a no cost tool that helps organization for larger financial rewards. In Dalco Metals Inc. at Madison, Wisconsin, after implementing 6S system, their office paperwork processing time reduced from 4 days to 2 and also they worked on 225 improvements on shop floor in a year along with better quality products and better communication within workers. Similarly, in Longview Fibre, 6S project helps the plant to be safer breaking the safety incident records corporate wide and also helped towards the Preventive Maintenance. 5S’s devised by Japanese along with 6th S, Safety has become the most easiest and powerful in today’s competitive market to remain efficient, effective and yet competitive. [1, 4, 5, 7, 11]

8.2 Future Work
Despite of many process improvements benefits, there are some environment issues that Environmentalists bring due to 5S system. The common ones are the overuse of chemicals like solvents and paints for cleaning and the immediate waste management for disposal of unwanted items after Sorting step. Therefore, there is an opportunity for researchers and Industrial Engineers to look and find any better and alternate ways to perform 6S and keep the environment safe and green. Along with environmental opportunity, there are other expansion of 6S methodology, few of them are implementing in office, manufacturing labs, health care industry and construction. There are already some implementations of 6S in health care industry and it will be very good opportunity to study its methodologies and results. [1, 3, 4, 12]
Bibliography

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