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AN APPLICATION OF 5S CONCEPT TO ORGANIZE THE WORKPLACE AT A SMALL SCALE MANUFACTURING COMPANY

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ABSTRACT

The purpose of the case study is to use 5S tool to assist small scale manufacturing organization to become more productive and more efficient. A simple approach has been adopted to create the teams for implementing 5S. In the frames of case study, it has been analyzed that implementation of '5S' resulted in overall improvement of the organization. With the implementation of '5S', major benefits in the form of tools searching time has been achieved. Tool searching time from shop floor has been reduced from 40 minutes to 5 minutes. '5S' audit has been conducted in the organization. '5S' audit score has been increased from 7 (week 1) to 56 (week 16). 5S is powerful tool and can be implemented in various industries whether it's micro, small, medium or large. Implementation of 5S has large horizontal development and can be implemented in all the workstations of the organization. The publications and case study presented in this paper will be useful to researchers, professionals and others concerned with this subject to understand the significance of 5S.

KEYWORDS: 5S Implementation, Audit, Continuous Improvement, Elimination of Waste, Organizational Effectiveness.

INTRODUCTION

Takashi Osada in 1991 coined the original concept of 5-s in the early 1980s. 5-s is the acronym for five Japanese words Seiri (organization), Seiton (neatness), Seiso (cleanliness), Seiketsu (standardization) and Shitsuke (discipline) respectively. 5-s has been introduced in Japan mainly in the manufacturing and service industries. Toyota, the major car manufacturer is one of the pioneering firms who adopted the 5-s principles. Japanese believe that 5-s Principles are not only valuable at their workplaces but also improves their cognitive sense. Osada refers to the 5-s as the five pillars to establish and maintain total quality environment in an organization [1]. 5-s Principles focuses on effective workplace organization, simplification of work environment and minimization of waste while improving quality and safety. Success of 5-s totally depends upon total employee involvement, its continuous monitoring and everyone should work in a team [2]. 5S are explained as follows:

Seiri: It means sorting things that are necessary from those that are unnecessary and keeping quantity of necessary ones minimum and at an accessible location [3].Red tagging is done to the items which are unnecessary. Unnecessary items are disposed of, or stored in a remote location and are redeemed if required in Future [4]. A proper name and one-location storage should be assigned to each and every item in order to reduce confusion, resulting in maximum efficiency [5]

Seiton: It means "A place for everything and everything in its place". It is to make the arrangement of necessary items in good order so that they can be easily picked up for use. It is a study of efficiency. It is a question of how quickly you can get the things you need and how quickly you can put those away [6].

Seiso: It means cleanliness, which should be the concern of everybody in the organization. Cleaning should be done by everyone in the organization, right from top management to the bottom. Cleaning should be done not only for the sake of cleaning but for a purpose [6]. To maintain a good image of cleanliness, everyone should be individually responsible for cleaning. Zone wise responsibilities should be given to the employees [1]. Cleanliness is also helpful to notice damage on equipment. A good, neat and clean working place provides motivation for effective functioning [7].

Seiketsu: It means making the first 3s a routine practice by implementing clear procedures for Sorting, straightening and scrubbing. Regular 5s audits should be done and scores against each S should be displayed.

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Display through photographs should be encouraged. The emphasis is on visual management and 5s standardization [6].

Shitsuke: It means to promote, communicate and train in the 5s to ensure that it is a part of the company's corporate culture. It is right to keep practicing 4s activities until they become habitual. This might include assigning a team to be responsible for supervising compliance with the 5s. The principles of 5s are for everybody. It is hopeless to expect subordinates to follow 5s if managers do not comply also. This process helps people to become disciplined [7].

Table 1: 5S tools

Japanese	English	Translation	Meaning
Seiri	Sorting	Organize	Making a distinction between required and non-required items and removing unnecessary items
Seiton	Storing	Order	Arranging the items in a system within the reach of the user
Seiso	Shining	Clean	Clean the working space
Seiketsu	Standardizing	Standardize	Maintain above 3s
Shitsuke	Sustaining	Personal Discipline	Make a habit to follow 4s

LITERATURE REVIEW ON 5S

Gupta and Jain, 2014 demonstrated the application of 5s and Kaizen in a small scale manufacturing organization. Implementation of 5s and Kaizen results in increased efficiency and effectiveness in the processes, improved visibility of the process, improved morale and safety of the employees, reduced delays, searching time and dangerous conditions. In order to make successful 5S and kaizen system most important factors are participation, commitment and support from top level management [8]

Rahimi et al., 2013 employed 5s components in department of youth and sports of Isfahan physical education organization. The study demonstrated that the organ needs to improve the level of standardization in the work place. Standardization in the organs leads to increase in the immune condition, decrease of the dangerous benefit, decrease as the price and waste increase of the effectiveness, satisfy the customer, and improve the operation and good management. So according to the important role of this subject and because of the lower level of standardization in the office of sport and youthfulness of Isfahan and for improving the quality of the work and increasing the effectiveness of the organs, this office needs to use the new and effective ways to increase the level of standardization [9].

Sorooshian et al., 2012 implemented 5s in some basic environment problems at Milad Company and found that 5S will foster teamwork, discipline and will increase the sense of responsibility and compassion for company. 5S is an ongoing need to maintain excellent service delivery performance. Assessment of Internal Audit will normally move the organization to continually repair the quality and effectiveness of services delivered to customers [10].

Urban and Mazurek, 2011 did their study in Bianor, a polish manufacturing company and found that the application of the 5S method has allowed the creation of a clean and tidy workplace, virtually without large-financial input. It contributed to the introduction of the company's new way of thinking and new values. The company has made a significant step towards perfection. Employees cooperated willingly in creating the new rules and standards, and therefore, their awareness of the importance of maintaining order in the workplace has increased considerably [11]

Rahman et al., 2010 applied 5s audit in order to assess implementation of 5s practice in two manufacturing companies. Study concluded that although both companies A and B perform an excellent 5s practice, still Company A score 90.48% which is more than Company B with 72.35% and also there are a few weaknesses that still need to be considered such as arrangement of the documents, tool and equipment. Moreover, 5S practice is seen as an effective technique

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that can improve housekeeping, environmental performance, health and safety standards in their workplace. However, effort and participation from top management is a key factor that determines the success of the 5S practice [12]

Rosas et al., 2010 implemented 5s in 66 Mexican organizations and found that greater commitment from the top management is essential to lead in the creation of an organizational culture, and 5S practice should be included in the strategic planning of the organization. Further training is needed to enhance the perception of the 5S practice and adopt it as a lifestyle rather than a management tool. Moreover, to enhance the 5S implementation: personnel commitment with the 5S practice; the design of official communication channels to know personnel suggestions to improve their jobs; quality and continuous improvement orientation of all activities and operations is essential [13]. Khamis et al., 2009 demonstrated the application of 5s in two medium scale companies A and B in Malaysia and surveyed that 5S practice is an effective technique that can improve housekeeping, environmental performance and health & safety standards in an integrated holistic way. Effective implementation of the 5S activity depends on the commitment of the top level management, total involvement of the staff at all levels within the company, function and background of the business, publicity given to the 5S activity and finally the training conducted for the organization in implementing the 5S practices [14].

Kumar et al., 2007 conducted a study in Grindwell Norton Company. The data on the performance of 5-S teams from Grindwell Norton were gathered. These data were substituted in QCFAS and the financial accounting statements were developed. The literature review led to the finding that 5-S could be used as an interweaving device for conglomerating world class paradigms such as total quality management (TQM) and quality circles (QCs). The practical implementation study revealed the compatibility of employing QCFAS for financially accounting 5-S teams [15].

Pheng, 2001 highlighted in his study that ISO 9001:2000 requirements for quality management and 5s principles can be integrated only by extending the ISO 9001:2000 template to incorporate relevant 5s principles. Also it discusses how these two sets of principles could be integrated to move towards total quality management [5].

Ho and Cicmil, 1996 describes the application of 5s approach in two companies. The SIRIM company case demonstrates how the 5s was successfully implemented in a large organization which consequently became a benchmark for others to follow. The Wellex company case proves that the 5s culture is universal and can be related to any working environment if there is a commitment to the common objective and also it's productivity increased by 26% with turnover exceeding US$23 million [3].

METHODOLOGY OF RESEARCH

Getting started with an effective program to implement 5s requires careful planning, design and execution of the business changes needed to achieve the desired improvement goals. Implementation should not begin unless top management is solidly championing the effort with an understanding that many business processes must be changed.

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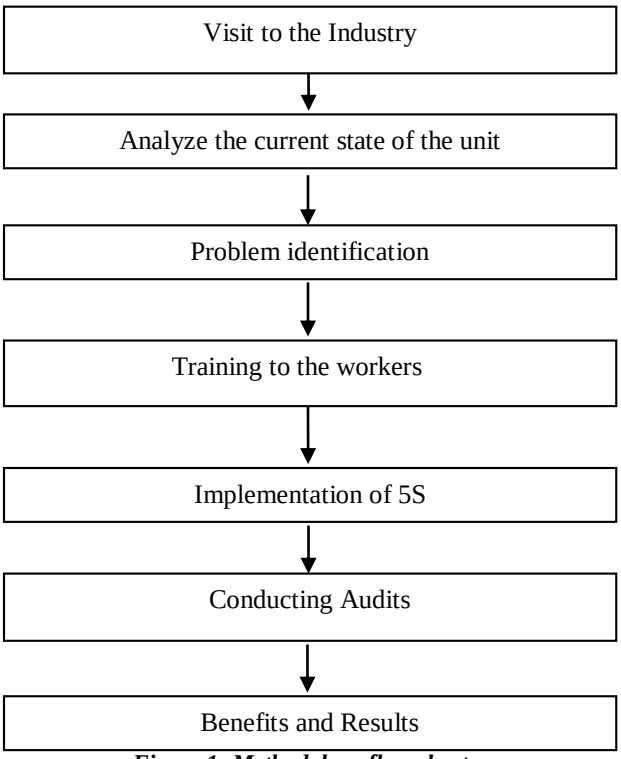

Figure 1: Methodology flow chart

Introduction to the Company

The Company is manufacturing and exporting Suction Units, Autoclaves, High pressure, Aerosol Disinfector and all types of Surgical scientific and Laboratory equipments. The Company was established in 1980 and with a profound understanding of business dynamics; the company has established itself as a vertically integrated manufacturer and always strives to provide consistent quality products and excellent customer services to attain the maximum customer satisfaction.

Company name – XYZ LTD
Year of Establishment- 1980
Address: Saha -133001, Haryana, India.

Observations

Table 2: Observation at company

Turnover	05Crore
Employees	12
Organization	Structured
Quality Systems	ISO certified, not Implemented
Marketing Network	Well Developed
Customers	Hospitals, Dentists, Gynaecologists

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Organization Structure

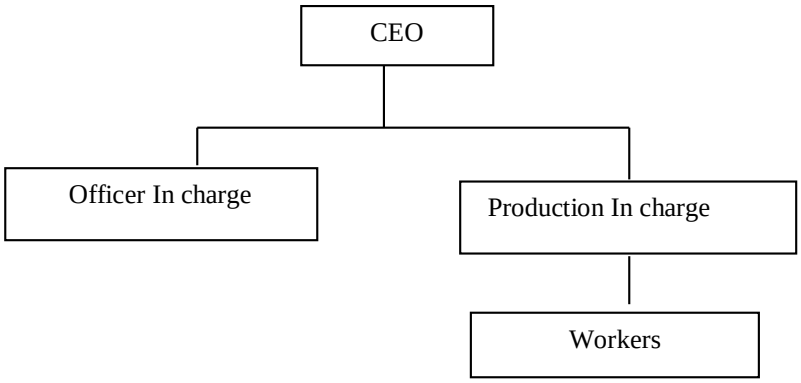

Figure 2: Organization structure of the company

5S Case Study

Observation of past condition

Before using 5S tool status of industry was very poor. Inventories were not given proper place and were lying here and there on the floor. They were damaged badly thus making over spending. In the store the scenario was not different from the previous mentioned. We observed items were scattered here and there, workers were encountering a lot of problems. They were wasting their productive time in searching for the small parts and inventories which was a big loss to the production. Equipment and items present on floor were covered with layers of dust and rust. These were becoming problems in paths of walking and may cause injury to workers. And side by side these were making a barrier in moving parts from one work station to other stations. This whole was creating an unsafe working environment in the industry. Here some pictures of that workplace represent this situation more effectively.

1S implementation

Before

Fig 3: Needed and unneeded inventory Were mixed

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After
Fig 4: Stratification done to separate needed and unneeded inventory

Before implementing 5s unneeded equipments, tools, inventories, materials or parts were lying on the floor. This can lead injuries to the workers. But after implementing 5S inventories were stratified. Those inventories which are useful are kept safe and are given proper place. Those inventories which are of no use at the workplace were brought out and eliminated from the workplace immediately. Now the worker does not waste their productive time in searching the necessary items from unnecessary items. 50 square foot area was saved by removing inventories from the floor.

Cost Analysis
Cost of 1 square foot area = Rs 1000/-
Area saved = 50 square foot.
Savings = Saved area (sq foot) × cost per square foot= 50 × 1000 = Rs 50000/

Fig 5: Pump Covers

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Fig 6: Defective Rotors

Red Tagging is done to the items which are unnecessary. Items which are occasionally used are moved to a more organized storage area outside of the work area. Items which are completely unnecessary are disposed through sale.

Cost Analysis 1) Cost of Aluminium Pump covers = Rs 95/Kg
Quantity of aluminium pump covers red tagged= 40 Kg

Total amount recovered after sale of Aluminium Pump covers= 95*40= Rs 3800/-

2) Cost of Cast Iron Rotor and Stator= Rs 25/Kg.
Quantity of Cast Iron Rotor and Stator red tagged= 200 Kg.
Amount recovered after sale of Cast Iron Rotor and Stator= 25*200= Rs 5000/

2S implementation

Fig 7: Scenario of tools before 5s

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Fig 8: Scenario of tools after 5s

Before implementing 5S, tools were dislocated and spread here and there. Improper conditions were leading the tools to damage and additional costs were paid for purchasing new tools. Workers were wasting their productive time in search for tools. This situation arises because place for tools was not defined and workers were not trained in housekeeping. It was found that a worker has to spend an average of 40 minutes/day in search of tools. It was affecting the production and diminishing it. After implementing the 5S, conditions changed dramatically. After providing a board for tools now average time spend is only 5 minutes/day. Workers were guided to place the tools each time on board after use.

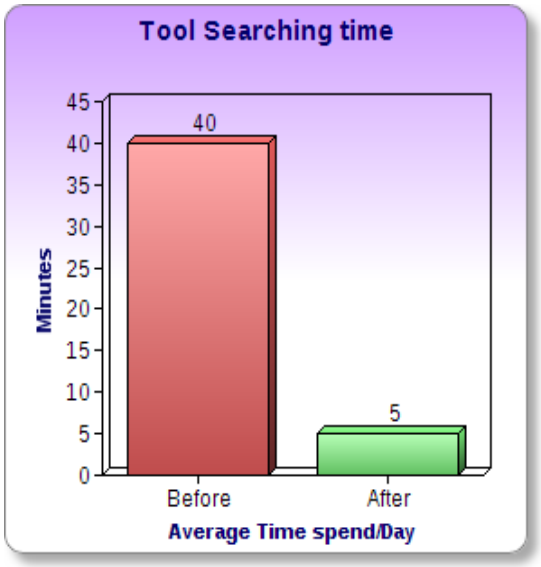

Fig 9: comparison of time taken by the worker for searching the tools before and after 5S

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Cost analysis:
Worker pay per month = Rs 7000/-
Average working hour per day=8
Average labor rate per minute=7000/ (30*8*60*) = Rs 0.49/-
Saved minute per day = (40-5) = 35 min
Total Money saved per day =35*0.49= Rs17.15/-
Per month saving=17.15*30= Rs 515/-

3s Implementation

Fig 10: Before No Housekeeping

Fig 11: After Housekeeping done

Before implementing the 5S, materials were lying on the floor. There was no cleaning done around the machine. The material gets dirty and damaged because of their lying on the floor. This was making extra cost to replace the damaged items with the new ones. This overspending needed to be eliminated. After implementing 5s, Cleaning was done surrounding the machines. Separate racks were provided for materials and a habit of housekeeping was developed inside the workers. After this, overspending on the inventories due to the damaged inventories was much reduced.

4S and 5S implementation

Every worker was given duty to maintain above steps and maintain a habit to perform above steps regularly at their own levels. A weekly audit was done in order to keep an eye on workers. The audit was done for 16 weeks and it was ensured that the workers should follow 5s strictly because it is generally seen that workers jump back again to old ways of working because they don't accept the change easily. They were rated in terms of scores from 0 to 4. After this it was found that workers and employer were boosted with great satisfaction and morale.

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RESULTS OF 5S

- Workers were comfortable in finding inventories from the store due to proper arrangement of the inventory. Now they don't have to spend time to find the items in the store.
- Inventories were protected from damage.
- Paths were clean now and there was not any problem in flow of parts between two stations.
- Chances of injuries to workers were eliminated from the paths.
- A habit of cleanliness and discipline was developed among the workers.
- Morale and satisfaction of employer and workers was increased and they now started doing justice to their jobs respectively.

5S AUDIT

For better execution of 5S activities under the company and the performance of controls in a regular manner, the quality management department's engineers have been commissioned. 5S activities applied in the assembly department of the surveyed company have been reviewed for 16 weeks and the forms have been filled as a result of the weekly routine controls. Scores of each week are summed up, so weekly total assessment scores are obtained and the assessments are made through reflecting the weekly scores on the graphics. In order to provide well understanding of 5S weekly score calculations, 5S control list of week 5 has been given in TABLE 4 and scoring section has been given in TABLE 4 as examples. In the study, the data on these forms have been used and the analysis is tried to be performed through observing the applications within the company. 5 assessment questions have been prepared and 5S assessment form has been prepared (TABLE 3). For answers to be given to these questions in each week, assessment scores as 0 = Very bad, 1 = Bad, 2 = Average, 3 = Good and 4 = Very good have been determined.

5S Audit Results

In Fig.12 it has been observed that from week 1 to week 8 Sort score increases, reason being the sort activities are accepted as work discipline by the personnel of the company. From week 9 to 13 sort score declines. In this period, sort activities are not performed well, reason being heavy work load in the company during the same period.

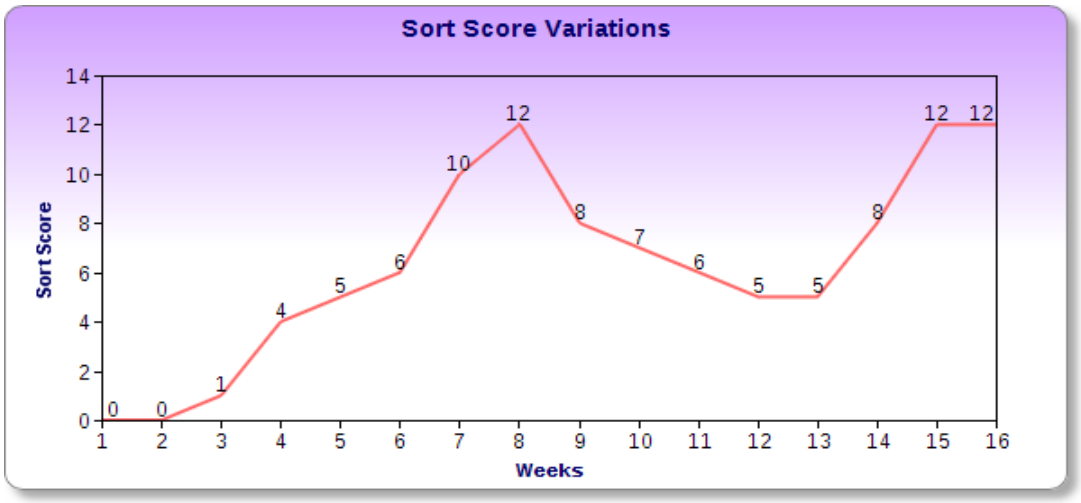

Fig 12: Sort score variations

In Fig.13 up to week 8 set in order activities are performed very well. Fluctuation from week 9 to week 12 is observed but this fluctuation is not on higher side. Then a Horizontal line is observed indicating a continuous habit process.

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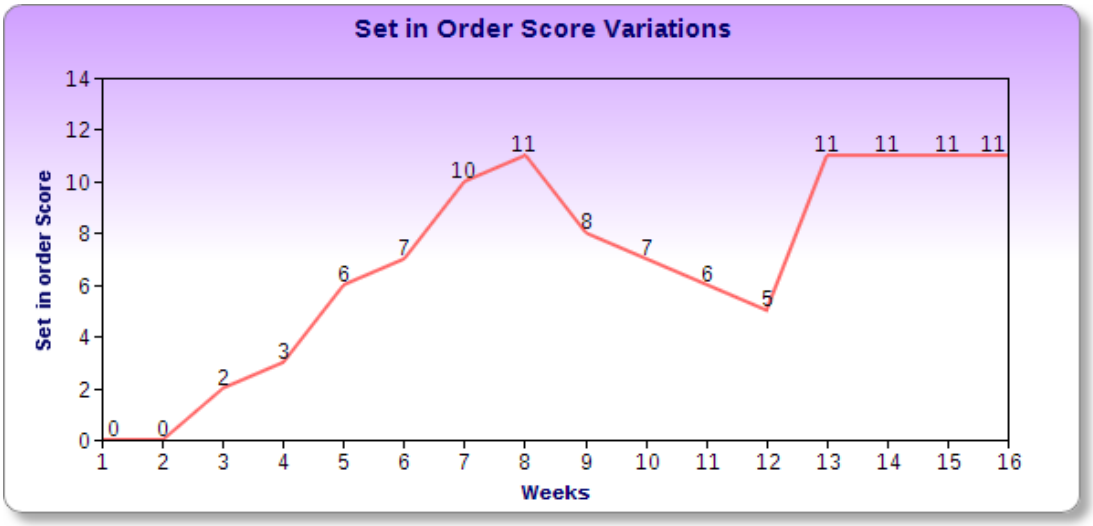

Fig 13: Set in order score variations

In Fig.14 it is shown that shine activities begin through the removal of water, dust, lubricants and Chips from the workplaces. The increase in the work load during the period week 7 to week 13 results in dirty conditions in the work place. But after week 14 again a positive improvement is seen and now shine activities are taken as habit by the personnel

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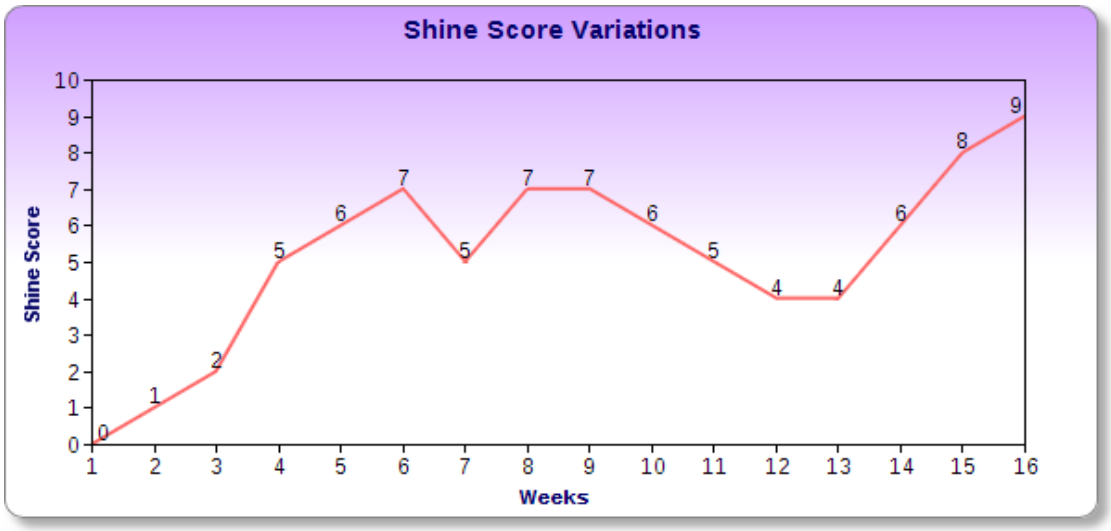

Fig 14: Shine score variations

In Fig.15 it is observed that from week 1 to week 7, standardize score rises but from Week 8 to week 10, score declines but not on a higher side and then till week 16, success level increased in a rapid manner. Increase in standardize activity reflects that rules are very well accepted in the company and 5S activities are applied in a very well manner.

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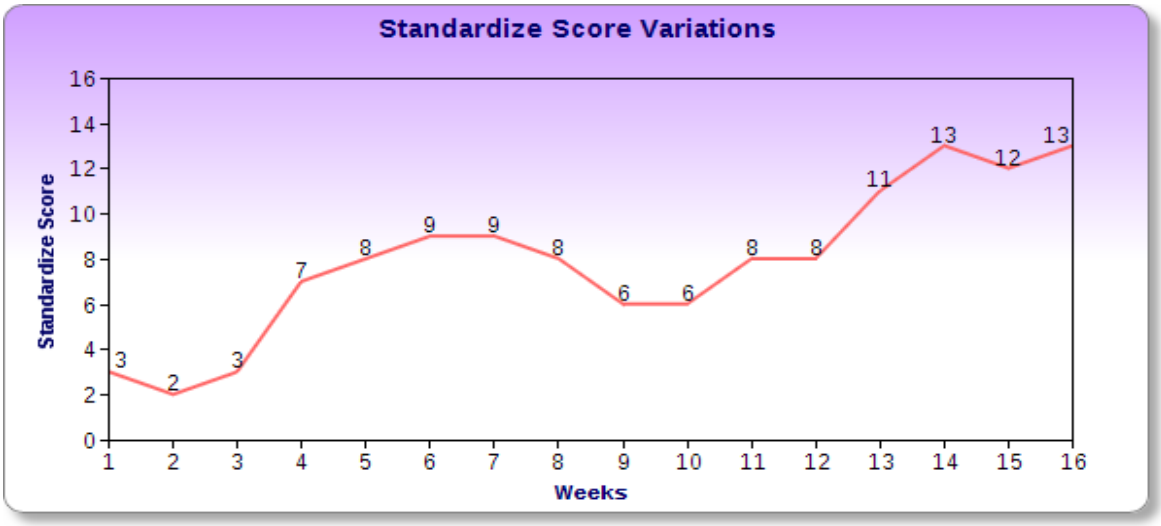

Fig 15: Standardize Score Variations

As it can be seen from Fig.16 the curve of sustain scores is vertical till week 10 and after that a horizontal line is observed till week 16.It shows that 5S activities are performed by the company with total employee involvement and as a routine work. This results in acceptance of system.

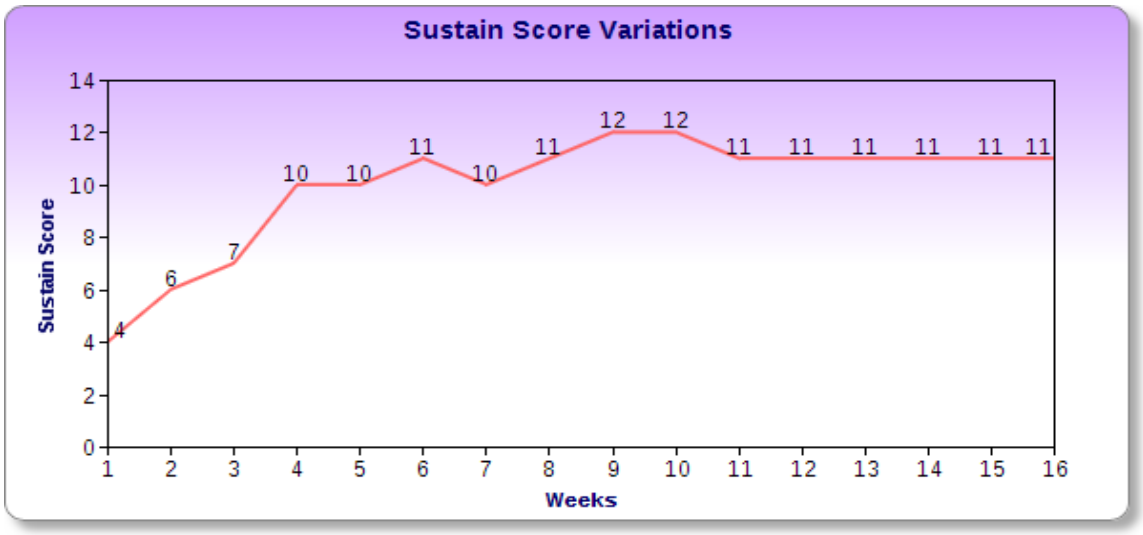

Fig 16: Sustain score variations

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Table 3: 5S audit check sheet form (of week 5).
****0: Very bad, 1: Bad, 2: Average, 3: Good, 4: Very good***

5S	No.	Check point	General Assessment Criteria	Score				
				0	1	2	3	4
SEIRI	1	Materials	There is no unneeded material or parts.	x				
	2	Equipments	All machines should have identification labels		x			
	3	Connection apparatus	No unused tools, dies or jigs are present.		x			
	4	Visual control	Unnecessary materials can be easily recognized.		x			
	5	Written standards	Clear standards to dispose unused things			x		
SEITON	6	Quantity indicators	Maximum and minimum inventory levels should be indicated			x		
	7	Item indicators	Each shelf at the storage areas and each part on it are marked	x				
	8	Location indicators	Regions and places have clearly designated name and place		x			
	9	Separation lines	Separation lines are certain and clear		x			
	10	Connection apparatus	30 seconds retrieval of tools and equipments			x		
SEISO	11	Machines	Machines kept away from chips and oil		x			
	12	Floors	Floor should be free of waste water and oil			x		
	13	Cleaning and control	Cleaning inspections and correct minor problems		x			
	14	Cleaning responsibility	Individual cleaning responsibility assigned	x				
	15	Cleaning habit	Operator habitual of cleaning his place			x		
SEIKETSU	16	Ventilation	Air is odorless and fresh		x			
	17	Lighting	Adequate lightening should be there		x			
	18	Working clothes	Operators clothes are clean & free of lubricant			x		
	19	Protection from dirt	Avoiding dirtiness is must			x		
	20	First 3S	System for protecting first 3S			x		
SHITSUKE	21	Training	Regular training programs for workers				x	
	22	Safety gadgets	Regular wearing of helmets/gloves/shoes		x			
	23	Interaction between people	5s applied properly & good environment		x			
	24	Rules and procedures	Up to date & regularly reviewed			x		
	25	Seeing is believing	Check for 5s environment				x	

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Table 4: 5S Weekly Appraisal Scores

5S activities (weeks)	Sort score	Set in order score	Shine score	Standardize score	Sustain score	Total score
1	0	0	0	3	4	7
2	0	0	1	2	6	9
3	1	2	2	3	7	15
4	4	3	5	7	10	29
5	5	6	6	8	10	35
6	6	7	7	9	11	40
7	10	10	5	9	10	44
8	12	11	7	8	11	49
9	8	8	7	6	12	41
10	7	7	6	6	12	38
11	6	6	5	8	11	36
12	5	5	4	8	11	33
13	5	11	4	11	11	42
14	8	11	6	13	11	49
15	12	11	8	12	11	54
16	12	11	9	13	11	56

Table 5: Possible impacts on safety after 5S

Phase	**Possible impacts on safety**
Sort	Risk of using a broken/rusted tool or machine was eliminated.
Set in order	Work environment was more visible and organized making potential ergonomic risks and hazards transparent. Motion waste was reduced.
Shine	Less risk of accident in the factory.
Standardize	Lesser units on the table and floor made the workplace less prone to slip and trip hazards.
Sustain	The workplace was continuously monitored for safety hazards. Solutions to reduce safety hazards were put forth by different workers rather than the management alone.

CONCLUSION OF 5S

The 5S event was a part of the lean initiative at the manufacturing facility. Several changes were made to the layout, operating procedures, tool organization, material handling and cleaning schedules.

The first phase, sort, resulted in removing unwanted items, broken tools and cabinets, unused parts and scrap materials. Unused inventory was returned to purchasing, rarely used tools and items were assigned a new location and scrap items were discarded.

The second phase, set in order, resulted in several changes in the organization of the workplace. Each of the workstations received their own set of tools. All the tools were color coded to their respective workstation. All equipment had specific locations. Trashcans and other items on the floor had floor markers to indicate their locations. All tools and hoses were removed from the floor and were placed on clamps. Commonly used parts were placed in bins on every workstation.

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The third phase, shine, resulted in removing scrap, dust and other unwanted items from each workstation. This initial clean-up helped to visualize other issues clearly.
The fourth phase, standardize, resulted in developing standard operating procedures for the employees in the assembly area. Some of the standards developed were:

1. Each worker should use the tools assigned to him and put back the tools in their allocated location after use.
2. No units should be placed on the floor.
3. Any time a tool is missing, it should be immediately reported to the supervisor.

The fifth phase, sustain, resulted in the assembly employees conducting periodic audits to monitor the changes made through 5S in the assembly area. Once a week, the activities needed for continuous improvement and the audit results were put up on an electronic notice board.

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