Review Article on 5S – Most Powerful Lean Manufacturing Tool

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Abstract: Lean is a philosophy that seeks to eliminate waste in all aspects of institution's production activities- human relations, vendor relations, technology, and the management of materials and inventory. 5s is one of the most powerful Lean Manufacturing Tools and a cornerstone of any successful implementation. The paper deals with what is 5S and its 5 Steps of Seiri, Seiton, Seiso, Seiketsu and Shitsuke., and eliminating wastes from the institution and cultivating value based culture, for the better management of institute employees and its facilities through the process of 5S, a Japanese technology used in improving the housekeeping index and thus improving the productivity of the institute, and thereby, it not only helps to identify wastes in the workplace but also creates an environment where in teams get involved in improvements. It is a movement to make sure that all the elements of a "workplace system" function in order to allow the facilities to deliver an optimum level of performance.
Key Words: *Seiri, Seiton, Seiso, Seiketsu* **and** *Shitsuke,* **Housekeeping index***.*

1. INTRODUCTION:

One of the most significant developments in recent times is giving more importance to the Work place organization and information management. Work place organization is key to increase the effectiveness of teams and thereby the organization. Proper planning and management of Information, ranging from personal data to organizations details and small information to business prospects is necessary in the present world. Every action is being recorded for future references, either in the form of soft copy or hard copies. Hence there is a need to have a well organised work place organization methodology in every part of the organization. Among all other world class manufacturing technologies being implemented by various companies across the world, 5S Housekeeping Index is the most appropriate one which can be used and implemented successfully in service sector. 5S is mainly concerned with creating a well organised and neat and clean working environment in the whole working place. In service sector the implementation of 5-S will help in enhancing customer satisfaction and also improve the corporate image among its competitors. It will help in knowing the process which could help in implementing 5S and improve the work place and enhance better environment. This will help to know and identify the wastes and also would provide the methods for removing and limit the wastes in the institute which will also help in more systematic work procedures in the college. This 5S makes all the members in the institute to work towards its principles, starting from the Dean to even to the cleaning person and also makes the students follow certain rules which help in keeping the place in a well organised way. The 5S are a group of techniques which would promote workplace

organization, ensure adherence to standards and encourage the spirit of continuous improvement. The "5S" Philosophy once fully implemented, the 5S process would increase moral, create positive impressions on customers, and increase efficiency in a well organized way. Not only will employees feel better about where they work, the effect on continuous improvement can lead to less waste, better quality and shorter times of locating.

A. 2.0. Origin of 5S

5S as a methodology has come out of the techniques within Total Productive Maintenance (TPM) and from the Toyota Production System (TPS). However, many of the individual components such as creating ergonomic and efficient work places can be seen to owe their roots to people such as Taylor for his work on "scientific management" and Frank Gilbreth's "time and motion studies"

B. 2.1. The Concept of 5S

5S is a methodical way to organize workplace and working practices as well as being an overall philosophy and way of working. It is split into 5 phases, each named after a different Japanese term beginning with the letter "S"; *(Seiri, Seiton, Seiso, Seiketsu, Shitsuke)* hence the name 5 S.

5S is a set of techniques providing a standard approach to house keeping within Lean. It is often promoted as being far more than simply house keeping. The best part of 5S is that it can be adopted by everyone in the institution. There are no burdens of complicated tools or difficult data analysis. 5S is a set of practices that needs to be practiced every day until it becomes a habit for every individual in the institution. Implementing 5S in service sector like an educational institute is a very challenging thing to be done as it is believed that the particular technique is most effective in manufacturing sector. It is more difficult because it is difficult to engage each and every staff member and also students to implement the technique each time and every time and strictly follow the rules. 5S is a process of creating and maintaining a safe, well organized and clean environment. Promoting 5S doesn't mean just picking up the waste and throwing it. Though identifying the wastes is one of its major aspects but the major emphasis is on being organized, and maintaining a designated place for each thing and also implementing it. When things are taken from their respective places they are kept back in the same place from where it was been picked. The concept of the 5S was initiated in Japan. Name 5S is the acronym of five Japanese words of the following meanings a) *Seiri* - SORT, b) *Seiton* – SET IN ORDER, c) *Seiso* – SHINE,d) *Seiketsu* – STANDARDIZE, e) *Shitsuke* – SUSTAIN

2.2. Benefits of 5S:

By the implementation of 5S the institutions will get good profits. Some of these profits are:

• Better utilization of resources.
• Identification and removal of wastage
• Organized and disciplined way of work
• Maintaining a neat and hygiene climate.
• Making the communication very easy.
• Making the work place easy accessible.
• Helps to know what work we need to do and from where.

3.0. 5S Explanation:

3.1. *SEIRI*-SORT: *Seiri* is sorting through the contents of the institutions environment and removing unnecessary items. This is an action to identify and eliminate all unnecessary items from different places in the institute. This refers to the practice of sorting all the materials in the institute and keeping only essential items. Everything else is stored or discarded. This leads to lesser hazards and less clutter to affect the productive work. Through the suitable sorting the necessary items required for a good performance of the institute can be identified and also the wastes or the not required things which can be eliminated from the institute and make it waste free and create a good working environment. *SEIRI* helps in maintaining a clean place and also helps in improving the productivity. It helps to maintain the clean workplace and improves the efficiency of searching and receiving things, shortens the time of running the operation. Seiri is the identification of the most successful physical Organization of the workplace. It has been variously anglicized as Sort, Systematization or Simplify by those wishing to retain the S as the initial letter of each element. It is the series of steps by which we identify things which are being held in the workplace when they should not, or are being held in the wrong place. The time spent searching is a waste or in Japanese speak a (Muda) and if we only held the items needed regularly in a prominent position we would save time.

Items which have not been used can then potentially be disposed of. As a first pass we should perhaps create a quarantine area before throwing items away, selling them or reworking them into something else. Other items may be deemed necessary but used infrequently and so an alternative location can be found. Another element of the standard approach is red tagging where items are given a tag which says what the item is, which location it is in and when it was identified in this location. We then leave the area for a while and anybody using the item notes this. We go back some time later and can readily identify things that have not moved, or been used.

3.2. *SEITON* – SET IN ORDER: "Place for everything and everything in its place" becomes the way of thinking for every member when the second stage of 5-S implemented. The main aim for this stage is that it helps the people to know the correct place to find the thing for which he/she is searching around. In some cases it is convenient to use different color codes for keeping different things like files, pens, stapler, keyboard, mouse etc. Shelves assigned to keep certain materials or tools should also show a clear identification that makes it easy for the user to find and return them after use. The key concept here is to order items or activities in a manner to promote work flow. It deals with the segregation of things and mark the places for each of the objects all the way from toilets to the faculties desk

and even in the class rooms. The separation must be done in a way that the most useful things should be kept near the hand and the other objects which are not that randomly used can be kept a bit away. This phase helps in removing the muda i.e; waste which does arise generally in day to day life
• Motion waste
• Searching waste
• The waste of human energy
• The waste due to unsafe conditions

3.3. *SEISO*-SHINE: We know that cleanliness is next to God, this step indicates to keep the place clean and neat. Regular cleaning in a proper way helps to identify and eliminate the wastes. During cleaning of the computers, floors, toilets, canteen, the store places etc, cleaning properly and also implementing it by all the members of the institute, provides a very good study environment for the students and also helps the teachers to teach in a better way. This cleanliness also gives a good image to the institute in the eyes of its customers those are the students looking for admissions in to and also the companies which come in the college for recruitment purpose. Another purpose of this step is to create awareness and go to the root cause of the problem, cleanliness helps in knowing the cause of the problem for which techniques like root-cause effect can be used, which in turn helps:
• Turn workplaces into clean, bright place where all will enjoy working.
• Keep everything in top condition so that when someone needs to use something it is ready to be used.
• Cleaning should become a daily habit like bathing.
       This S helps in removing the problems like:
• Defects are less obvious in stuffed cupboards.
• Cabinets do not receive sufficient checkup maintenance and tend to damage easily.
• Filthy work environments can lower morale and also doesn't give a good environment for studies.
• Ineffective cleanliness leads to some kind of diseases.

3.4. *SEIKETSU* – STANDARDIZE: *Seiketsu* involves in creating visual controls and guidelines for keeping the institute in an organized and orderly place and also keep it clean. In this step very high standard of House keeping is been followed. Seiketsu helps to return back and work in a standard order or way. In the institute the human nature being so variable, there is always a chance that the members in the institute divert from the practices and go back to their original way of working. Seiketsu is used to prevent all the members of the institute from diverting. Basically this technique is to keep revising the whole process on a regular basis. Standardizing refers to standardized work practices. It refers to not only standardized cleanliness but also means operating the practices in a consistent and standardized fashion. Everyone knows exactly what his or her responsibilities are. Standardization is the condition that exists when the first three pillars-sort, set in order and shine are properly implemented.

       The problems that can be avoided by implementing Seiketsu are:

- Conditions going back to their old undesirable levels even after implementing 5S throughout the institution.
- At the end of the day piles of waste items are left out
- Any storage place becomes disorganized and must be put back in order at the end of the day.

The basic purpose of standardization is to prevent setbacks in first three pillars, to make implementing these practices as a daily habit, and to make sure that all pillars are maintained and practices in full flow.

3.5. *SHITSUKE* **- SUSTAIN**: The final stage is that of being discipline. To retain the initial use of S it is needed to sustain and be self-disciplined. The way in which management achieves this establishment of ongoing commitment within the work force depends, on the culture and discipline they follow from starting. This step increases the consciousness of staff and decreases the number of waste goods and processes; it brings in improvements in the internal communication and also helps in improving the human relations. Regular inspection can be done using check sheets on the basis of which graphs can be drawn and the estimation of the amount of improvement in the institute can be known, which can be executed by a selected team in every month to have a regular check on the process.

Problems that can be avoided by implementing this phase of 5S:
- Unnecessary items begin piling up as soon as sorting is completed.
- No matter how well set in - order is planned and implemented, tools and jigs do not get returned to their designated places after use.
- Little or nothing is done to clean the equipments even when it gets dirty.
- Dark, dirty, disorganized institute will affect the education system in the institute.

4. Implementation of 5S in college:

The implementation process of 5S in the institute will undergo certain steps that are to be followed very strictly. The steps that are to be followed for the implementation of 5S are:
- All members in the institute must undergo 5S Housekeeping training
- A vision statement has to be evolved and it should be started with all employees.
- Divide the institute into convenient zones.
- Divide each zone into convenient sub-zones.
- Decide on date(s) for launching 5S in each zone and sub-zone.
- Take pledge for the implementation and sustaining the practices
- Apply 5S phases one by one.
- Form internal audit teams.
- Carry out audit checks time to time.
- The vision statement which has to be developed by the institute must be related to having a continuous improvement and sustain the implemented practices for good purpose for a long time.

The success of 5S implementation depends mainly on the principle: "Take up one idea. Make that one idea companies life – think of it, dream of it, live on that idea. Let the brain, muscles, nerves, every part of company's body, be full of that idea, and just leave every other idea alone. This is the way to success."

4.1. Implementation of *SEIRI*-SORTING:

SEIRI is concerned with sorting the items and finding out the necessary and unnecessary items. This phase is mainly to identify the wastes in each zone's and their sub zones and to eliminate them. This would reduce the space utilization in the college and also will create more clean and neat environment. The implementing of this phase has to undergo the following steps:

- Look at all the parts of the college at each and every sub - zone and identify the items which are not needed and are not necessary.
- Develop a criteria and a particular way of disposing the products
- Take photographs wherever it is necessary for checking purpose.
- The items are kept by tagging them with different colors. This visual display gives the advantage of finding out the unnecessary items very easily.
- Red tag is used to ask the following questions:
  - Is the item needed?
  - If it is needed, is it needed in that much amount of quantity?
  - If it is needed, how frequently it is been used?
  - If it is needed, should it be kept here?
  - Who is ultimately taking care for this item?
  - Are there any other not-needed items cluttering the workplace?
  - Are there any materials left on the floor with no use?
- Finding an area to keep all the red tagged items.
- If there is certain confusion with a particular item regarding whether it is necessary or not then tag the particular item with some other color and keep it away in a holding area.
- Classify the items in the sub - zones based on the frequency they are being used, in the way such that the items that are being used more frequently are kept near the hands and which are used very rarely can be kept a bit away from hands.
- All the unnecessary items can be kept in the stores room in an organized way.
- The store place must be very well marked so that the items can be easily visible.
- Responsibility should be given to a particular person to look after the stores room.
- The items kept in the store should be kept for some months and if they are not been used within that time limit then they should be disposed off.
- Someone should be kept to have check on the stores in regular level.
- Take "after" photographs to compare with the earlier situation.

4.2.Implementation of *SEITON*- SET IN ORDER:

SEITON is concerned with keeping the necessary items in correct place so that they can be easily accessed. In this phase every necessary items are kept in a good order and focus on more effective and efficient way of using the storage space. For implementing this phase, college needs to undergo the following steps:

• To make sure that all unnecessary things are eliminated from the college.

• As per the requirement the items are kept according to their frequency of usage.

• Take "before" photographs for comparing it later

• All the members in the institute should answer the questions:

▪ What do I need to do my job?

▪ Where should I find the required item?

▪ How many of these items are really needed?

• Use 5 Whys to decide the exact location of each item.

• Inform everyone in the institute about the items so that anyone can find it easily.

• The clear list of items and their locations are listed down and kept in lockers and cabinets.

• Each drawers, lockers, cabinets should be labeled properly with the name of the item kept in it.

• Use labels, color codes to identify the location of the items and use index for indicating the place for files, records and drawings.

• Different lines of different colors give different indications.

• Take photographs "after" to have an analysis of the improvement.

• Complete evaluation can be made by appointing a person in the institute who has knowledge regarding this field.

4.3. Implementation of *SEISO*- SHINE:

SEISO is concerned with keeping everything clean and cleaning everything in the college on daily basis and using this to inspect the defects in equipments. This step deals with not only cleaning the toilets, floors, classrooms, seminar hall, libraries, basement and other places but it is also concerned with cleaning the equipments that are daily used in the institute like the computers, lift, fans, lights, AC's so that these equipment can perform in the best possible way for a long time.

The steps to be followed for implementing this phase are:

• Determine the cleaning Targets.

• Determine whom to assign for cleaning what.

• Determine the cleaning method.

• Start the cleaning process

4.4. Implementation of *SEIKETSU*-STANDARDISE:

Seiketsu is concerned with creating visual controls and guidelines for keeping the institute in a good organised way. The first three steps of 5S are executed by giving orders to others or by assigning other duties, but *seiketsu* enhances these behaviors naturally into everyone and makes those as their standard behavior. This phase is mainly implemented to see that the above 3S's are implemented in proper way and on daily basis.

The steps involved in implementing this phase are:

• To decide who is responsible for which particular activity with regard to the maintaining the above 3S.

• To prevent the members from returning to their old practices and implementing those duties into regular day – to - day activities.

• Check how the 3S are maintained.

4.5. Implementation of *SHITSUKE*-SUSTAIN:

Shitsuke is concerned with giving training to develop the discipline among all the members of the institute that everyone follows the 5S standards, and it becomes a part of their life. Implementing sustains needs to create:

Awareness: Create awareness about the 5 pillars to every member in the institute.

Time: Provide enough time to the members to adopt and implement the 5S.

Structure: Structure for implementation of 5s activities

Support: Support the efforts of everyone in terms of Satisfaction and Excitement.

This phase is to check that the implemented 5S are being followed on daily basis, and becomes a part of the daily activity of every member in the institute starting from the director to the students and even the cleaning staff.

Regular inspection can be done using check sheets on the basis of which graphs can be drawn and the estimation of the amount of improvement in the institute can be known, which can be executed by a selected team in every month to have a regular check on the process.

5.0. Application of 5S in an office:

The office environment for 5S may include administrative, transactional or service based processes in, or attached to, a manufacturing organization, within their value stream or similar environments, such as health care, education, financial, construction or Defense services.

5.1. Elements and Performance Criteria for implementation in an office

A. Prepare for implementation of 5S in office

• Identify own functions in the target work area in terms of internal and/or external customer requirements

• Identify how own and office team tasks contribute to the office functions

• If required, assist with process mapping to identify any gaps or clarification of customer expectations of office functions

• Confirm arrangements for assistance and reporting for 5S implementation.

B. Sort needed items from unnecessary

• Identify all items in own and wider office area

• Distinguish between essential and non – essential items.

• Place any non-essential item in an appropriate location other than the work area/space

• Regularly check that only essential items are in the work area

C. Set the workplace in order

• Identify the best location for each essential item

• Place each essential item in its assigned location

- After use immediately return each essential item to its assigned location/state or condition
- Regularly check that each essential item is in its assigned location/state or condition

D. **Shine the work area**

- Keep the work area clean, tidy and organised at all times
- Conduct regular 'shine' activities during shift
- Ensure the work area is neat, clean, tidy and organised at both beginning and end of shift
- Report any malfunction, damage and/or safety risks that require immediate attention

E **. Standardise activities**

- Follow procedures
- Follow checklists for activities, where available
- Keep the work area to specified standard

F. **Sustain the 5S system**

- Clean up/organise workspace after completion of job and before commencing next job or end of shift
- Identify situations where conformance to standards is unlikely and take actions specified in procedures
- Inspect work area regularly for conformance to specified standard
- Recommend improvements to lift the level of conformance in the workplace

6.0. Benefits to the Company/Factory on using the 5S methodology

Benefits to the company from using the 5S methodology include raising quality, lowering costs, promoting safety, building customer confidence, increasing factory up-time, and lowering repair costs.

The 5S methodology is typically implemented using a 3-step process, which includes establishing a cross functional team (including employees that work in the associated areas), touring all areas associated with manufacturing process under review, and brainstorming on ways to improve organization to reduce waste. For example, factories have more than their share of searching waste. It is not unusual for a three hour changeover routine to include 30 minutes of searching. When attempting to reduce changeover time radically (for example, going from 3 hours to 10 minutes), there is clearly no room for 30 minutes of searching waste.

Value stream mapping (VSM) can be used in the 5S process to analyze the material, process, and information flow. The information is used to develop a current state map, which sets out how things have been done in the past. The team then analyzes the current state map to identify opportunities for workplace organization and housekeeping improvements. A wide range of ideas is considered – while all ideas won't end up being viable, all are worthy of investigation. The key is to observe non value added processes and create an environment to promote value added work through waste elimination.

Finally, the team envisions a future state based on the exercise and begins implementing the future state. The process is iterative; the future state becomes the current state, and a continuous improvement process should be used to identify new ways to reduce waste. Waste is defined very broadly, and

includes things like waste in the movement of material, carrying too much inventory, defects or rework, producing scrap, waiting or unnecessary motion.

Some examples include waste of motion because the person sent to get a part or tool could not find it; searching waste because no one can find the key to the locked cabinet that contains needed tools; waste of defective products because defective parts were not separated properly and used by mistake; and even waste caused by unsafe conditions, as boxes of supplies that are left in a walkway, causing someone to trip and get injured.

For example, team members might observe workers walking long distances to obtain needed parts, or spending time reaching into bins on shelves to find parts. Or they may identify hardware, like nuts, bolts and screws that are used in a certain area, but stored in a central storage facility far away from the point of use. The goal of the VSM is for the team to walk the process, and identify what operators really need versus what they receive.

7. Conclusions:

5S should become part of the culture of the business and the responsibility of everyone in the organization, so that waste in the following functions of management can be eliminated, paving the path for prosperity.

- Excess (or early) production
- Delays
- Transportation (to/from processes)
- Inventory
- Inspection
- Defects or correction
- Process inefficiencies and other non-value added movement (within processes)

The 5 S may be viewed as a philosophy, with employees following, established and agreed upon rules at each step. By the time they implement all these 5S, they develop the discipline to follow the Ten Commandments namely

- Eliminate waste
- Minimize inventory
- Maximize flow
- Pull production from customer demand
- Meet customer requirements
- Do it right the first time
- Empower workers
- Design for rapid changeover
- Partner with suppliers
- Create a culture of continuous improvements and thus meeting the objective of Latest manufacturing trends – absolute profit, prosperity of the organisation.

The implementation of 5S in the college will improve its effectiveness and also creates an image in the eyes of the parents, upcoming students and also recruiters and other bodies.

References:

1. Dr. K.C. Arora. (2007). Total Quality Management
2. Dr. R.K. Suresh and K.Pandian "Total Quality Management" of Sooraj Publications, Chennai- 600010,
3, K. Shridhara Bhat "Total Quality management", Himalaya Publication House.