



The "5S" Strategy by Using PDCA Cycle for Continuous Improvement of the Manufacturing Processes in Agriculture Industry

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ABSTRACT

The global marketplace has witnessed an increased pressure from customers and competitors in manufacturing. In this age of agile manufacturing the global competition characterized by both technology push and market pull had forced the companies to achieve world-class performance through continuous improvement in their products and processes, reduction in cost, reduce wastes, increase quality, increasing of effectiveness, safety increasing, reduction of the pollution, increase decision making power and improved methodology. To want all this changes, there is need to adopt new the management system. In management system there are many types of techniques. The present work is dedicated to study and implement 5S Methodology. In this work, proper system will be analyzed to reduce the wastes, reduction in cost, processes, and increase decision making power by implementing 5S techniques. Apart from this, theoretical results compared with original data from industry before and after implementation.

1. Introduction

5S originated from Japan and is one of foundation stone of TPM. In organizing workplace, a robust tool of housekeeping methodology of 5S is often used to reduce time wasted by looking for things, repairing the machines, changeover, and helps to decide what should be kept, where it should be kept, and how it should be stored. This method asserts it makes work easily to understand and act. 5S, standard work and TPM are the foundations for fast, flexible flow. 5S is learned from five Japanese words – Sorting, Straighten, Sweeping, Standardizing, and Sustaining (Wireman, 1990) [1].

5S is a systematic process of housekeeping to achieve a serene environment in the work place involving the employees with a commitment to sincerely implement and practice housekeeping.

Problems cannot be clearly seen when the work place is unorganized. Cleaning and organizing the workplace helps the team to uncover problems. Making problems visible is the

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first step of improvement. If this 5S is not taken up seriously, then it leads to 5D (delays, defects, dissatisfied customers, declining profits, and demoralized employees) [2].

5S is regarding to make the workplace is an organized one, as problems are really difficult to define in an unorganized organization [3].

5S effects on performance in similar organizations, review requirements of the implementation and deployment of 5S practice, and review of the key success factors for organizations that have been successful in implementing of 5S and other quality management systems [4].

The 5S implementation requires commitment both from the top management and everyone in the organization. Entire organizations distributed in three zones. For each zone teams are formed. All the employees are distributed in to teams and one team leader for each zone. The 5S system is implemented in to these three zones [5].

Establish and maintain a clean, neat and tidy workplace Translation of 5 Japanese S's, what is 5S and why do we wants to do it? 5S represents 5 disciplines for maintaining a visual workplace (visual controls and information systems). These are foundational to Kaizen (continuous improvement) and a manufacturing strategy based "Lean Manufacturing" (waste removing) concepts. 5S is one of the activities that will help ensure our company's survival [6].

The 5S methodology relies on the creation and keeping well organized, clean, high effective and high quality workplace [7].

5S in order to help the organization to have a better working environment and improve the process flow. 5S could only improve the result in the working environment, but it proved also to help the company to gain better efficiency [8].

The successful implementation of 5S requires that everyone understand why it is being used and what the expected results are, as the removal of familiar (although unneeded) items and the reorganization of processes can be extremely unsettling. This may need to be coupled with training in the principles of 5S [9].

2. Background of 5'S

5'S technique is part of TPM. It is becomes with combination of 5 Words (i.e. Seiri, Seiton, Seiso, Seiketsu, Shitsuke) or simply says 5 steps at the time of productivity. To get a good result, there is need to follow all steps in an Industry.

The 5'S features are shown in Table 1 and the objectives of 5'S are shown in Table 2.

3. Keys to Success of 5S

1. 5'S technique not applicable not for only one person, it is responsibility of lower to higher level employee and management.
2. After 5'S implementation we have reduced the cycle time on the assembly line and increase the production.
3. Reduce the scrap or waste and increase the quality of the product.
4. Increase the visibility of spare parts and easy handling of materials.
5. 5'S implementation increases the level of discipline in the organization.

Table 1. Terms and Features of 5'S

Japanese Term	Equivalent 'S' term (5S)	Equivalent 'C' term (5C)	Features
<i>Seiri</i>	Sort	Clear	<ul style="list-style-type: none"> ✓ Search useful and useless items ✓ Separate both items& Classify them ✓ Critical items should be kept for use nearby
<i>Seiton</i>	Systematize or Set in order	Configure	<ul style="list-style-type: none"> ✓ Arrange useful items properly ✓ Discard useless items ✓ Gives color according to their use
<i>Seiso</i>	Sweep or Shine	Clean and Check	<ul style="list-style-type: none"> ✓ Clean and polish all working places ✓ Remove trash or dirt properly
<i>Seiketsu</i>	Standardize	Conformity	<ul style="list-style-type: none"> ✓ Maintain Cleanliness ✓ Tested / Inspected randomly ✓ Convert into high standard
<i>Shitsuke</i>	Self – Discipline or Sustain	Custom and Practice	<ul style="list-style-type: none"> ✓ Motivate employee towards work ✓ Generate Self discipline

Table 2. Objectives of 5'S

Objectives of 5S	
Reduce	Improve or Increase
Overall Cost	Customer satisfaction
Waste	Quality
Time	standardized work
Inventory or Stock	Awareness And Morale of employees
Industry Pollution	Efficiency
	Safety
	Self – Discipline
	Work Environment
	Inter Human Relation or Team Work
	Productivity

4. The step by step procedure of 5S Implementation in an Agriculture Industry-

In this paper we outlined that 5'S Implementation in small scale industry with the help of PDCA Cycle. In order to start the Implementation we used the step by step procedure and analyzed each phase deeply and addressed using the PDCA Cycle approach. In figure: 1 explains that, after studying the proposed road map we have found that implementation of PDCA Cycle and that cycle is divided into four parts in first phase "Plan" we will prepared all the data related to our investigation. In second phase "Do" we have Implementation of 5'S and in third phase "Check" we will cross checks all the data and compare with the old

investigated data. In the last Cycle “Act” we will follow the improved investigations and also work on motto “Continuous Improvement”.

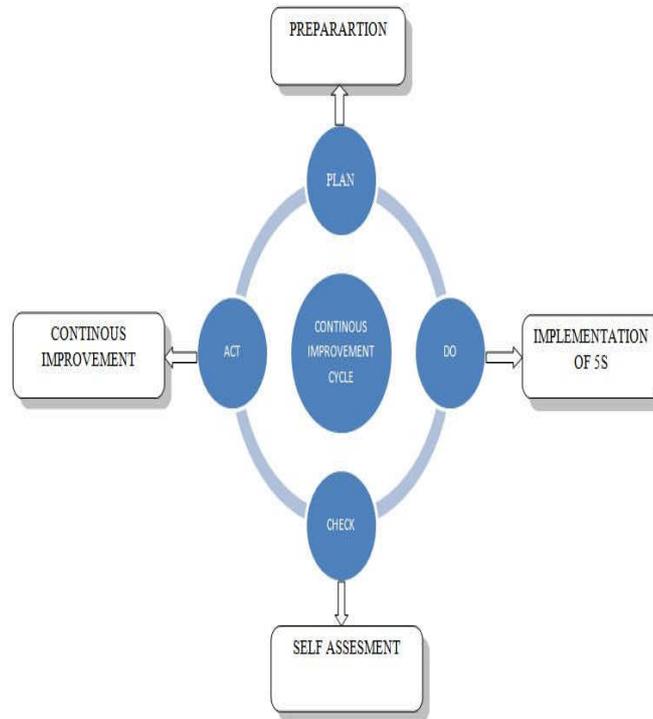


Figure 1. Route Map

4.1.Plan

In first phase “Plan” we will prepared all the data related to our investigation. For the implementation of 5’S in the small scale Industry, we will prepare a plan that should have executed or implemented successfully. First of all we have given the training to all employee or workers on 5’S concept or technique properly. Then we will make a 5’S council for its better execution. The 5’S council divided into four parts in which Co - coordinator, Co - Coordinator, Team leader and Team members. This council coordinator has worked on to determine the objective and their root cause and perfect Implementation phase. The team leader has exchanges all the responsibilities to team members to complete the 5’S implementation plan. The team member’s now know his responsibilities very well and he know all the instructions regarding the execution of plan. Each and every instruction, work plan and assign duties has given by the Coordinators to the team leader and he attached on the notice board and it is very easy read or learn from there. The team members work according to given by instruction or work plan. He knows well what he do or don’t. Then action plan have been prepared and it start to working in this Industry.

The Figure 2 explains that, the investigation procedure of our study. In our investigation first of all we have found the exact work location, explain reasons and set the goals. After setting the goals we will prepare the action plan and also gathering the data and that data dividing, learning, training and then start working or implementation of our study and the find the results and show the comparison of before and after.

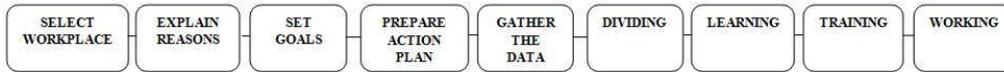


Figure 2. Implementation Road Map

4.2.Do

The second Phase is “Do” We have executed 5’S technique in this phase.

4.2.1. Seiri

In this step separate the necessary and unnecessary items from the work place. After separation we have found a separate workplace for the disposal of unnecessary items and attached the red tag on each item. The Red Tag description is shown in Figure 3, After preparation of a record sheet of all the unnecessary items, if these items are not used in one week, then we discard them. If we want to use these items, then we will remove the red tag from them. In this way we have reduce the waste and get more open space in workplace in industry for working.

No.....

5S Red Tag

Name.....

Date.....

Item Description.....

Department.....

Quantity.....

Category

- Equipment or Tool
- Files
- Finished Good
- Raw Material
- Others.....

Reasons for Tag

- Defective
- Unnecessary
- Storage
- Obsolete
- Others.....

Action Required

- Move to Red Tag Area
- Discard
- Recycle
- Return To
- Storage
- Shared
- Others.....

Action Completed By

Name.....

Date.....

Signature.....

Figure 3. Red Tag

4.2.2. Seiton

In this step we have arrange all the necessary items at their proper location in the workplace. As shown in Figure 1 before implement the 2'S in nearby area of plasma cutting machine, there is no proper arrangement of cutting sheets. After implement 2'S in this area we arrange sheets in vertical racks as shown in Figure 2. In this step we also make the blocks for store the small parts used in machine and give the name of each block according to parts that placed in this blocks that shown in Figure 3(b).

Before 2'S Implementing



Figure 2(a)



Figure 2(b)

After 2'S Implementing



Figure 3(a)



Figure 3(b)

In this step we also take some efforts to get improved performance:

- a. **Equipment's and tools** - Gives the label of equipment and tools to specify it properly. Arrange the tools and equipment according to their use.
- b. **Safety** – It is used to alert the people from hazardous conditions and prevent at time of unsafe conditions. We provide the hazard warning and instruction at point of unsafe zone. And used safety precaution and First Aid Box in all places of Industry.
- c. **Procedures** –In this we have separate the employees according to their job responsibility, and use mistake proofing methods to reduce the errors in the workplace.
- d. **Quality** – In this we have represent the quality standards in graphical or physical form.
- e. **FIFO Technique** –FIFO means first in and first out technique. We have used this technique for reduced the time for documentation and record keeping. Before implement it, the purchased raw material is placed in the store room and preparation of record of that raw material. After preparation of the record, then this material is issued to the internal customer of the company that is a time consuming process. Due to this to get the relief from this time consuming process we have implement FIFO. In this technique the purchased raw material is directly coming from vendors is directly stored on the assembly

line store as shown in Figures 4 and 5. This techniques help for time saving, laborsaving, easy to handle and cost savings.

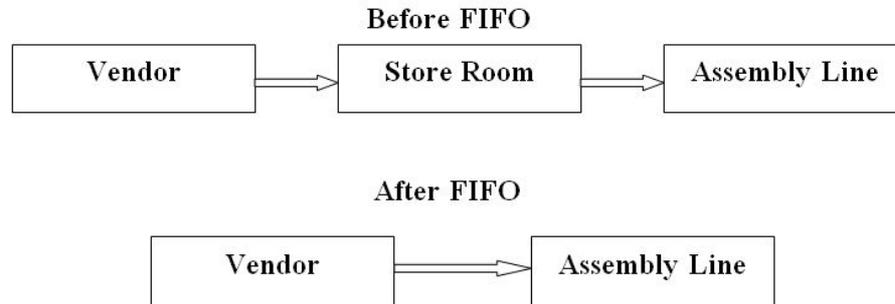


Figure 4. Effect of FIFO Before and After



Figure 5. Implementation of FIFO on Assembly Line

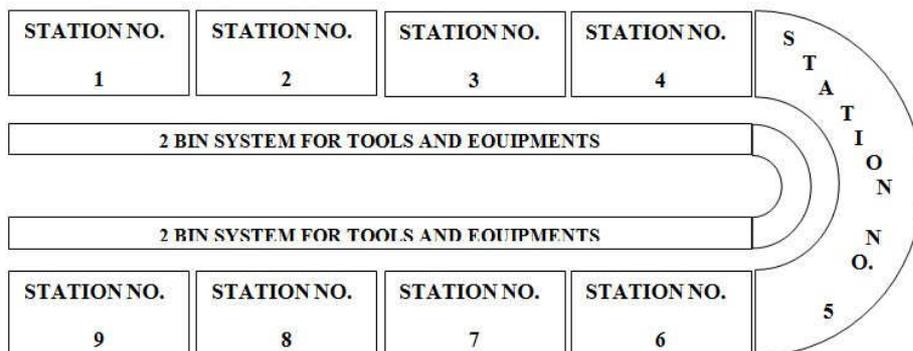


Figure 6. Assembly line

4.2.2.1. Two Bin Systems

We have implemented two-bin method on assembly line, it can be often used for low-value, frequently used material when exact requirements or usage cannot be planned. The materials frequently used on the assembly line with the two-bin system include common nuts, bolts, bearings, belts and other low-value, high-usage items as shown in Figures 6 and 7. The two-

bin method for replenishing material is easy to implement and equally easy to use for tracking usage. In the bin section 1 diagram, items are used from the first section of the bin only. When all the material is used, the second section of the bin is opened for use and an order is placed with the vendor for a refill. In bin section 2, the item is placed in a barrel. When the items level at reserve section of the barrel, the item is reordered.

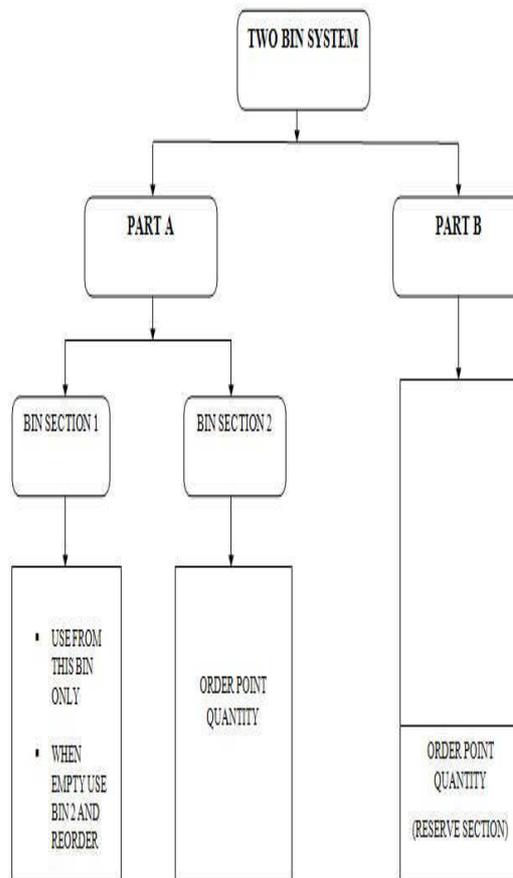


Figure 7. Two Bin System

4.2.3. SEISO

In this step, we have removed all type of dirt, dust and contamination from the workplace. First of all we have find out the dirty area and take the pictures of this area as shown in figure no. 08 (a, b &c). After find the dirty area, we have assigned the additional duty to employees for cleaning the work place. The assigned duties of employees have divided on weekly bases for cleaning the workplace. We have find the area where preventive coating is required as shown in figure no. 08 (c), there is need of preventive coatings on the small gates of blocks. As shown in figure no. 09 (a, b and c) for clean the different areas in industry, where it needed and used the preventive coating to prevent rust where it needed and gives the name of every block. After implement the 3'S we find that the clean and shine the workplace and increase the standard the workplace and increase the interest of employee toward the work and the goals.

Before 3'S Implementing



Figure 8(a)



Figure 8(b)



Figure 8(c)

After 3'S Implementing



Figure 9(a)

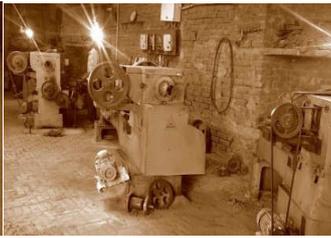


Figure 9(b)



Figure 9(c)

4.2.4. SEIKETSU

In this step, we have defined clearly the roles and responsibility of all the Supervisor and workers according to their work or roles in the industry.

We have made the charts of workers in which we have defined the day and time of work with his Employee code.

Table 3. Defined Responsibility of each activity

Sr. No.	Work Code	Activity	Responsibility
1	A	Sweeping the Workplace	House Keeping Supervisor
2	B	Garbage Removal	House Keeping Supervisor
3	C	Cleaning of Machine	Machine Shop Supervisor
4	D	Removal of Scrap from Machine Shop	Machine Shop Supervisor
5	E	Arrangement of Tools (Assembly Line)	Assembly line Supervisor
6	F	Implementation of FIFO and Two Bin Systems	Storekeeper

Table 4. Chart of Employees duties with date and time

Day/Work Code/Time	A		B		C		D		E		F	
	AN*	EN*	AN	EN	AN	PM	AN	PM	AN	EN	AN	EN
Monday	VK20	JK25	PL24	KL26	MS32	KS35	RK38	NK39	LL42	BS44	CV45	FS48
Tuesday	HS22	JN23	PS28	AS29	KS35	MS32	NK39	RK38	BS44	LL42	NG50	HK49
Wednesday	SS21	VK20	PK31	PL24	MS32	KS35	RK38	NK39	LL42	BS44	FS48	BL33
Thursday	JK25	HS22	KL26	PS28	KS35	MS32	NK39	RK38	BS44	LL42	HK49	NG50
Friday	JN23	SS21	AS29	PK31	KS35	MS32	RK38	NK39	LL42	BS44	BL33	CV45

*AN & EN – AFTERNOON & EVENING

4.2.5. SHITSUKE

Considering 5'S as a way of life and bring about self-discipline among the employees of the organization. This includes wearing badges, following work procedures, punctuality, dedication to the organization etc.

Table 5. 5'S Housekeeping chart for check the performance

5'S Housekeeping Score Sheet								
	NA	0	1	2	3	4	5	Description of Area
Sort								
1					✓			No old or unnecessary materials and equipment in defined area or assembly line.
2							✓	All machines and equipment's are operated and placed in a proper place.
3						✓		There are clear standards to dispose unnecessary things in the defined area.
Set In Order								
4							✓	Bearings, Flat -Belts, batteries etc. are properly identified and stored in designated area.
5						✓		The material is places in the racks order wise.
6						✓		Movable machines are in proper location.
7						✓		Inventory, organized by implementation of FIFO and Two Bins System.
Shine								
8					✓			Machines and racks are clean and painted as per requirement and designated their names.
9						✓		Floors are clean and shining around the work area.
10						✓		There is a rotation of workers for cleaning and the place.
11					✓			Same importance given on both cleaning and control.
Standard								
12					✓			Damaged or non-functional tools / equipment is removed from the area or marked for replacement.
13						✓		There is adequate Lightning and Ventilation for proper working.
14						✓		There is a proper system for protecting and managing the first 3'S.
Sustain								
15						✓		Organization follows all rules and implemented properly.
16						✓		Work Safety equipment is compulsory.
17						✓		All rules and regulations have been adapted and well used.
Sub Total						✓		

Table 6. Distribution of Grade No. according to percentage of improvement of 5'S

Sr. No.	Grade No.	Improvement in 5'S (Percentage)
1)	0	00 - 10%
2)	1	10 - 30%
3)	2	30 - 50%
4)	3	50% - 70%
5)	4	70% - 85%
6)	5	85% - 100%

4.3. Check

In this phase we have checked the assessment form see that 5'S Implementation has effective or not. In which we have compared the data of time consuming in Assembly line work for multi crop threshers in this Industry. In which we already had known the Takt and Cycle time of assembly line work, which calculated before 5'S Implementation at this Workplace and then calculated the Cycle Time after Implementation of 5'S. Takt Time and Cycle Time Before Implementation of 5'S in Industry on assembly line as shown in Tables 7 and 8 the Takt time is 35.91 minutes per machine and cycle time is 50 minutes per machine. After 5'S Implementation in Industry on assembly line shown in Table 9 the cycle time is 41.5 minutes per machine. So it clearly shows that the impact of 5'S the Cycle time is reduced 8.5 minute per machine in the assembly line.

Table 7. Takt Time Calculation

TAKT TIME CALCULATOR	
Working Shift Per Day	01
Hours Per Day	08
Lunch Break (Minute)	30
Tea Break (Minute)	30
Planned 5'S Time (Minute)	05
Planned Downtime Time (Minute)	20
Available Time (Minute)	480
Net Working Time (Minute)	395
Customer Demand	11
Takt Time	35.91

Station wise Time and Cycle Time before Implementation of 5'S in an assembly line in this Industry:

Table 8. Cycle Time of Assembly Line before 5's Implementation

Station NO.	COMPONENT TASK	TIME* (T ₁)	TIME* (T ₂)	TIME* (MEAN) $T_m = (T_1 + T_2) / 2$
1	Put the Frame on line	02	02	02
2	Drum fitting on this station.	05	04	4.5
3	Put main shafts and balancing it properly. Fit the Syndicate and 3 step pulley (6", 7" & 8").	08	08	08
4	Fitting Rula Shaft and Top cover.	06	07	6.5
5	Thresher Sieve fitting	04	05	4.5
6	Flywheel (Front & Rear) & Pulley (24") Fitting.	07	06	6.5
7	Covering of Thresher	07	08	7.5
8	Hooper cover fitting	04	04	04
9	Greasing of all Bearing.	06	07	6.5
	Cycle Time	49	51	50

*Time in Minute

Station wise Time and Cycle Time after Implementation of 5S in an assembly line in this Industry:

Table 9. Cycle Time of Assembly Line after 5's Implementation

Station NO.	COMPONENT TASK	TIME* (T ₁)	TIME* (T ₂)	TIME* (MEAN) $T_m=(T_1+T_2)/2$
1	Put the Frame on line	02	02	02
2	Drum fitting on this station.	04	03	3.5
3	Put main shafts and balancing it properly. Fit the Syndicate and 3 step pulley (6", 7" & 8").	05	06	5.5
4	Fitting Rula Shaft and Top cover.	06	05	5.5
5	Thresher Sieve fitting	04	05	4.5
6	Flywheel (Front & Rear) & Pulley (24") Fitting.	06	07	6.5
7	Covering of Thresher	06	06	06
8	Hooper cover fitting	04	03	3.5
9	Greasing of all Bearing.	05	04	4.5
	Cycle Time	42	41	41.5

Graphical Representation of station wise time and its Cycle Time of Assembly Line:

The Figure 7 shows the graphical comparison of 5'SImplementation in Industry on assembly line before and after implementation each station wise. The Figure 8 shows the graphical comparison of 5'SImplementation in Industry on assembly line before and after implementation and also shows the cycle time reduction on the assembly line. The cycle time is reduced 8.5 minutes per machine.

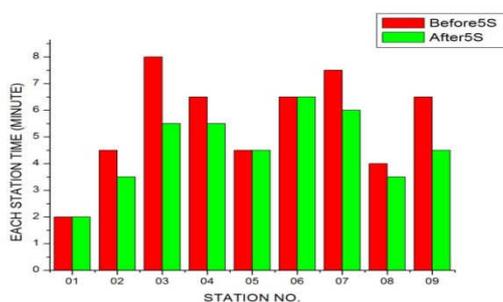


Figure 7

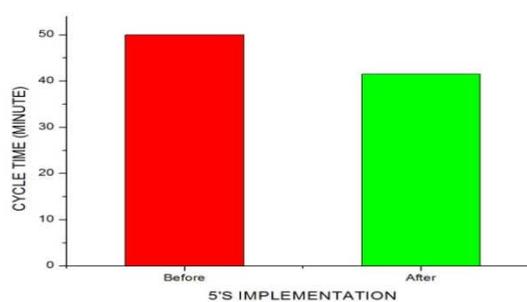


Figure 8

4.4.Act

To get the better result or continual improvement, there is need to implement of 5'S on regular basis. There is also need to compare the actual and set objectives. Customer as well as

employee satisfaction is always key of success of any organization. To increase the morale of employees, there is need to givenreward as per him performance.

5. Conclusion

The 5'S implementation is good idea for this Industry. In this we gain the real changes after implementation in this Industry. With the help of PDCA Cycle, it gives the Roadmap to implement the 5'S. The implement of all the 5'S in this Industry we find that their have step wise step improvement different section of this Industry. In 1'S, it helps to remove waste material from the different section of Industry and we know about status of every type of material, tools, equipment and accesorry etc. In 2'S, we arrange the all items in all departments and we use FIFO and Two Bin system to reduce inventory work and it also causes to reduction of time and labour in this Industry. In 3'S, we clean all workpalce and machine in Industry and its dirctly helps to increase standard of Industry and morale of employees. In 4'S, we distribute all types of duties or resposibility to supervisor of different section of industry and make a chart with given employee code. With this help, in every workplace everybody knows his work. In 5'S, we make a score sheet to calculate the weekly performance of 5'S implementation in this Industry and mainatin the self disipline among employees and gives reward according to performance of employees to increase the morale of employees. In this paper we calculate the Takt Time of assembly line, we found that it is 35.91 and calculate cycle time of this Industry before implementation and we found that it is 50 minutes. After implementation of 5'S in this Industry we again caculate the cycle time of assembly line area, it is 41.50 minutes. And we find that after implmentation of 5'S we reduce the cycle time of assembly line work.

6. Future Scope

5'S implementation has really helpful for this industry to reduce time and labour work. But our aim will be to increase the performance of this Industry to World class performance level and complete the customer requirement at that time. And it will possible with the help of using all Pillars of Total Productive Maintenance. We hope that we reach our goals after implementation in this Industry.

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