A PROJECT REPORT

ON

"IMPLEMENTATION OF 5S IN AN INDUSTRIAL INVENTORY STORE"

Submitted by

BHOIRA MAAZ WASIULLAH[1]

ANSARI MOHD. ABDUL MOAAEZ AYED[2]

AHMED DHANGE DR PARVEZ[3]

INAMDAR ZISHAN[4]

In partial fulfillment for the award of the Degree

Of

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Of

Prof. SHAIKH SAAD

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KALSEKAR TECHNICAL CAMPUS NEW PANVEL

(Approved by AICTE, recg. By Maharashtra Govt. DTE,

Affiliated to Mumbai University)

PLOT #2&3, SECTOR 16, NEAR THANA NAKA, KHANDAGAON, NEW PANVEL,NAVI MUMBAI-410206,
Tel.: +91 22 27481247/48 * Website: www.aiktc.org

CERTIFICATE

This is to certify that the project entitled

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Submitted by

BHOIRA MAAZ WASIULLAH[1]

ANSARI MOHD. ABDUL MOAEEZ AYED[2]

AHMED DHANGE DR PARVEZ[3]

INAMDAR ZISHAN[4]

To the Kalsekar Technical Campus, New Panvel is a record of bonafide work carried out by him under our supervision and guidance, for partial fulfillment of the requirements for the award of the Degree of Bachelor of Engineering in Mechanical Engineering as prescribed by **University Of Mumbai**, is approved.

Internal Examiner **External Examiner**

(Prof. SHAIKH SAAD)

Head of Department **Principal**

(Prof. ZAKIR ANSARI) (Dr. ABDUL RAZAK HONNUTAGI)

ANJUMAN-I-ISLAM

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Tel.: +91 22 27481247/48 * Website: www.aiktc.org

APPROVAL OF DISSERTATION

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BHOIRA MAAZ WASIULLAH[1]

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INAMDAR ZISHAN[4]

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(Internal Examiner) **(External Examiner)**

_____ _____

Date: _____

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BHOIRA MAAZ WASIULLAH[1]
ANSARI MOHD. ABDUL MOAEEZ AYED[2]
AHMED DHANGE DR PARVEZ[3]
INAMDAR ZISHAN[4]

DECLARATION

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed

SIGNATURES

Bhoira Maaz Wasiullah (13ME70)

Ansari Muhammed Abdul Moaeez Ayed (13ME14)

Ahmed Dhange Dr Parvez (14DME146)

Inamdar Zishan (12ME19)

DATE:

ABSRTACT

5S is a basic foundation of Lean Manufacturing systems. It is a tool for cleaning, sorting, organizing and providing the necessary groundwork for workpiece improvement. This project dealt with the implementation of 5S methodology in the small scale industry. By following the 5S methodology.

5S is a systematic technique used by organizations comes from five Japanese words; Seiri (sort), Seiton (set in order), Seiso (shine), Seiketsu (standardize), and Shitsuke (sustain). This system helps to organize a workplace for efficiency and decrease wasting and optimize quality and productivity via monitoring an organized environment. It also provides useful visual evidences to obtain more firm results. There is a real need for empirical studies in field of new management systems and their impact on company's performance. As importance role of continuous improvement in today's organizations, and lack of sufficient evidence to show the positive impact of 5S on organizational performance, this project aims to determine performance factors and characteristics in OTOKLIN GLOBAL BUSINESS LTD. and identifying the effectiveness of 5S implementation on organizational performance as well.

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LIST OF ABBREVIATIONS

Abbreviations	Descriptions
PVY	Private
e.g	For example
Etc	And other things
FYP	Final Year Project
i.e.	That is
ISO	International Organization of Standardization
JIT	Just in Time
TPS	Total Production System
TQM	Total Quality Management
UK	United Kingdom
USA	United States of America

CHAPTER NO: 1

INTRODUCTION

1.1 Introduction

These chapter overall discuss the introduction of the 5S implementation in the Otoklin filters & solutions pvt ltd. In this part, the briefing of the background, problem statement, objectives, scopes and the objective of the project are discussed.

1.2 Background of the Project

The 5S framework was originally developed by just-in-time expert and international consultant Hiroyuki Hirano. The 5S framework is an extension of Hirano's earlier works on just-in-time production systems. The 5S represent a simple "good housekeeping" approach to improving the work environment.

In general, the 5S approach includes the controls the work floor conditions rather than the worker's behavior. It is relatively inexpensive for the company to implement. It makes the worker's job easier and safer. It promotes daily activity for continuous improvement. It fosters efficiency and productivity while improving work flow. It encourages a proactive approach that prevents problems and waste before they occur. It provides a practical method for dealing with the real problems that workers face every day. And it fits with a facility's other efforts, such as total preventive maintenance, just-in-time manufacturing, pollution prevention, safety initiatives, and lean manufacturing effort.

The goal for this project is to let people realize about the importance of good housekeeping, especially in manufacturing plan. Many people think that housekeeping should be done by housewives at home, and cleaners at work. They do not realize that they, too, play an important part in keeping their houses/workplaces clean. More importantly, they do not know how much they can gain for themselves by just practicing good housekeeping. Whether work in an office, the factory, the warehouse, the laboratory or any other place, housekeeping is relevant to every people.

Good housekeeping is important as it can create an environment in which even minor abnormalities and mistakes will be obvious. Plus, it will produce an easily managed, safer and more pleasant environment. In industry, a clean, well-ordered and attractive work environment sets can help encourages tidy work habits in employees. It helps reduce fatigue.

It will promote good worker-management relations. It also gives a lift to morale, which is reflected in the quality of production and overall efficiency. It can stimulate efforts to improve productivity through better use of people, space, equipment, time and materials.

Good housekeeping is also a good advertisement for every company. It is because customers and clients will have more confidence in an organization when their works is being carried out efficiently in clean, pleasant, well-ordered work surroundings. Good housekeeping portrays professionalism and efficiency to others. It can be expected that the standards displayed in the environment will be reflected in the product.

The more important reason why good housekeeping matter is it makes the undertaking a safer place to work in. Good housekeeping is a main factor in preventing accidents. Majority of all work accidents are caused during the handling of goods or materials, and by people falling, being hit by falling objects, or striking against objects in the workplace. All these causes can be reduced by good housekeeping practices. In fact, good housekeeping is the only cure for hundreds of accidents that occur.

Typical examples of poor housekeeping that lead to these accidents are:

- Excessive material, waste or chips in the working area.
- Congested aisles.
- Tools left on machines.
- Waste containers overflowing.
- Lockers and workroom in disorder.
- Broken glass.
- Electric leads or air lines across aisles.
- Dirty light fittings, windows and skylights.

We can stop accidents through good housekeeping. Where housekeeping is bad, fire is a 3 constant hazard. It can be caused by many housekeeping problems, such as oil-soaked rags and clothing igniting from spontaneous combustion and many more risks.

1.3 Problem Definition:

The small scale industry occupies a prominent position of unique importance in economy of India. It has emerged as powerful tool in providing relatively larger employment next to agriculture. Global markets are continuously changing and demanding product of high quality and low cost. In India, the survival and the growth of small scale industry largely depends on its ability to innovate, improve operational efficiency and increase productivity. Many business have been trying to adopt new business initiative in order to stay alive in the new competitive market place. Lean manufacturing is one of these initiatives that focuses on the cost reduction by eliminating wastes.

There is a need to follow the method according to its framework to be easy to use and allow a practical and comprehensive measurement and also to cover most aspects of total quality management. It also allows a meaningful and practical analysis in the sense of being usable for total quality management approach and being applicable to the industry.

1.4 Objective:

The main objective of the present work is to simplify, clean, and sustain a productive work environment at OTOKLIN Limited. 5S is a system which will reduce waste and optimize productivity through maintaining an orderly store and using visual cues to achieve more consistent operational results. Implementation of this method will "clean up" and organize the store basically in its existing configuration using 5S which is an effective tool for improvement of organizational performance regardless of organization type, size, its production or its service. 5S techniques would strongly support the objectives or organization to achieve continuous improvement and higher performance.

The objective of our research was to increase the storing place with 30%, create and preserve standards and service procedures specific to the workshop, reduce unproductive time with 10%, redefine access, working and storage spaces, readjust the location

The Otoklin Limited is keen on increasing the effectiveness of their manufacturing and assembly operations through a better workflow and an enhanced layout of the inventory store. This is essential step in the industry’s effort toward attaining excellence at all aspects and activities. Hence, this project aims to study the current workflow at Otoklin Industry pinpoint existing flow issues, and analyze the overall impact on the effectiveness of the production system

1.5 Scope of the Project

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 and store keeping systems. The methodology used can be extended for more factors by involving more reviews to get more accurate results.

1.6 Summary

The report writing mainly consists of four chapters which are ;

Chapter 1: It covers the introduction of 5S and various aspects of the project.

Chapter 2: Literature survey of related issues along with the philosophy in regards with 5S system is stated in this chapter.

Chapter 3: It will give a clear idea of the methodology adopted for the implementation of 5S lean manufacturing system and

Chapter 4: This chapter shall showcase the present work scenario at the inventory store of *OTOKLIN GLOABAL BUSINESS LTD.*

Lastly, conclusions and obtained results along with references will be stated.

1.7 Company Profile

Fig 1.1- Company Profile

Otoklin Global Business Limited Filters making company which sells various types of filters using German technique, it does not consist of any hydraulic or pneumatic connections and not used any types of motors.

Establishment Year: 2003

Products

- Cartridge Filters
- Air Filters
- Coolant Filters 5
- Sand Filters
- Bar Filters Slot Tube Filters
- Basket Filters
- Strainer Filters

Import/Export Region

- Import region North America Asia-Pacific
- Export region North America Western Europe Central/East Europe

Vendors

- L&T
- TATA Groups
- RELIANCE

Plant Layout

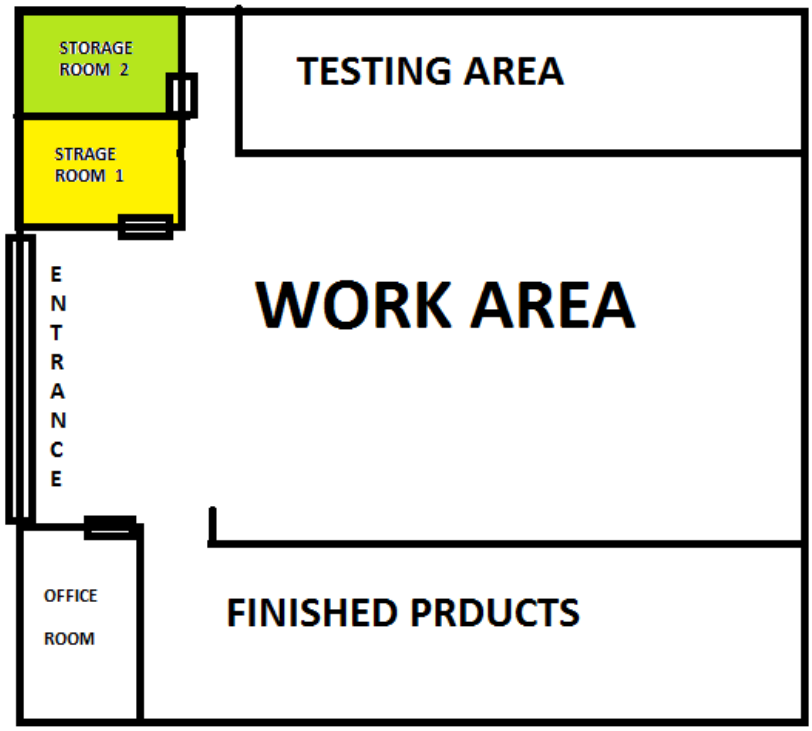

Fig 1.2: Plant layout

In **Fig 1.2**, The overall layout of the OTOKLIN industry wherein, the store highlighted in yellow has been undertaken for implementation of 5S wherein it manufactures Cartridge Filters, Air Filters, Coolant Filters, Sand Filters, Bar Filters Slot Tube Filters, Basket Filters, Strainer Filters etc.

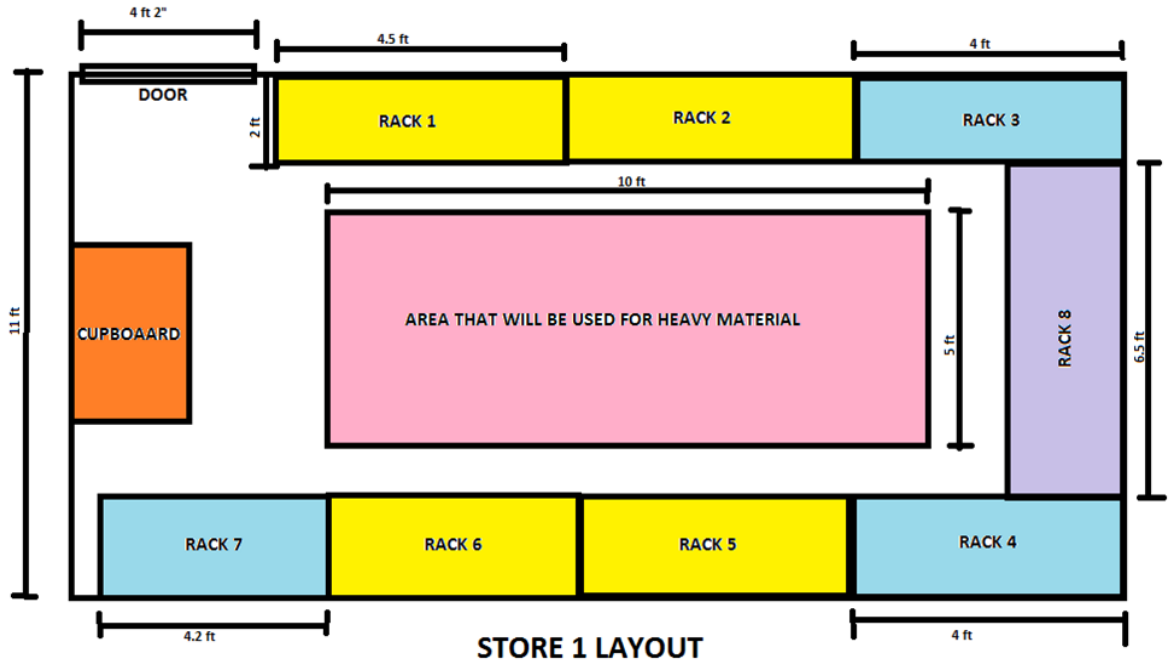

Fig 1.3: Store layout

Fig 1.3 shows The Schematic representation of the store with complete dimensions and with installation of racks (7 in number) and a cupboard which is already OTOKLIN property

1.8 Problem Faced

Scattered inventory in the store of OTOKLIN Limited consumes much non-productive handling time in fetching required tools and material for manufacturing for various parts hence affecting the efficiency of production and also working ambience do not motivate workers to perform. So as to increase the productivity and efficiency of the industry it is necessary reduce material and equipment handling cost.

1.9 5S Strategy

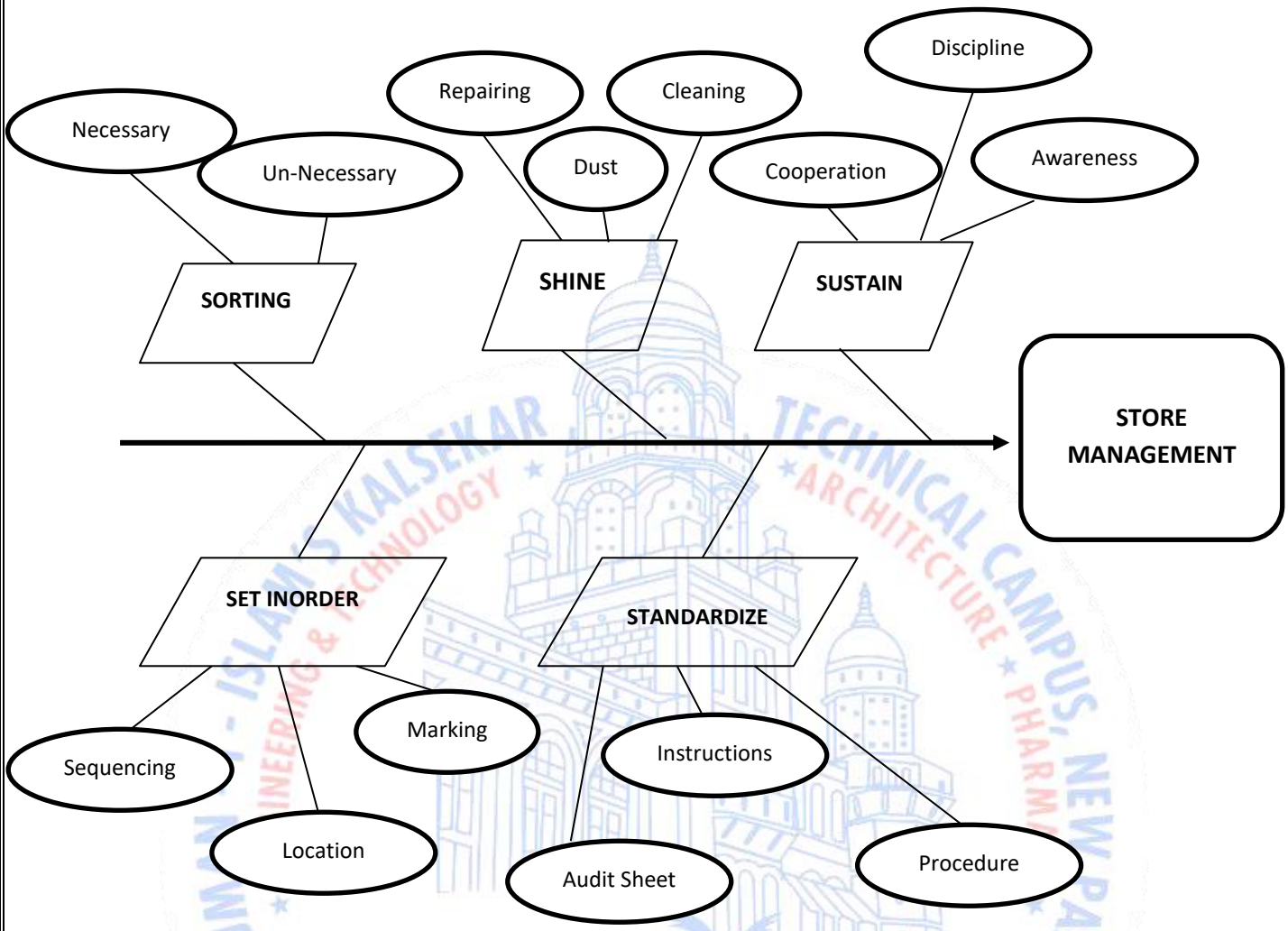

Fig 1.4: Fish Bone Diagram

Fig 1.4 shows the strategy followed for the implementation of 5S in OTOKLIN; wherein a short representation of the further sub-detailing of 5S has been done

CHAPTER NO: 2

LITERATURE REVIEW

2.1 Introduction

In this chapter we will proceed with the reference review from the relevant literature. It includes the details related to the information and history which have been done already by other people that involve implementing of 5S lean manufacturing methodology.

2.2 Introduction of 5S

5S initially based on the Japanese acronyms of seiri (organization), seiton (neatness), seiso (cleaning), seiketsu (standardization) and shitsuke (discipline), is used as a platform for developing an integrated management system by the parallel use of total productive maintenance (TPM) (Bamber et al., 2000).

Osada (1991) refers to 5S as the five keys to a total quality environment. 5S is a system to reduce waste and optimize productivity and quality through maintaining an orderly workplace and using visual cues to achieve more consistent operational results. The practice of 5S aims to embed the values of organization, neatness, cleaning, standardization and discipline into the workplace basically in its existing configuration, and it is typically the first lean method implemented by firm.

Kobayashi et al. (2008) make a distinction between 5S as a philosophy or way and 5Sas a technique or tool by comparing the frameworks provided by Osada (1991) and Hirano (1995) respectively. From their study, they conclude that 5S tends to be recognized as a philosophy in Japan, but in the other hand it is likely to be considered as a technique or tool in the United Kingdom and United State of America. Osada (1991) views 5S as a strategy for organizational development, learning and change, whereas Hirano (1995) considers 5S to be an industrial formula that differentiates a company from its competitors.

A common definition of 5S in the West is housekeeping (Becker, 2001; Chin and Pun, 2002; Ahmed and Hassan, 2003; Eckhardt, 2001). In the West both 5S and TPM are sometimes 9 disregarded or at least underutilized (Douglas, 2002). A framework of applying 5S within a business (as appose to a personal philosophy of way of life) was first formalized in the early 1980s by Takashi Osada (Ho et al., 1995).

The practice of 5S aims to embed the values of organization, neatness, cleaning, standardization and discipline into the workplace (Osada, 1991). In Japan the 5S practice was initiated in the manufacturing sector and then extended to other industries and services sector. The Toyota Production System provides a well-known example of 5S principles in practice, the early versions were based on 3-S this, became 4-S (Ohno, 1988).

Boeing in the USA pursues 5S as a world-class strategy (Ansari and Modarress, 1997). Even with these prestigious and complex examples it appears that many researchers and practitioners have difficulty going beyond the simplest 5S concept.

2.3 History of 5S

5S was developed in Japan. It was first heard of as one of the techniques that enabled what was then termed 'Just in Time Manufacturing'. The Massachusetts Institute of Technology's 5- year study into the future of the automobile in the late 1980s identified that the term was inappropriate since the Japanese success was built upon far more than components arriving only at the time of requirement. John Krafcik, a researcher on the project, ascribed Leanto the collective techniques being used in Japanese automobile manufacturing; it reflected the focus 10 on waste in all its forms that was central to the Japanese approach. Minimised inventory was only one aspect of performance levels in companies such as Toyota and in itself only arose from progress in fields such as quality assurance and Andonboards to highlight problems for immediate action.

5S was developed by Hiroyuki Hirano within his overall approach to production systems. Many Western managers coming across the approach for the first time found the experience one of enlightenment. They had perhaps always known the role of housekeeping within optimized manufacturing performance and had always known the elements of best practice. However, Hirano provided a structure for improvement programs. He pointed out a series of identifiable steps, each building on its predecessor. Western managers, for example, had always recognized the need to decide upon locations for materials and tools and upon flow of work through a work area; central to this (but perhaps implicit) is the principle that items not essential to the process should be removed – stored elsewhere or eliminated completely. By differentiating between Seiri and Seiton, Hirano made the distinction explicit. He taught his audience that any effort to consider layout and flow before the removal of the unnecessary items was likely to lead to a sub-optimal solution.

Equally the Seiso, or cleanliness, phase is a distinct element of the change program that can transform a process area. Hirano's view is that the definition of a cleaning methodology (Seiso) is a discrete activity, not to be confused with the organization of the workplace, and this helps to structure any improvement program. It has to be recognized, however, that there is inevitably an overlap between Seiton and Seiso. Western managers understood that the opportunities for various cleanliness methodologies vary with the layout and storage mechanisms adopted. However, breaking down the improvement activity in this way clarifies that the requirements for the cleanliness regime must be understood as a factor in the design aspect of Seiton. As noted by John Bicheno, Toyota's adoption of the Hirano approach is '4S', with Seiton and Seiso combined – presumably for this very reason. The improvement team

must avoid the trap of designing the work area and then considering the cleanliness or tidiness mechanism.

Hirano also reminded the world of the Hawthorne effect. We can all introduce change and while people in the business consider the change program to be under management focus the 11 benefits of the change will continue, but when this focus has moved (as is inevitably the case) performance once more slips. Western managers, in particular, may have benefited from the distinction between the procedural or mechanical elements, Seiketsu, of keeping these matters in focus and the culture change, Shitsuke, which is a distinct approach to bringing about a new way of working. A number of publications on the subject in the West have questioned whether this culture can really be tackled as part of an exercise of relatively limited scope. The broader kaizen, or continuous improvement, approach is built, among other things, upon the company's valuation of all members of the workforce. If employees don't feel valued within the overall company culture, perhaps the change required falls outside the limits of a housekeeping improvement program.

2.4 Philosophy of 5S

2.4.1 Introduction

5S is a manufacturing technique for work place organization and it is used to the implementation of lean conditions.5S is a reference to five Japanese works which described standardized method to improve the work in the organization.

2.4.1.1 SEIRI - Sorting Out

5S Seiri or Sort is the first step in 5S, it refers to the sorting of the clutter from the other items within the work area that are actually needed. This stage requires the team to remove all items that clearly do not belong in the working area and only leave those that are required for the processes in question. The necessary and unnecessary items available in the workplace should be sorted and classified. By sorting one can identify the materials, tools, equipment and necessary items for this. Frequently used items are placed near to reach while not frequently used items are placed after that. It helps to maintain the clean workplace and improves the efficiency of searching and receiving things, shortens the time of running the operation.

Rules of Performing Seiri:

- If there are any unnecessary things which are causing mixing of things should be cleared.
- Any unnecessary part of the item placed other side should be brought back to its original position.
- Tools of material which lie on production floor should be in the tool floor.
- Check weather all necessary things sorted to its own place.
- All tools are classified properly with the rule.
- After all these steps, we will use Red Label or Red Tag technique, this technique is applied to all the unnecessary items for its reorganization.
- **Fig. 2.1** shows the sorting that is usually done in an industry.

Fig. 2.1 SEIRI

Benefits of Seiri:

- Improve the processing in the work place.
- Reduction in the cost.
- Solves the problem of Stock of item.
- Problem of losing tools eliminated.
- Better Work area.

2.4.1.2 SEITON - Set in Order

5S Seiton or Straighten is the process of taking the required items that are remaining after the removal of clutter and arranging them in an efficient manner through the use of ergonomic principles and ensuring that every item ―has a place and that everything is in its place. It means cleaning & organizing the necessary items neatly and systematically so that they can easily be taken and returned in the original place after use. By this we can increase the efficiency of production in the industry. The aim of this is to minimize the number of work that a worker has to perform during operation. Visualization of the workplace is also very important. Eg. painting the floor helps to identify the places of storage of each material or transport ways, drawing out the shapes of tools makes possible the quick putting aside them on the constant places, coloring labels permit to identify the material, spare parts or documents. Tools, equipment, and materials must be systematically arranged for the easiest and the most efficient access. There must be a place for everything, and everything must be in its place.

Rules of Performing Seiton:

- Position of every place should be decided earlier where items supposed to be placed.
- All tools should be segregated on the basis of regular uses.
- Put all the important items in a accessible position where it can be brought easily.
- Small tools should be placed in a specific place or recognized place.
- **Fig. 2.2** shows the safety equipment should be placed in the right position for emergency requirement.

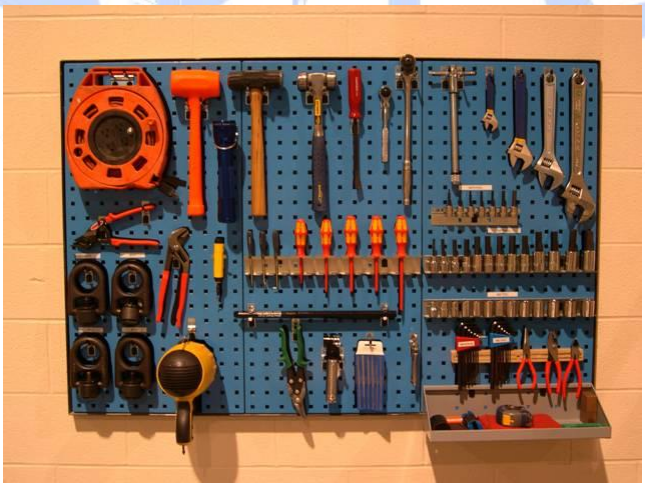

Fig 2.2: SEITON

Benefits of Seiton:

- Increases the efficiency of the production.
- Effectiveness increases.
- Time required for seeking the items are reduced.
- Improves the safety.

2.4.1.2 SEISO – Shine 5S

Seiso or Sweep is the thorough cleaning of the area, tools, machines and other equipment to ensure that everything is returned to a ―nearly new status. This will ensure that any non-conformity stands out; such as an oil leak from a machine onto a bright, newly painted clean floor. For asthetic view, it is essential to create a clean and regular working and living environment in the workplace. This is because dust, dirt and wastes can stop the efficiency of workplace. Cleaning should become a daily activity. Work place should be cleaned at regular intervals for better production. Regular cleaning permits to identify and to eliminate sources of disorder and to maintain the clean workplaces. During cleaning it is checked the cleanness of every item in the workplace on the regular basis. A sheet of cleaning can also be made by operator to check cleanness in the workplace. By providing this sheet, we can enhance the maintenance of the work place.

Rules of Performing Seiso:

- Check roughly everything, and clear all major source of unnecessary things.
- Clean all the machines present in the work shop on daily basis.
- Check all the tools, equipments on weekly basis, and provide necessary cleaning.
- Clean the shop floor & work floor.

Benefits of Seiso:

- Cleans the workplace.
- Increases the efficiency of machines.
- Maintains the cleanness in the industry.
- Finds the errors in the workplace.
- **Fig. 2.3** explains that it eliminates accidents due to cleanness.

Fig: 2.3: SEISO

2.4.1.4 D-SEIKETSU – Standardize

5S Seiketsu or standardize is the process of ensuring that what we have done within the first three stages of 5S become standardized; that is we ensure that we have common standards and ways of working. Standard work is one of the most important principles of Lean manufacturing. It maintains the habit or standard of cleanness all time in the industry. It maintains good practices at the workplace. Standards should be very clear and easy to understand. There is a need after some period to choose the best ways to practice sort, set in order and cleaning. It is assumed that standards should not be implemented only in the processes such as production, maintenance, storing, but also in the administrative processes, for example: book-keeping, customer service etc.

Rules of Performing Seiketsu:

- Give strict instructions about cleanness to the whole staff.
- Maintain habit to check the progress in the cleanness.
- Make an audit sheet to ensure cleanness.

Benefits of Seiketsu:

- Increases the safety of industry.
- Reduction in the pollution created by industry.
- **Fig.2.4** shows that it maintains the good habit among the staffs about cleanness

Fig 2.4: SEIKETSU

2.4.2.5 SHITSUKE – Sustain

The final stage is 5S Shitsuke or sustain, ensuring that the company continue to continually improve using the previous stages of 5S, maintain housekeeping, and conduct audits and so forth. 5S should become part of the culture of the business and the responsibility of everyone in the organization. It makes the habit for staffs of industry to learn all the above 4S.Trained skilled persons teaches the staff about the all 4S.The task here is undertaken by the leader directors. The directors should explain the importance of 5S to the personnel through various trainings. The knowledge of the personnel about 5S should be kept updated through the 5S boards to be formed at the workplace. To maintain the standards and keeping the technique in safe and efficient order. It is also important to understand the need of executing the 5S rule on a fixed interval. The learning of the 5S rule is executed once a month by chosen team.

Rules of Shitsuke:

- Manager of the industry should take the responsibility to held a program for 5S rule.
- Staffs should also be eager to learn the technique.

Benefits of Shitsuke:

- Increases the awareness among the staffs.
- Reduces mistake resulting by staffs.
- Improves relations between the staffs.
- **Fig 2.5** shows the disciplined arrangement of tools which increases the efficiency and reduces the calamities

Fig 2.5: SHITSUKE

2.5 Literature Survey

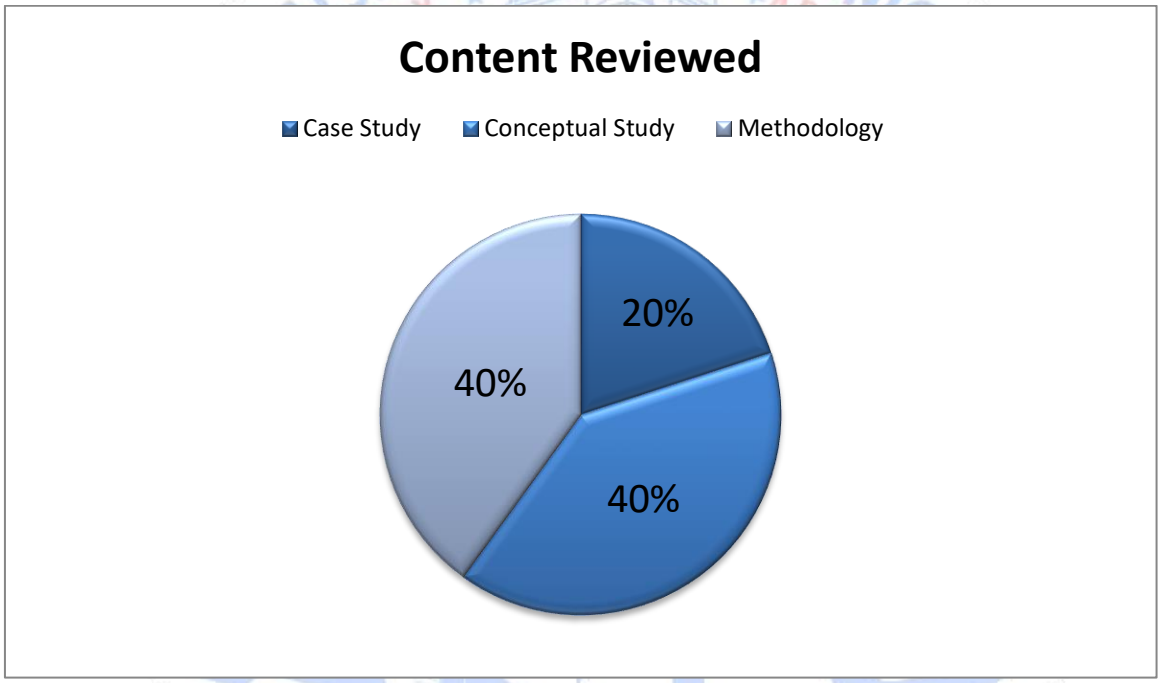

Fig 2.6: Content Reviewed

The above pie chart **Fig 2.6** shows that we have reviewed 25 papers out of which 20% of the papers consisted of case studies, 40% papers were of conceptual studies and 40% consisted methodologies of 5S.

2.6 Project Planning

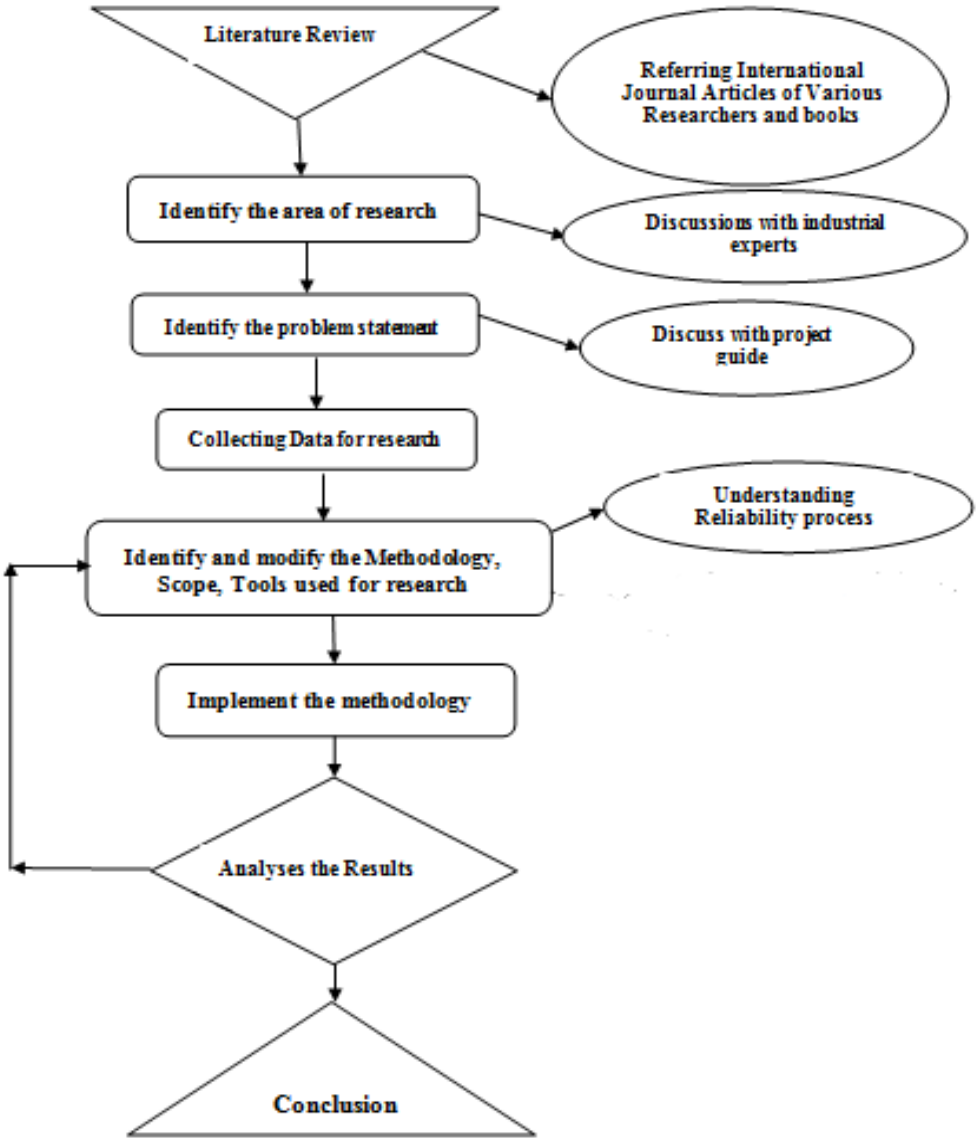

Fig 2.7: Flow Chart

As shown in **fig 2.7**, The planning of the project sequence was followed as described in the flow chart wherein; starting from the literature review and going through the different journals and verities of papers followed by expert talks and ideas to implement in more effective way with our guide and further collecting the required data from the industry and defining the problem and then initiating with 5s and in the end, implementing 5S.

CHAPTER NO: 3

Methodology

3.1 Introduction

Many manufacturing facilities have opted to follow the path towards a "5S" workplace organizational and housekeeping methodology as part of continuous improvement or lean manufacturing processes. 5S is a system to reduce waste and optimize productivity through maintaining an orderly workplace and using visual cues to achieve more consistent operational results (see chart on page 3). The term refers to five steps – sort, set in order, shine, standardize, and sustain – that are also sometimes known as the 5 pillars of a visual workplace. 5S programs are usually implemented by small teams working together to get materials closer to operations, right at workers' fingertips and organized and labeled to facilitate operations with the smallest amount of wasted time and materials. The 5S system is a good starting point for all improvement efforts aiming to drive out waste from the manufacturing process, and ultimately improve a company's bottom line by improving products and services, and lowering costs.

"A place for everything, and everything in its place" is the mantra of the 5S method, and storage and workspace systems such as those provided by Lista International allow improved organization and maximum use of cubic space for the highest density storage. The result is an improved manufacturing process and the lowest overall cost for goods produced**.**

3.2 Implementation of 5S

Implementing the 5S method means cleaning up and organizing the workplace in its existing configuration. It is typically the first lean method that organizations implement. This lean method encourages workers to improve their working conditions and helps them to learn to reduce waste, unplanned downtime, and in-process inventory.

A typical 5S implementation would result in significant reductions in the square footage of space needed for existing operations. It also would result in the organization of tools and materials into labelled and colour coded storage locations, as well as "kits" that contain just what is needed to perform a task.

The 5S methodology is a simple and universal approach that works in companies all over the world. It is essentially a support to such other manufacturing improvements as just-in-time

(JIT) production, cellular manufacturing, total quality management (TQM), or six sigma initiatives, and is also a great contributor to making the work-place a better place to spend time.

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), 21 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.

3.3 Value Stream Mapping on 5S

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 house-keeping 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. 22 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, as shown in **fig 3.1** 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.

Fig 3.1: Open shelving (left) is very inefficient at storing small items. High density drawer and shelf storage (right) enables storage of small items in right-sized compartments, increasing cubic capacity and organization.

3.4 The role of storage in 5S workplace

As noted, one of the 5S pillars is identifying and eliminating many kinds of waste, including time wasted searching for items, waste due to difficulty in using items, and waste due to difficulty in returning items. Storage solutions play an important part in implementing waste elimination through space reduction, organization improvement, and inventory management. Storage cabinets and workbench products that allow dense storage, a smaller footprint, and visual organization near where the tool is needed, become a key factor in implementing the 5S program.

Systems should be set up so everything has a place that is available when needed, including the manufacturing floor, areas where products are being packaged, through the equipment maintenance area. Everything should be labelled and identified. Local storage minimizes travel time, and adjustable storage and workbenches make it easier to adapt to the differing needs of individual employees. Using Storage Walls organized with bar-coded handles can reduce wasted time due to lost inventory and searching. Such systems also facilitate quick

tool changes for different product lines. Storing tools next to machines in use rather than in multiple storage locations around the facility can save hours each day.

Modular drawer storage cabinets that allow the maximum use of cubic space for the highest 24 density storage are ideal for high-density storage of parts, tools and items of virtually any size and type. They are scalable enough to adapt to future requirements, provide maximum weight-bearing capacity, tailored drawer organization, and ergonomic item handling and access.

CHAPTER NO: 4

PRESENT WORK

Scheduling

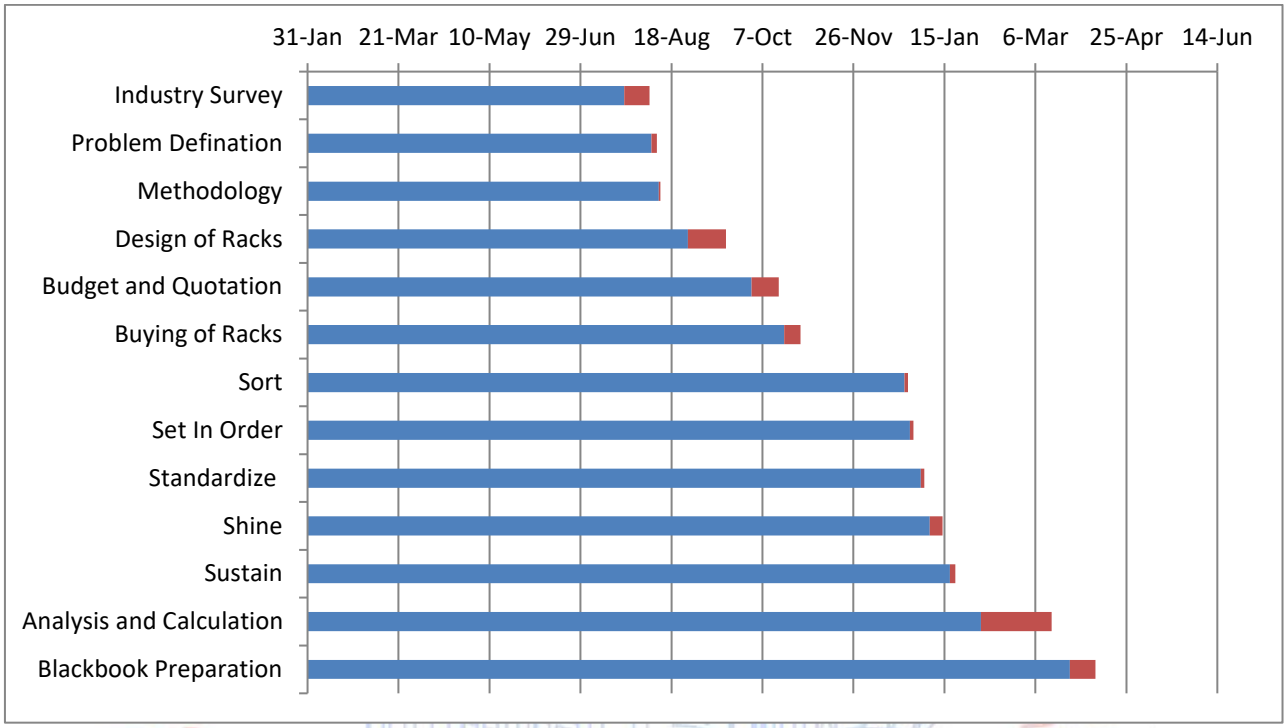

Fig 4.1: Scheduling

As shown in **Fig 4.1**, The initial phase of the project was to survey the industry which would allow us to do a quality based project. We started surveying various industries from 23rd July, 2016 onwards. We got a green light from Otoklin after 14 days of surveying. Defining of the problem was to be done which we began on 7th August, 2016. Brainstorming sessions with our guide took us 3 day to define the problem in a clear manner. Now, we started with literature review on 11th August 2016. We opted the best methodology of 5S lean manufacturing system based on the papers reviewed in less than a day. Now our paramount goal was to design the racks for the scattered store room. We began that on 27th August, 2016 and which took a little less than month to complete. Once the racks were designed, it was now time to find out quotation and budget with in which the racks shall be made and the installation will be done. It took 15 days after 1st October, 2016. Now, the company couldn't afford to fabricate new racks as per designs so we had to purchase second hand racks from the local vendors in Chandivali. It took 9 days to buy all the racks needed for implementation. Once the racks were installed implementing all the 5 S's according to the literature survey we had done at the very beginning, started from 24th December, 2016, soon after our exams concluded. There were five stages in which, the first stage; **1S: SORT** was implemented by 26th December, 2016 ; **2S: SET IN ORDER** was implemented by 29th December, 2016 ; **3S:**

STANDARDIZE was implemented by 4th January, 2017 ; **4S: SHINE** was implemented by 14th January, 2017 ; followed by **5S: SHINE** which was implemented by 21st January, 2017.

After Implementing 5S at the inventory store of *OTOKLIN GLOBAL BUSINESS LTD.* Analysis and conclusion were made which took the most time out of all activities. This activity took around 39 days to complete 8 weeks analysis and conclusion. Lastly, it took 19 days to write a detailed report (BLACK BOOK) about the project.

We started implementing 5S one by one in steps as learned from Literature Review after proper design of racks.

4.1 Design of Racks

We designed the rack of the store room on the basis of materials are the frequently used, seldom used and rarely used and also the size and quantity of the materials were taken into consideration. We took required guidance from the store manager at *OTOKLIN GLOBAL BUSINESS LTD.* as he had proper knowledge of how material is kept and used in various months of the year.

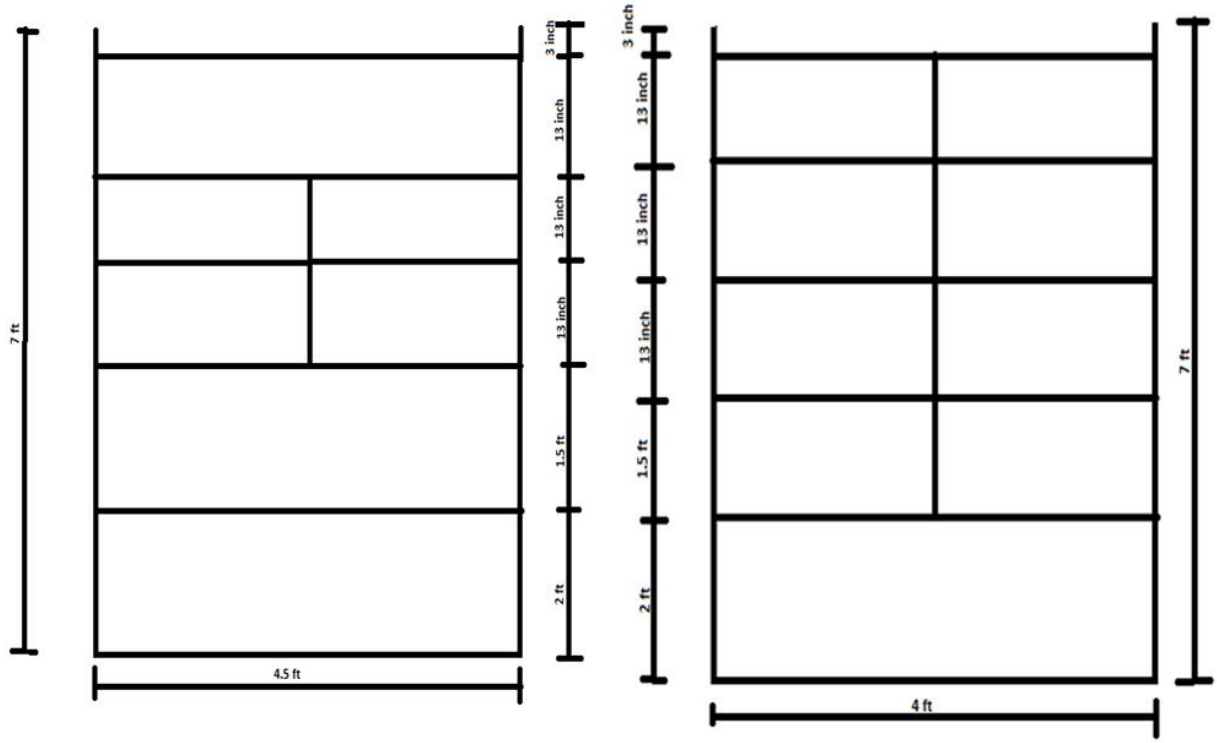

Fig4.2 Design of Racks

The racks shown in **fig 4.2** were designed as per the limitations of the store measurements, the lower deck is for the heavy flanges and paint boxes which cannot be placed in the upper decks and further upper sections were for small tools like nuts, cutting and grinding wheels and other valves.

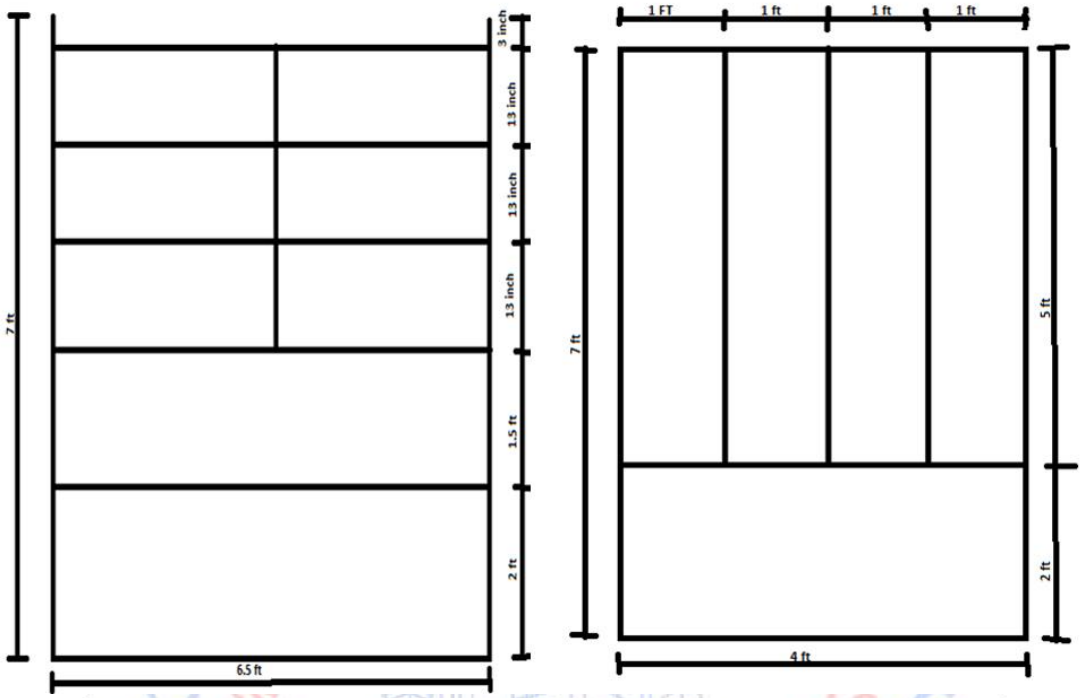

Fig 4.3: Design of Racks

The racks shown in **fig 4.3** were designed as per the limitations of the store measurements, the rack (on right) is specially designed for the wire meshes which can be stored vertically without causing any damage to the wire mesh

4.2 Implementation of 5S

4.2.1 SORT

As shown in **Fig. 4.4** In sorting we distinguished the useful and scrap items. Then scrap items were kept all aside at one location and we named the location as scrap yard which is just located outside the storeroom.

Fig 4.4: Scrap yard kept in front of the store

The above image is of the scrap yard just opposite to the entrance of the store room. We chose this place because it had sufficient place to dump all the scrap. Scrap included, cut outs of M.S plate, empty boxes of gas cutter, welding rods, cutting wheel, grinding wheel, used office stationary, rusted bolts and nuts, wooden blocks used for support, cut outs from wire meshes, SS Spee perforated sheet, manifold valve etc.

In store room there is lots of material present such as cutting wheel, grinding wheel, wire mesh, different types of valves & fasteners, etc. We also asked for a list of all the materials which are present in the company & then we sorted these materials according to frequent used, seldom used and rarely used.

After removing scrap we sorted the useful materials according to their respective sizes.

4.2.2 Set In Order

As shown in **fig 4.6**, We differentiated grinding wheels and cutting wheels according to the sizes i.e 4", 5", 7" then we sorted fittings into their following categories as butt welded elbow, socket welded elbow and equal tee.

Sorted and arranged the flanges in accordance to their sizes i.e 20NB, 25NB, 50NB, 80NB, 65NB, 100NB. Then we differentiated special welding rod (6010, 316L, 308L, 309L). Sorted all the fasteners in size 3/4, 5/8 and also ejectors, spanners and name plates sorted as per sizes. Differentiated couplings according to sizes 1", ½", ¾". Sorted all Types of valves which are gate valve (Flange end 1", threaded butt weld ½" &1"), ball valve (screwed end 1". 3pic design 1",¾"; 2pic design 1", ½", 1 ½"; flange end ½"), gate valve flange end (80NB), ball valve flange end (SS316).

Fig 4.5: The overall presentation of the store before 5S: wherein all the inventories were not sorted in its place which made it difficult for the workers to hunt for the required tools

Fig 4.6: Overall presentation of store after implementing 5S: wherein all the inventories are sorted, kept in its place, cleaned and the disciplinary norms are maintained

4.2.3 Shine

Cleaning is third method of 5S technique; we implemented this method as we were proceeding with the sorting method. As we were proceeding the sorting, we were differentiating used & not used items and then we cleaned the whole work place, then after this we reached every racks & then cleaned every racks for cleaning method. The unwanted items were placed in Rejection box.

Fig 4.7: Cleaning and disposing unwanted items were kept in a separate section which would automatically keep the store clean and help to maintain it in proper condition

Cleaning also involved dusting of the material which were untouched from a long period of time. It also involves proper light exposure in the room for better work environment. We did that by cleaning the entrance area as it is the only source for air to vent in and out as shown in the **fig 4.7**

4.2.4 Standardize

The fourth "S" stands for standardize. In this step standard procedure, audit sheet and work instructions are prepared to maintain 3S. Before starting of work to check and correct the sorted items, placing equipment at its place and cleaning etc. and give proper reading on audit sheet and create awareness in employee to maintain this thing on production line or on non-productive line.

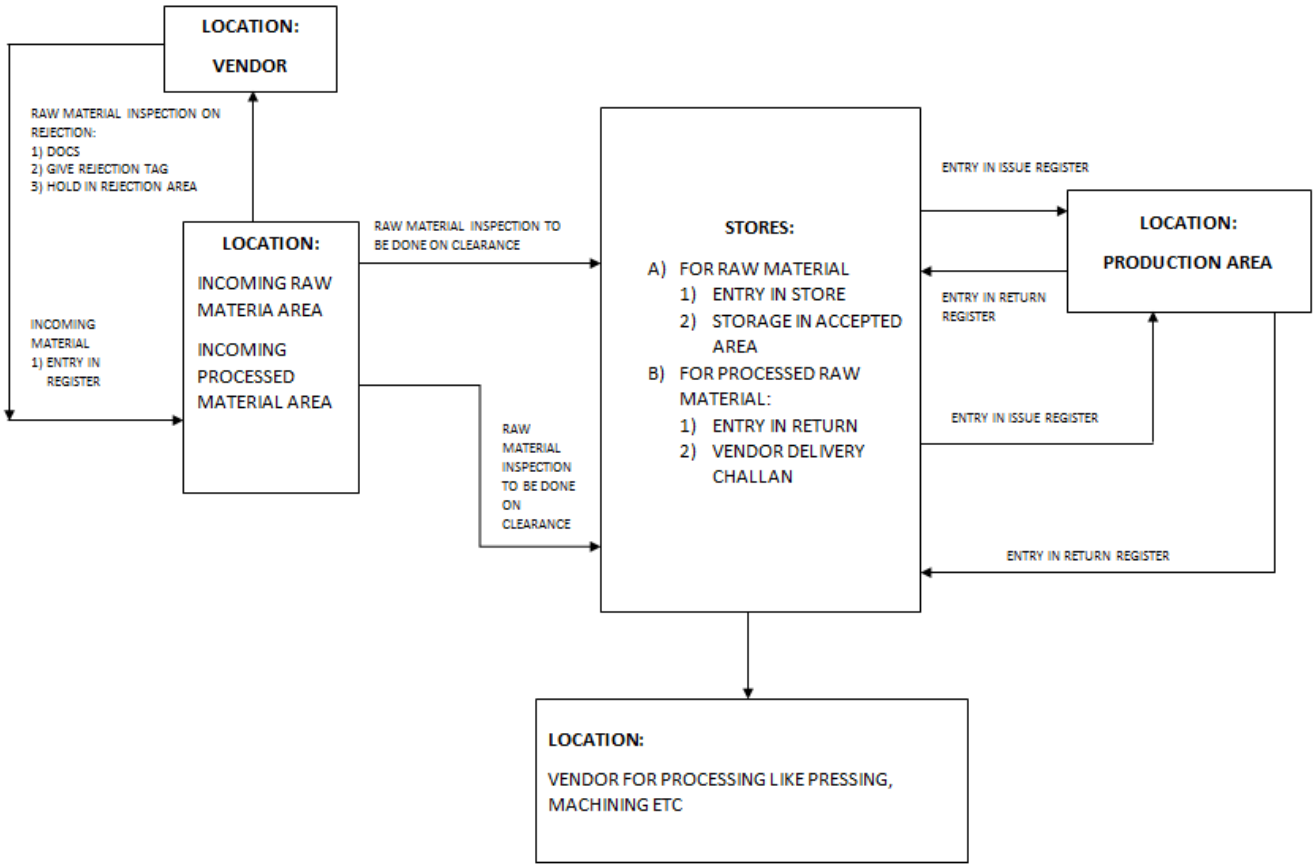

Fig 4.8: Material Flow Chart of the industry pre-implementation of 5S

The above **fig 4.8** flow chart depicts the old material flow upon arrival i.e. from the transport to the store room and forth. It was not designed properly to maintain proper records of material in-flow and out-flow. Hence, as shown in **fig 4.9** we standardized the material In-flow so that proper records can be maintained right from raw materials to finished products. Systematic way of material flow can be cost efficient and time efficient which ultimately benefits the company in overall market scenario.

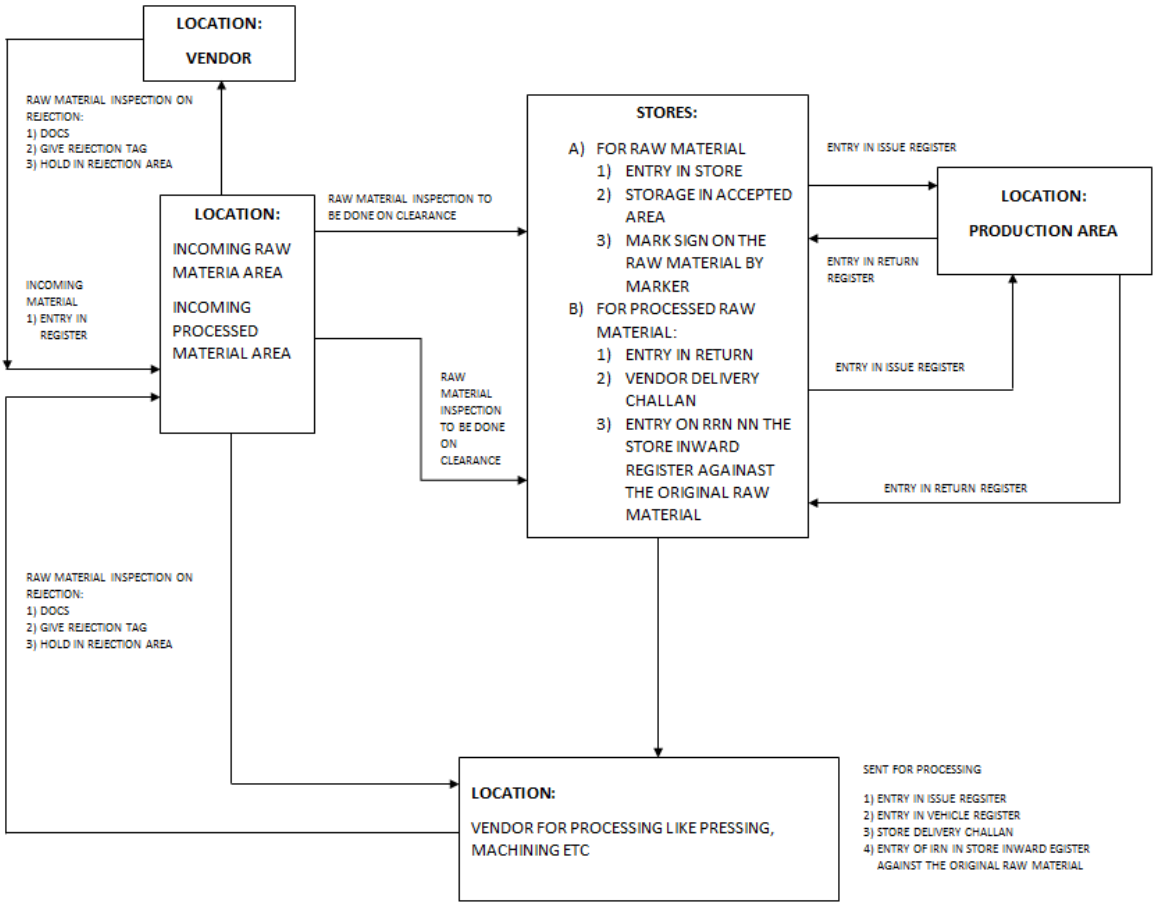

Fig 4.9: The Raw material inspection and rejection was included and additional points were added for raw material and processed material in stores department to maintain the discipline of the store department

4.2.5 Sustain

The fifth „S" stands for Shitsuke (sustain), Sustain is about the mental and physical disciplines required to maintain the other 4S items. As shown in the **fig 4.10** It is done with help of co - operation between employees, store keeper, engineer and manager.

Fig 4.10: Making workers familiar with 5S System by explaining the about the whereabouts of the inventories and how to fetch them and place them after use and to follow the disciplined pattern to keep the 5S alive

4.3 5S Rating System

4.3.1 S1: Seiri (Sort):

Seiri is the first S in 5S system, which is basically deal with the availability of materials and process of product manufacturing. For calculation of Seiri rating, we allot 4 criterion regions for seiri arrangement, and decide that the sub system should achieve minimum 3 marks out of 4 because it tends us to define that the system will be in issue when it is above 50% active. Following are the Seiri rating criterion.

(1)Material availability:

Give 1 mark if material is fully available or give 0 marks if material is not fully available.

(2) Defective goods:

If there are X items which contains Y items as defective Then the marks will be Fraction of fine goods = [1- {Y/X}]

(3) Operating condition:

Operating condition is an important aspect for the arrangement of material and tools, because without the comfort of operator the best process arrangement also has zero value. Give 1 mark if operating condition is under control and give 0 marks if operating condition is not under control.

(4) Elimination of waste:

Elimination of waste is also an important aspect for Seiri rating. Let total N no of waste are listed but only M were eliminated the marks of elimination process will be Fraction of waste elimination = [1- {M/N}] Now add all five marks and get total rating of Seiri out of 5.

If the Seiri system will get less than 3 marks then do the arrangement again because if it is got below 3 marks it means it has very poor condition of analysis.

S1 SEIRI RATING

Week No.	Duration	Material Availability Rating	Defective goods Rating	Operating Condition Rating	Elimination of Waste Rating	Total Rating
		0 or 1	[1-{Y/X}]	0 or 1	1 [1-{M/N}]	
Week 1	Feb 12th – 18th 2017	1	0.37	1	0.08	1.45
Week 2	Feb 19th – 25th 2017	1	0.598	1	0.12	2.718
Week 3	Feb 26th – 4th March 2017	1	0.787	1	0.4	3.187
Week 4	March 5th – 11th 2017	1	0.795	1	0.4	3.195
Week 5	March 12th – 18th 2017	1	0.795	1	0.5	3.295
Week 6	March 19th – 25th 2017	1	0.803	1	0.6	3.403
Week 7	March 26th – 1st April 2017	1	0.818	1	0.6	3.418
Week 8	April 2nd – 8th 2017	1	0.834	1	0.7	3.534

Table 4.1 : S1 SEIRI

4.3.2 S2: Seiton (Set In Order)

Seiton is second S of 5S system which deals with the proper arrangement of equipment and tools on the shop floor. The main objectives of Seiton are forming a regular workplace, avoiding time loss while searching the material and mistake proofing work. Following are the Seiton rating criterion.

(1) Sequence rating Let there are A no. of tools are in proper sequence and B no of tools are not in proper sequence. Then sequence rating will be Fraction of proper sequence = [1-{B/A}]

(2) Material arrangement rating this criterion basically deals with the providing of raw material and accessories for the particular operation. Let D be the lack of material and C be the total material required, then Fraction of material available = [1-{D/C}]

(3) Tool arrangement rating: This criteria shows the consistency if the system about providing service for proper fulfilment of tooling requirement. Let P be the no. of irregular

process and Q be the total no. of process. Fraction of consistency to tool arrangement: [1-{P/Q}]

Now do sum of all the above three criteria and note it as the rate of the Seiton system. This rate should have minimum value of 3 points, if not then system will set again or need analysis again.

S2 SEITON RATING

Week No.	Duration	Sequence Rating	Material Arrangement Rating	Tool Arrangement Rating	Total Rating
		[1-{B/A}]	[1- {D/C}]	[1-{P/Q}]	
Week 1	Feb 12th – 18th 2017	0.066	0.143	0.076	0.2848
Week 2	Feb 19th – 25th 2017	0.4	1	0.4	1.8
Week 3	Feb 26th – 4th March 2017	0.5	1	0.5	2
Week 4	March 5th – 11th 2017	0.7	1	0.6	2.3
Week 5	March 12th – 18th 2017	0.7	1	0.6	2.3
Week 6	March 19th – 25th 2017	0.8	1	0.7	2.5
Week 7	March 26th – 1st April 2017	0.9	1	0.9	2.8
Week 8	April 2nd – 8th 2017	0.9	1	0.9	2.8

Table 4.2: S2 Seiton

4.3.3 S3 Seiso (Shine / Clean)

In order to realize effective tasks, it is essential to create a clean and regular working and living environment. This is because dust, dirt and wastes are the source of untidiness, indiscipline, inefficiency, faulty production and work accidents. We can handle cleaning practices by two approaches: “general cleaning of workplace” and “machine, hardware and tool cleanliness”. Seiso process indicates the “Renovation of the work place”. Seiso system contents the following criteria:

(1) Process path clean: If the path of process is clean then allot 1 point and if not give 0 point.

(2) Proper environment for working condition: Working environment include the ergonomics of the worker like proper souse of light and air, which makes the worker continuously fresh and energetic and make him stay away from errors during operation. Working condition rating will be Let J will be total aspect for favorable condition and I be the no. of fail arrangement. Fraction of environment: [1-{I/J}].

(3) Safety from accident: Let K be the total no. of accident chances and L be the total no for accidents occurs. Then safety rate will be Fraction of safety: [1-{L/K}].

(4) Cleaning consistency: Let E be the total no. of cleaning required and F be the cleaning not done say inconsistency. So consistency rate will be Fraction of consistency = [1-{F/E}].

After adding all the above five criteria the rate of Seiso system can be recorded. This rate should have minimum value of 3 points, if not then system will set again or need analysis again.

S3 SEISO RATING

Week No.	Duration	Process Path Cleanliness Rating	Working Environment Rating	Safety Rating	Cleaning Consistency Rating	Total Rating
		0 or 1	[1-{I/J}]	[1-{L/K}]	[1-{F/E}	
Week 1	Feb 12th – 18th 2017	1	0	1	0.1	2.1
Week 2	Feb 19th – 25th 2017	1	0.4	1	0.4	2.8
Week 3	Feb 26th – 4th March 2017	1	0.4	1	0.5	2.9
Week 4	March 5th – 11th 2017	1	0.6	1	0.6	3.2
Week 5	March 12th – 18th 2017	1	0.6	1	0.6	3.2
Week 6	March 19th – 25th 2017	1	0.8	1	0.7	3.5
Week 7	March 26th – 1st April 2017	1	0.8	1	0.7	3.5
Week 8	April 2nd – 8th 2017	1	0.8	1	0.8	3.6

Table 4.3: S3 Seiso

4.3.4 S4 Seiketsu (Standardize):

Seiketsu is generally means for make a peak standard which should be achieve by the manufacturing process practice. Standard should be communicative and easy to understand. Seiketsu rating will be found by calculating the average of previous three S, because standard of any system will rise and fall by mean rate depending factors.

$$Seiketsu\ Standarize\ rating = Sierirating + Seiatonrating + Seisorating/\ 3$$

S4 SEIKETSU RATING

Week No.	Duration	Total Rating = (S1+S2+S3) /3
Week 1	Feb 12th – 18th 2017	1.278
Week 2	Feb 19th – 25th 2017	2.44
Week 3	Feb 26th – 4th March 2017	2.695
Week 4	March 5th – 11th 2017	2.898
Week 5	March 12th – 18th 2017	2.932
Week 6	March 19th – 25th 2017	3.134
Week 7	March 26th – 1st April 2017	3.239
Week 8	April 2nd – 8th 2017	3.311

Table 4.4: S4 Seiketsu

4.3.5 S5 Shitsuke (Sustain):

Shitsuke (Sustain) is the last S of the 5S system which is deal with the regularity of maintaining the standard of the organization for the particular process, which is only done by regular practices and by following the proper instruction of machine operating. By doing regular following of accurate of instruction we can maintain the machine condition at its peak level, which may help for better production and stay away from breakdown.

(1) Removing small faults through the aid of cleaning.

(2) Providing the execution of visual control.

(3) Providing the performance of protective activities.

(4) Granting the responsibility of the machine to the operator.

(5) Formation of a disciplined company. Shitsuke rating will be depending on the previous four S because without that the regularity will not maintain. Therefore Shitsuke rate will be the average of previous four S ratings.

***Shitsuke Sustain rating = Sierirating + Seiatonrating + Seoso rating + Seisukerating*/ 4**

S5 SHITSUKE RATING

Week No.	Duration	Total Rating = (S1+S2+S3+S4) /4
Week 1	Feb 12th – 18th 2017	1.278
Week 2	Feb 19th – 25th 2017	2.44
Week 3	Feb 26th – 4th March 2017	2.695
Week 4	March 5th – 11th 2017	2.898
Week 5	March 12th – 18th 2017	2.932
Week 6	March 19th – 25th 2017	3.134
Week 7	March 26th – 1st April 2017	3.239
Week 8	April 2nd – 8th 2017	3.311

Table 4.5: S5 SHITSUKE

After the calculation of this rating of 5S, efficiency is calculated at the end of every week and will so the performance improvement at the end of four week. The overall efficiency of the 5S system for the permitted.

4.4 Efficiency of the System

EFFICIENCY OF 5S SYSTEM

Week No.	Duration	(S1+S2+S3+S4+S5)*100/25	Efficiency
Week 1	Feb 12th – 18th 2017	(2.963+1.7+2.8+2.487+2.487)*100/25	30.56%
Week 2	Feb 19th – 25th 2017	(3.063+1.8+2.8+2.554+2.554)*100/25	35.786%
Week 3	Feb 26th – 4th March 2017	(3.187+2+2.9+2.695+2.695)*100/25	40.908%
Week 4	March 5th – 11th 2017	(3.195+2.3+3.2+2.898+2.898)*100/25	46.964%
Week 5	March 12th – 18th 2017	(3.295+2.3+3.2+2.932+2.932)*100/25	53.636%
Week 6	March 19th – 25th 2017	(3.403+2.5+3.5+3.134+3.134)*100/25	60.684%
Week 7	March 26th – 1st April 2017	(3.418+2.8+3.5+3.239+3.239)*100/25	69.784%
Week 8	April 2nd – 8th 2017	3.534+2.8+3.6+3.399+3.399)*100/25	74.22%

Table 4.6: Efficiency of the System

From the above **Table 4.6**, It is evident from the above table that the efficiency has increased significantly over 8 weeks of implementation of 5S. Pertaining implementation of 5S will lead to ultimate quality of production increasing the profits to company. Also, it will enhance the working conditions for the employees which will ultimately reap best fruits to the company. It's a win-win for both the customer of the company and the company itself.

4.5 Calculations

Week 1

Feb 12th – 18th 2017

Total Items (X)	127	***S1 SEIRI RATING***
Defective Items (Y)	80	1. **Material Availability Rating = 1**
Waste Eliminated in KG (M)	33	2. **Defective goods Rating =** $1 - \frac{Y}{X} = 0.3700$
Total Waste in KG (N)	36	3. **Operating Condition Rating = 1**
Total Number of Tools (A)	90	4. **Elimination of Waste Rating =** $1 - \frac{M}{N} = 0.08$
Tools Not in Proper Sequence (B)	84	**TOTAL RATING = 1.45**
Total Material Required (C)	21	***S2 SEITON RATING***
Lack of Material (D)	18	1. **Sequence Rating =** $1 - \frac{B}{A} = 0.066$
Total No of Irregular Processes (P)	12	2. **Material Arrangement Rating =** $1 - \frac{D}{C} = 0.143$
Total Number of Processes (Q)	13	3. **Tool Arrangement Rating =** $1 - \frac{P}{Q} = 0.076$
Total Number of Fail Arrangement (I)	20	**TOTAL RATING = 0.2848**
Total Aspect for Favorable Cond. (J)	20	***S3 SEISO RATING***
Total Number of Accident Chances (K)	0.2	1. **Process Path Cleanliness Rating = 1**
Total Number of Accident Occurs (L)	0	2. **Working Environment Rating =** $1 - \frac{I}{J} = 0$
Total No of Cleaning Required (E)	1	3. **Safety Rating =** $1 - \frac{L}{K} = 1$
Total No of Cleaning Not Done (F)	0.9	4. **Cleaning Consistency Rating =** $1 - \frac{F}{E} = 0.1$
		TOTAL RATING = 3.3492

S4 SEIKETSU RATING

$$S4 = \frac{S1+S2+S3}{3} = 1.278$$

S5 SHITSUKE RATING

$$S5 = \frac{S1+S2+S3+S4}{4} = 1.278$$

EFFICIENCY OF 5S SYSTEM

$$\eta = \frac{(S1+S2+S3+S4+S5)*100}{25} = 30.56\%$$

Week 2

Feb 19th – 25th 2017

Total Items (X)	127	***S1 SEIRI RATING***
Defective Items (Y)	51	**1. Material Availability Rating = 1**
Waste Eliminated in KG (M)	30	**2. Defective goods Rating = $1 - \frac{Y}{X}$ = 0.598**
Total Waste in KG (N)	34	**3. Operating Condition Rating = 1**
Total Number of Tools (A)	42	**4. Elimination of Waste Rating = $1 - \frac{M}{N}$ = 0.12**
Tools Not in Proper Sequence (B)	25	**TOTAL RATING = 2.718**
Total Material Required (C)	25	***S2 SEITON RATING***
Lack of Material (D)	0	**1. Sequence Rating = $1 - \frac{B}{A}$ = 0.4**
Total No of Irregular Processes (P)	10	**2. Material Arrangement Rating = $1 - \frac{D}{C}$ = 1**
Total Number of Processes (Q)	17	**3. Tool Arrangement Rating = $1 - \frac{P}{Q}$ = 0.4**
Total Number of Fail Arrangement (I)	13	**TOTAL RATING = 1.8**
Total Aspect for Favorable Cond. (J)	22	***S3 SEISO RATING***
Total Number of Accident Chances (K)	0.2	**1. Process Path Cleanliness Rating = 1**
Total Number of Accident Occurs (L)	0	**2. Working Environment Rating = $1 - \frac{I}{J}$ = 0.58**
Total No of Cleaning Required (E)	1	**3. Safety Rating = $1 - \frac{L}{K}$ = 1**
Total No of Cleaning Not Done (F)	0.6	**4. Cleaning Consistency Rating = $1 - \frac{F}{E}$ = 1.4**
		TOTAL RATING = 3.98

S4 SEIKETSU RATING

$$S4 = \frac{S1+S2+S3}{3} = 2.44$$

S5 SHITSUKE RATING

$$S5 = \frac{S1+S2+S3+S4}{4} = 2.44$$

EFFICIENCY OF 5S SYSTEM

$$\eta = \frac{(S1+S2+S3+S4+S5)*100}{25} = 35.786\%$$

Week 3

Feb 26th – 4th Mar 2017

Total Items (X)	127	***S1 SEIRI RATING***
Defective Items (Y)	27	**1. Material Availability Rating = 1**
Waste Eliminated in KG (M)	18	**2. Defective goods Rating = $1 - \frac{Y}{X} = 0.787$**
Total Waste in KG (N)	38	**3. Operating Condition Rating = 1**
Total Number of Tools (A)	42	**4. Elimination of Waste Rating = $1 - \frac{M}{N} = 0.4$**
Tools Not in Proper Sequence (B)	21	**TOTAL RATING = 3.187**
Total Material Required (C)	28	***S2 SEITON RATING***
Lack of Material (D)	0	**1. Sequence Rating = $1 - \frac{B}{A} = 0.5$**
Total No of Irregular Processes (P)	11	**2. Material Arrangement Rating = $1 - \frac{D}{C} = 1$**
Total Number of Processes (Q)	23	**3. Tool Arrangement Rating = $1 - \frac{P}{Q} = 0.5$**
Total Number of Fail Arrangement (I)	20	**TOTAL RATING = 2**
Total Aspect for Favorable Cond. (J)	32	***S3 SEISO RATING***
Total Number of Accident Chances (K)	0.2	**1. Process Path Cleanliness Rating = 1**
Total Number of Accident Occurs (L)	0	**2. Working Environment Rating = $1 - \frac{I}{J} = 0.4$**
Total No of Cleaning Required (E)	1	**3. Safety Rating = $1 - \frac{L}{K} = 1$**
Total No of Cleaning Not Done (F)	0.5	**4. Cleaning Consistency Rating = $1 - \frac{F}{E} = 0.5$**
		TOTAL RATING = 2.9

S4 SEIKETSU RATING

$$S4 = \frac{S1+S2+S3}{3} = 2.695$$

S5 SHITSUKE RATING

$$S5 = \frac{S1+S2+S3+S4}{4} = 2.695$$

EFFICIENCY OF 5S SYSTEM

$$\eta = \frac{(S1+S2+S3+S4+S5)*100}{25} = 40.908\%$$

Week 4

Mar 5th – 11th 2017

Total Items (X)	127	***S1 SEIRI RATING***
Defective Items (Y)	26	**1. Material Availability Rating = 1**
Waste Eliminated in KG (M)	24	**2. Defective goods Rating = $1 - \frac{Y}{X} = 0.795$**
Total Waste in KG (N)	40	**3. Operating Condition Rating = 1**
Total Number of Tools (A)	42	**4. Elimination of Waste Rating = $1 - \frac{M}{N} = 0.4$**
Tools Not in Proper Sequence (B)	13	**TOTAL RATING = 3.195**
Total Material Required (C)	34	***S2 SEITON RATING***
Lack of Material (D)	0	**1. Sequence Rating = $1 - \frac{B}{A} = 0.7$**
Total No of Irregular Processes (P)	11	**2. Material Arrangement Rating = $1 - \frac{D}{C} = 1$**
Total Number of Processes (Q)	28	**3. Tool Arrangement Rating = $1 - \frac{P}{Q} = 0.6$**
Total Number of Fail Arrangement (I)	14	**TOTAL RATING = 2.3**
Total Aspect for Favorable Cond. (J)	34	***S3 SEISO RATING***
Total Number of Accident Chances (K)	0.2	**1. Process Path Cleanliness Rating = 1**
Total Number of Accident Occurs (L)	0	**2. Working Environment Rating = $1 - \frac{I}{J} = 0.6$**
Total No of Cleaning Required (E)	1	**3. Safety Rating = $1 - \frac{L}{K} = 1$**
Total No of Cleaning Not Done (F)	0.4	**4. Cleaning Consistency Rating = $1 - \frac{F}{E} = 0.6$**
		TOTAL RATING = 3.2

S4 SEIKETSU RATING

$$S4 = \frac{S1+S2+S3}{3} = 2.898$$

S5 SHITSUKE RATING

$$S5 = \frac{S1+S2+S3+S4}{4} = 2.898$$

EFFICIENCY OF 5S SYSTEM

$$\eta = \frac{(S1+S2+S3+S4+S5)*100}{25} = 46.964\%$$

Week 5

Mar 12th – 18th 2017

Total Items (X)	127	***S1 SEIRI RATING***
Defective Items (Y)	26	**1. Material Availability Rating = 1**
Waste Eliminated in KG (M)	21	**2. Defective goods Rating =** $1 - \frac{Y}{X} = 0.795$
Total Waste in KG (N)	42	**3. Operating Condition Rating = 1**
Total Number of Tools (A)	42	**4. Elimination of Waste Rating =** $1 - \frac{M}{N} = 0.5$
Tools Not in Proper Sequence (B)	13	**TOTAL RATING = 3.295**
Total Material Required (C)	35	***S2 SEITON RATING***
Lack of Material (D)	0	**1. Sequence Rating =** $1 - \frac{B}{A} = 0.7$
Total No of Irregular Processes (P)	13	**2. Material Arrangement Rating =** $1 - \frac{D}{C} = 1$
Total Number of Processes (Q)	32	**3. Tool Arrangement Rating =** $1 - \frac{P}{Q} = 0.6$
Total Number of Fail Arrangement (I)	15	**TOTAL RATING = 2.3**
Total Aspect for Favorable Cond. (J)	37	***S3 SEISO RATING***
Total Number of Accident Chances (K)	0.2	**1. Process Path Cleanliness Rating = 1**
Total Number of Accident Occurs (L)	0	**2. Working Environment Rating =** $1 - \frac{I}{J} = 0.6$
Total No of Cleaning Required (E)	1	**3. Safety Rating =** $1 - \frac{L}{K} = 1$
Total No of Cleaning Not Done (F)	0.4	**4. Cleaning Consistency Rating =** $1 - \frac{F}{E} = 0.6$
		TOTAL RATING = 3.2

S4 SEIKETSU RATING

$$S4 = \frac{S1+S2+S3}{3} = 2.932$$

S5 SHITSUKE RATING

$$S5 = \frac{S1+S2+S3+S4}{4} = 2.932$$

EFFICIENCY OF 5S SYSTEM

$$\eta = \frac{(S1+S2+S3+S4+S5)*100}{25} = 53.636\%$$

Week 6

Mar 19th – 25th 2017

Total Items (X)	127	***S1 SEIRI RATING***
Defective Items (Y)	25	**1. Material Availability Rating = 1**
Waste Eliminated in KG (M)	16	**2. Defective goods Rating = $1 - \frac{Y}{X} = 0.803$**
Total Waste in KG (N)	40	**3. Operating Condition Rating = 1**
Total Number of Tools (A)	42	**4. Elimination of Waste Rating = $1 - \frac{M}{N} = 0.6$**
Tools Not in Proper Sequence (B)	9	**TOTAL RATING = 3.403**
Total Material Required (C)	33	***S2 SEITON RATING***
Lack of Material (D)	0	**1. Sequence Rating = $1 - \frac{B}{A} = 0.8$**
Total No of Irregular Processes (P)	9	**2. Material Arrangement Rating = $1 - \frac{D}{C} = 1$**
Total Number of Processes (Q)	30	**3. Tool Arrangement Rating = $1 - \frac{P}{Q} = 0.7$**
Total Number of Fail Arrangement (I)	7	**TOTAL RATING = 2.5**
Total Aspect for Favorable Cond. (J)	35	***S3 SEISO RATING***
Total Number of Accident Chances (K)	0.2	**1. Process Path Cleanliness Rating = 1**
Total Number of Accident Occurs (L)	0	**2. Working Environment Rating = $1 - \frac{I}{J} = 0.8$**
Total No of Cleaning Required (E)	1	**3. Safety Rating = $1 - \frac{L}{K} = 1$**
Total No of Cleaning Not Done (F)	0.3	**4. Cleaning Consistency Rating = $1 - \frac{F}{E} = 0.7$**
		TOTAL RATING = 3.5

S4 SEIKETSU RATING

$$S4 = \frac{S1+S2+S3}{3} = 3.134$$

S5 SHITSUKE RATING

$$S5 = \frac{S1+S2+S3+S4}{4} = 3.134$$

EFFICIENCY OF 5S SYSTEM

$$\eta = \frac{(S1+S2+S3+S4+S5)*100}{25} = 60.684\%$$

Week 7

Mar 26th – 1st Apr 2017

Total Items (X)	127	***S1 SEIRI RATING***
Defective Items (Y)	23	**1. Material Availability Rating = 1**
Waste Eliminated in KG (M)	14	**2. Defective goods Rating = $1 - \frac{Y}{X} = 0.818$**
Total Waste in KG (N)	34	**3. Operating Condition Rating = 1**
Total Number of Tools (A)	42	**4. Elimination of Waste Rating = $1 - \frac{M}{N} = 0.6$**
Tools Not in Proper Sequence (B)	4	**TOTAL RATING = 3.418**
Total Material Required (C)	27	***S2 SEITON RATING***
Lack of Material (D)	0	**1. Sequence Rating = $1 - \frac{B}{A} = 0.9$**
Total No of Irregular Processes (P)	2	**2. Material Arrangement Rating = $1 - \frac{D}{C} = 1$**
Total Number of Processes (Q)	18	**3. Tool Arrangement Rating = $1 - \frac{P}{Q} = 0.9$**
Total Number of Fail Arrangement (I)	5	**TOTAL RATING = 2.8**
Total Aspect for Favorable Cond. (J)	25	***S3 SEISO RATING***
Total Number of Accident Chances (K)	0.2	**1. Process Path Cleanliness Rating = 1**
Total Number of Accident Occurs (L)	0	**2. Working Environment Rating = $1 - \frac{I}{J} = 0.8$**
Total No of Cleaning Required (E)	1	**3. Safety Rating = $1 - \frac{L}{K} = 1$**
Total No of Cleaning Not Done (F)	0.3	**4. Cleaning Consistency Rating = $1 - \frac{F}{E} = 0.7$**
		TOTAL RATING = 3.5

S4 SEIKETSU RATING

$$S4 = \frac{S1+S2+S3}{3} = 3.239$$

S5 SHITSUKE RATING

$$S5 = \frac{S1+S2+S3+S4}{4} = 3.239$$

EFFICIENCY OF 5S SYSTEM

$$\eta = \frac{(S1+S2+S3+S4+S5)*100}{25} = 69.784\%$$

Week 8

Apr 2nd – 8th 2017

Total Items (X)	127	***S1 SEIRI RATING***
Defective Items (Y)	21	**1. Material Availability Rating = 1**
Waste Eliminated in KG (M)	11	**2. Defective goods Rating = $1 - \frac{Y}{X} = 0.834$**
Total Waste in KG (N)	36	**3. Operating Condition Rating = 1**
Total Number of Tools (A)	42	**4. Elimination of Waste Rating = $1 - \frac{M}{N} = 0.7$**
Tools Not in Proper Sequence (B)	4	**TOTAL RATING = 3.534**
Total Material Required (C)	21	***S2 SEITON RATING***
Lack of Material (D)	0	**1. Sequence Rating = $1 - \frac{B}{A} = 0.9$**
Total No of Irregular Processes (P)	1	**2. Material Arrangement Rating = $1 - \frac{D}{C} = 1$**
Total Number of Processes (Q)	15	**3. Tool Arrangement Rating = $1 - \frac{P}{Q} = 0.9$**
Total Number of Fail Arrangement (I)	4	**TOTAL RATING = 2.8**
Total Aspect for Favorable Cond. (J)	20	***S3 SEISO RATING***
Total Number of Accident Chances (K)	0.2	**1. Process Path Cleanliness Rating = 1**
Total Number of Accident Occurs (L)	0	**2. Working Environment Rating = $1 - \frac{I}{J} = 0.8$**
Total No of Cleaning Required (E)	1	**3. Safety Rating = $1 - \frac{L}{K} = 1$**
Total No of Cleaning Not Done (F)	0.2	**4. Cleaning Consistency Rating = $1 - \frac{F}{E} = 0.8$**
		TOTAL RATING = 3.6

S4 SEIKETSU RATING

$$S4 = \frac{S1+S2+S3}{3} = 3.311$$

S5 SHITSUKE RATING

$$S5 = \frac{S1+S2+S3+S4}{4} = 3.311$$

EFFICIENCY OF 5S SYSTEM

$$\eta = \frac{(S1+S2+S3+S4+S5)*100}{25} = 74.224\%$$

CHAPTER NO: 5

RESULT & DISCUSSION

Time Analysis of Implementation Of 5S

Time analysis or Time comparison is play an important role in a company or industry to improve working and productivity efficiency. Time analysis nothing but comparison of operation time means how much time take by the process, manufacturing of product, searching of tools and materials, etc., In our filter Company we have implement 5S, we have work on each stages of 5S and we recorded all data and compare it with before implementation of 5S data we have improve it after implementation of 5S, that comparison shown in below table.

Sr No.	Processes	Before	After
1	Material Searching Time	0.6	0.8
2	Tool Arrangement	0.5	0.7
3	Tool Sequence	0.4	0.5
4	Material Arrangement	0.4	0.5
5	Process Path Cleaning	0.4	0.5
6	Working Environment	0.5	0.6
7	Safety	0.7	0.9
8	Working Efficiency	0.5	0.7
9	Overall Efficiency Percentage	50%	65%

Table 5.1: Time Analysis

CHAPTER NO: 6

CONCLUSION

5S lean manufacturing system is one of the options to reduce non value-added activity (wastes) and improve operational efficiency of the organization. The efficient implementation of 5S technique leads to subsequent improvement in productivity of the manufacturing plant. The 5S improves environmental performance and thus relate primarily in reduction of wastes in manufacturing. It promotes neatness in storage of raw material and finished products. The 5S implementation leads to the improvement of the case company organization in many ways for instance.

(1) Better usage of working area

(2) Work environment improvement

(3) Prevention of tools losing.

(4) Reduction in accidents.

(5) Reduction in accidents.

(6) Reduction in pollution.

(7) Discipline in the employee.

(8) Increasing of awareness and moral of employee.

(9) Improvement in the internal communication.

(10) Improvement in the internal human relation.

(11) Decreasing of mistakes through error proofing.

CHAPTER NO: 7

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CHAPTER NO: 8

PAPER TO BE PUBLISHED

Implementation of 5S Technique in a Job Manufacturing Industry

[1]Prof. Saad Shaikh, [2]Bhoira Maaz Wasiullah, [3]Ansari Abdul Moaeez Ayed
[4]Inamdar Zishan Iqbal, [5]Dhange Ahmed Parvez

[1]Faculty of Mechanical Engineering, Anjuman-I-Islam's Technical Campus, School of Engineering and Technology, New Panvel. Mumbai University, Maharashtra (India)
[2,3,4,5]Bachelor of Mechanical Engineering (Students), Anjuman-I-Islam's Technical Campus, School of Engineering and Technology, New Panvel. Mumbai University, Maharashtra (India)

Abstract—This paper includes detailed information of implementation of 5S in a small scale manufacturing industry *OTOKLIN GLOBAL BUSINESS LTD.* based in industrial area of Mumbai. 5S offers good potential for required improvement out of all the available various lean manufacturing techniques. 5S comes from five Japanese words; Seiri (SORT), Seiton (SET IN ORDER), Seiso (SHINE), Seiketsu (STANDARDIZE), and Shitsuke (SUSTAIN). Implementing 5S lean manufacturing system in the inventory store of the company proved to be beneficial in terms of time saving and better productivity which will lead to continuous growth and higher performance. In this paper all five "S" have been explained with their implementation and their effect on performance of the production.

Keywords—5S, Lean Manufacturing, Productivity, Quality Control