

Study and Implementation of '5S' Methodology in the Furniture Industry Warehouse for Productivity Improvement

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Abstract— The paper represents an application of '5S' technology in one of the large warehouses of Furniture Industry in Maharashtra which is the leading E-commerce Company in terms of Furnishing and Home décor products. In simple terms, the '5S' approach is a Japanese technique that consists of five 'S' terms: Seiri (sorting), Seiton (order), Seiso (shine), Seiketsu (standardise), and Shitsuke (maintain) having a deep sense for managing the workplace. The goal of implementing 5S in the workplace is to organise a workspace for efficiency and effectiveness by identifying and storing commonly used objects, maintaining the area and products, and keeping the new order. The decision-making process is frequently triggered by a discussion on standardisation, which helps employees understand how they should do their duties. The results show that 5S is an effective tool for improvement of organizational performance, productivity, hygienist. 5S technique would strongly support the objectives of organization to achieve continuous improvement in performance and productivity.

Keywords—5s, Efficiency, Productivity, Warehouse operation, 5s implementation

I. INTRODUCTION

In a today's fast business, it is critical to capture customers' hearts through product or service quality. It is also necessary to have productive output that is always improving. The present need of the organization is to deliver high quality Services through continuous improvement. To fulfill these requirement, 5S technique emerged for better production in the industries [2]. 5S is a technique originated from Japan and it was first developed by Hiroyuki Hirano. It consists of five S words: Seiri, Seiton, Seiso, Seiketsu, and Shitsuke, which indicate Sort, Shine, Standardize, and Sustain, respectively. The 5S method comes from the Japanese word "Kaizen," which means "change for the better." It allows the enhancement of efficiency and productivity in the industry. The 5S technique is a program to achieve total organization cleanliness, and standardization in the workplace for better productivity. The benefit of 5S technique is improvement in productivity, quality, health, and safety [2].

"5S" is the techniques which was introduced by Takashi Osada in the early 1980s [10]. It is basically a workplace management methodology which helps for improving working environment, human capabilities and thereby productivity [11]. The word "5S" represents the 5 disciplines for

maintaining visual workplace. "5S" is workplace management to minimize the loss of time and unnecessary movements as well. It comprises 5 principles in making the organization highly efficient and effective is shown in Fig.1 and those are: -

Seiri: - (sorting)

1. It Perform Sorting Activities in workplace i.e. what is required and what is not required.
2. It Remove the unwanted things that are at your workplace.
3. Only keep those things that you need on the work floor



Fig.1. 5Pillars of 5S

Seiton: - (set in order)

1. Decide place for everything that you need
2. Give proper identification to it for ease of search
3. Keep everything at its defined place after use
4. Make sure every time that everything is at its place

Seiso: - (shine)

1. Always keep cleanliness at your workplace.
2. Keep the tools always clean after its use.
3. Areas should be properly marked or painted.

Seiketsu: - (standardize)

1. Define standard method/way of doing the work i.e. prepare standard operating procedure (SOP).

2. Do the work in that method/way only.

3. Maintain the discipline in your work [13].

Shitsuke: - (sustain)

1. Maintain consistency in the method of doing work [12].

2. Stick to the „5S“ rules for proper workplace management.

3. Encourage the participation of all, for consistency in “5S” activities.

4. Perform “5S” activities periodically

A. Organization Introduction

Organization is a leading online home and lifestyle service provider company, offering a wide range of furniture and home decor products. It is a e-commerce business which has created a platform for hundreds of furniture vendor to sell their products through website. They manage home brand & market-place orders through their platform. Marketplace is for directly shipping orders from vendors to customers without storing the inventory in the warehouse. But all the orders are processed through warehouse only.

Organization offers large variety in furniture products having around 4000 types of unique products in both furniture and non-furniture (Décor & utility) sector. In 2016, they shifted to the new warehouse spread over 2,85,000 sq. ft. area at Bhiwandi near Mumbai, with a capacity to fit about “3 airbuses” inside the warehouse. and having racked up to 10 meters of height, making them largest warehouse for a furniture business in the country. The warehouse is responsible to process all the orders in the west region and even many products are shipped all over India as per requirement. The warehouse ships the order to respective distribution centre and thereafter the product is delivered to end customer. Bhiwandi warehouse mainly stores the Mudra-Solidwood Inventory (from Local and Jodhpur Vendors). (Source: Internet)

Departmental Overview

- Inward – Unloading and GRN of material from fleet vehicles
- Put-Away – Mapping of unloaded material in the rack locations; mapped inventory is made live on website
- Quality Check: Quality check of inventory.
- Order Processing – To pick and ship the orders confirmed on website
- Inventory – To ensure the proper mapping and availability of inventory
- Décor and Utility – Non furniture segment

B. Warehouse Operation

Warehouse operation or warehousing is one of the most significant components in supply chain. It is the core operation of logistics regarding to distribution activities as storage and transportation. Managing product to be successfully at the right time, right place and right quantity, without damages and differentiations is a mission of warehouse management. This chapter explains the typical warehouse processes and the integration of warehouse processes and reverse logistics optimization

C. Typical warehouse processes for distribution chain

Basic processes of warehouse in Fig.2 are receiving, put-away, internal replenishment, order picking, accumulating, and sorting, packing, cross docking, dispatch and shipping. The processes in warehouse as mentioned by Bartholdi & Hackman are divided into two groups; receiving, put-away, and storage are considered inbound and order-picking, packing, and shipping are considered outbound processes. The details are explained as follows:

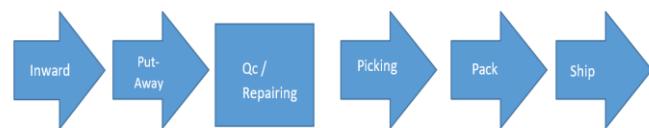


Fig.2. Simple flow of warehouse Operation

II. LITERATURE REVIEW

Most of the organization workplaces face the problems of disorder, wastage of time and cost due to non-value-added activities. These problems affect the work environment adversely and accumulate to bigger problems such as long lead times, higher defects, low productivity, frequent breakdowns of machines and hidden safety hazards, thereby critically affecting the cost competitiveness of the organizations. These problems can easily control and reduced by holistic 5S implementation at workplace (Chapman, 2005; Chuanjie, 2013). This technique is very useful and beneficial in Industrial organization. We also concluded that by implementing 5S we could improve the quality, productivity, and efficiency of industrial organization, it also has positive effect on overall performance (Abhay R. Kobarne, Vineet K. Gaikwad, Sourabh S. Dhaygude, Nikhil A. Bhalerao 2016). 5S is a holistic application used to raise moral, ethical standards and strongly associated with Japanese culture and society. 5S not only improves organisational working environment but also improves the overall industrial management process performance as well (Ho, 1999b). Ho (1997) has reviewed the reasons of having 5S technique in Japanese industries. He concluded that 5S practice was essential because it help to make the life of everyone good in organisation. It was implemented successfully with help of top management commitment, promotional campaign, training of 5S, evaluation of the results and keeping of records. It is also analysed that the practice of 5S become the supporting activity or in some cases as a base foundation for the implementation of other lean tools such as TPM, TQM, JIT, TPS and ISO

standards (Teeravaraprug et al., 2011; Chen and Tan, 2013; Kushwaha, 2015). ABK-AOTS Dosokai (2001) has reported that the Indian industries have gained lot of benefits such as reduction of customer complaints and worker absenteeism, improved resources utilization and worker morale through 5S initiatives at workplace. Kaushik Kumar, Sanjeev kumar gives the steps undertaken for the implementation of the 5S emphasizing on the benefits to the organization. He describes the detailed steps involved in the implementation from inception to execution have been discussed (2012). The last bottleneck activity which was related to the development of Steelyard for systematic storage of steel inventory was successfully executed using a simple Load-Distance-Technique which is a handy technique of Facility Planning used to minimize material handling and travel time thereby improving your efficiency of operations [18]. The real secret about inventory accuracy is that it is continuous improvement process. By improving inventory accuracy, the warehouse parameter like inventory turnover, inventory days, inventory value, idle time of workers etc. can be improve [19]. Using SCOR model and various techniques such as kaizen, 5S, lean manufacturing etc. we can improve the logistics system of any manufacturing system and also have a better result in customers satisfaction which leads better compete. Theoretical as well as practical exposure of the problems and how such problems are solved using various techniques [20]..

III. PROBLEM STATEMENT

In that leading company, there was a improper utilization of floor space for raw material, finished products and material handling equipment and machines used for repairing purposes which impact on the space management and floor utilization. Wastage of time for finding of material due to non-permanent location as per destination. Low productivity due to the time wastage in searching for materials due to improper workplace management. Presence of unwanted materials at the workplace which affects the moral of the worker while working, also due to such unwanted material there is a mess with needed items and required time for finding and utilization. There was no well-defined space for storing the unwanted or rejected material. More time and cost required for the inventory process of unwanted stored materials in raw material stores. There was a lack of visual communication for the worker to be understand better. No guidelines for each department were present on the work floor, so as there was no defined process flow as per guidelines. Timeline for each process i.e., TAT for each process not defined, Color code implementation is necessary. Will need to implement PDCA process flow for day-to-day work.

IV. METHODOLOGY

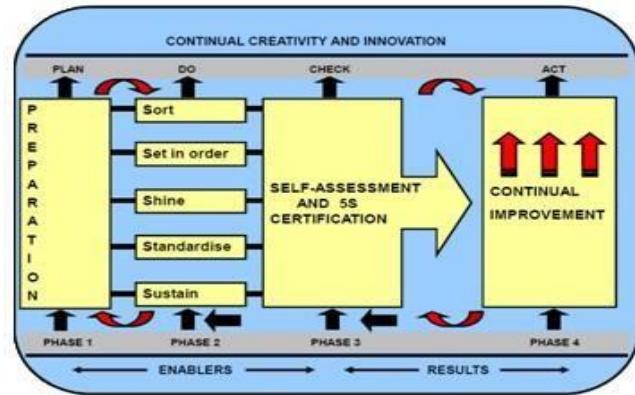
The basic Methodology to improve the operations following steps should be implemented:

- Implement 5 Pillars of 5S.
- Floor Management
- Visual Sign boards for better understanding.

- Implement colour coding system
- 5s audit scoreboard
- Safety Tools :6th “S”

A. Initiation for 5S Implementation

The 5S strategy described in this paper is a straightforward and methodical methodology that can be introduced and implemented in any size or type of business. Each phase must be properly evaluated and addressed utilizing the P- D- C-A Cycle technique before beginning the Step-by-Step Implementation of 5S is shown the for of



roadmap in Fig.3.

Fig.3. Roadmap to 5S implementation [4]

B. Step by step Implementation of 5S

- Formation of 5S council

The 5S council was founded with the goal of increasing overall participation at all levels of the organization and developing a culture of continuous improvement and high performance in the teams. Fig.4 shows a typical implementation process organizational structure.

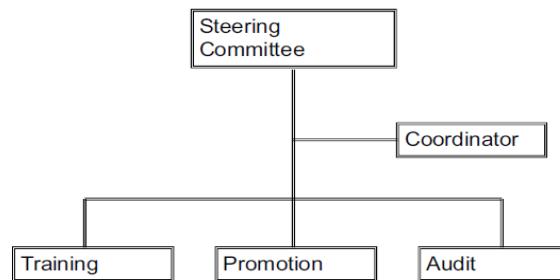


Fig. 4. The structure of Steering Committee for 5S implementation [4].

- Set up 5S zone

The 5S Coordinator will be in charge of establishing the zones. Assigning responsibilities will be the responsibility of the 5S Facilitators. They'd break down the tasks into small chunks. Obtaining the layout of the complete work area and separating each component into small zones is one way to accomplish this. After that, one team is assigned to each segment, and the names of team members and their areas are displayed. They must verify that each area has at least one person assigned to it and that each team has a leader.

Furthermore, it is necessary to ensure that the section size and team strength are as uniform as feasible.

- 5S Training

The 5S training committee was formed with the goal of disseminating 5S methodology and preparing the workforce to participate meaningfully in 5S activities. Workers are encouraged to participate actively in the application exercises in this training programme, which is the beginning point for 5S. After completing the preliminary training, everyone will have the necessary basic knowledge and will be responsible for ongoing actions. During the 5S declaration, plans defining the implementation of the 5S phases must be produced and released. The most common mistake businesses make when implementing the 5S system is failing to appropriately train employees from the start. Training should include 5S Awareness (for Top Management), 5S Awareness (for Operators), 5S Implementation (for Facilitators), Internal 5S Audit (For all) is shown the Fig.5 below.

5S Lays the Foundation for a Lean Enterprise



Fig.5. 5s Foundation

V. METHODOLOGY

A. Red Tag Area

Create a Red Tag Area are shown in Fig. 6 so that whatever unwanted Material should be kept at this area and working area should be free of unwanted clutter.

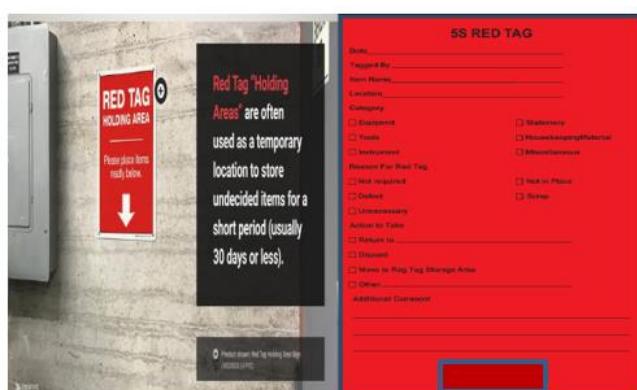


Fig.6. Red Tag

Set Red-Tag Criteria

- Not Needed at all.
- Needed but not now.
- Needed but not here
- Needed but not so much Quantity

B. Colour code System

Color code System sown in Fig. 7 is implemented for below reasons are some works like Put away and Mapping should be done on same day so that Product with that day Sticker should be proceed on same day. QC repairing Works should not take more than 1 week for process so that the sticker with color should proceed within next week same day are shown in Fig.8

Colour Coding System pepperfry					
Sr.No.	Day	वार	Colour	Colour/ कलर	रंग
1	Monday	सोमवार	Light Blue		फिकट निला
2	Tuesday	मंगलवार	Yellow		पिवळा
3	Wednesday	बुधवार	Orange		भगवा
4	Thursday	गुरुवार	Green		हिरवा
5	Friday	शुक्रवार	Dark Blue		गडव निला
6	Saturday	शनिवार	Brown		तपकिरी

Fig.7. Colour Code System



Color Code System Implementation

Fig.8. Colour code implementation

C. Visual Communication

In visual communication shown in the Fig. 9, it gives straight forward instruction to everyone working on work floor department wise i.e.in Quality check department QC checker got clear instruction how to do QC same is for inward and Outward department.

Visual guidelines such as process guidelines and material handling guidelines give workers a brief information on how to process SKU and how to handle the material while loading, unloading and QC and the dashboards and PDCA chart were prepared as shown in Fig.10..



Guidelines for each department



Fig.9. Visual Guidelines for 5S

D. PDCA Chart and Dashboard for daily process tracking



Dashboard and PDCA Board



Fig. 10. Dashboards and PDCA chart

In PDCA cycle process,1. Plan 2.DO 3. Check 4. Act ,this 4 terminologies are used .In this implementation we have implemented this for the 3 processes Inward, Quality check and Inventory and other .Plan should be decide on every morning and as per plan DCA will be implemented

E. 5S Audit

5S audit is the process of evaluating the proper implementation of 5S in the workplace with team were made are shown in Fig. 11. Conducting 5S audits help ensure that the workplace is consistently following the 5S principles: Seiri (Sort), Seiton (Systematize), Seiso (Shining), Seiketsu (Standardizing), and Shitsuke (Sustaining).

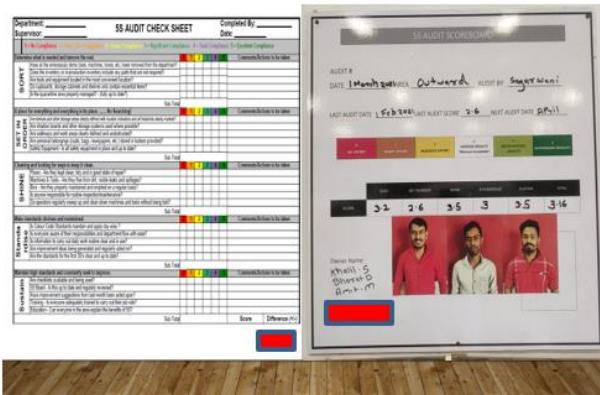


Fig.11. 5s Audit

VI. ANALYSIS AND RESULTS

By implementing 5S, following objectives are achieved: -

- Hygiene Maintaining on Work floor /proper Floor Utilization.
- Implementing color code system on permanent basis.
- Increase in Productivity.
 - Same day put away and Location mapping
 - QC Productivity
 - Refurbish Productivity Increase

A. Floor Management

Arrange Warehouse floor as per types of products on which actual process to be done lane wise are shown in the Fig. 12. Sort various SKU's on which similar work is required for repairing purpose. Sort SKU's as per color code, so that delay can be prevented. Start Same department for same work on floor so that there is no time delay due to hurry. Start daily Tracking on each department by sticking dashboards of each department and observe hourly.

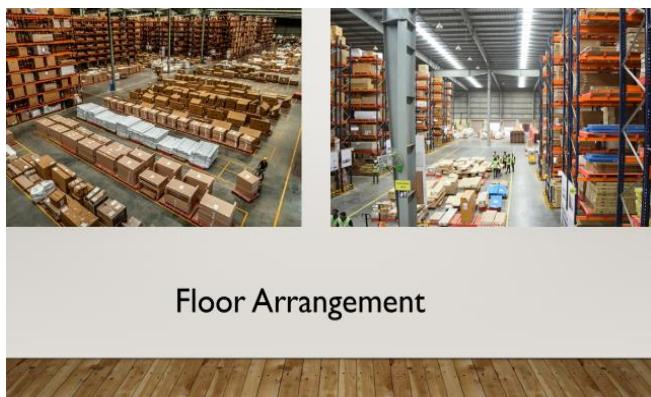


Fig. 12. Floor Arrangement

B. Same day putaway and location Mapping

As there were no Segregation method for Location wise and Hub wise, there is difficult to put away the SKU which are of same day or 2-3 days delayed SKU's. We have implemented Color code system as well to determine the same day product, so that Put away should be done on same day. It gave as good results as shown and increase the put away Productivity for Inward SKU's.

Analysis

As per below table shown, it is a data of Count of SKU's i.e. no of products to be In warded and Putaway done on what date is shown in the Table 1. It shows the delay for the putaway and mapping of SKU's months wise and is used for the analysis and is shown in the Fig.13.

Table 1 Putaway Data

Count of SKU	Delays in days						
	Same Day	5	4	3	2	1	Grand Total
Row Labels							
2021	2430	340	319	2050	1323	1066	7528
Apr	1119					446	1565
Mar	1311					620	1931
Feb		136	74	492	1073		1775
Jan		204	245	1558	250		2257
2020	2882	2805	2042	48			7777
Dec	285	442	1420	10			2157
Nov	273	1101	608	23			2005
Oct	948	1136	12	13			2109
Sep		1376	126	2	2		1506
Grand Total	2430	3222	3124	4092	1371	1066	15305

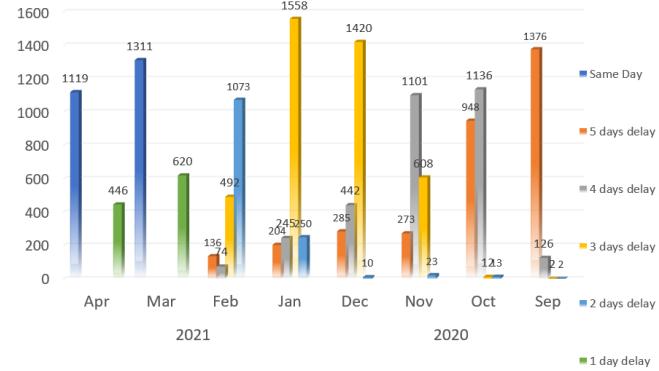


Fig. 14. Putaway chart

As per above Bar chart, it is clear that the Putaway and Mapping of the SKU's for the months of Jan, Feb, March April and onward after the implementation of 5s pillars and colour code system and PDCA chart is shown in the Fig.14, there is a large qty of SKU's whose putaway and Mapping done on the same day compare to earlier months

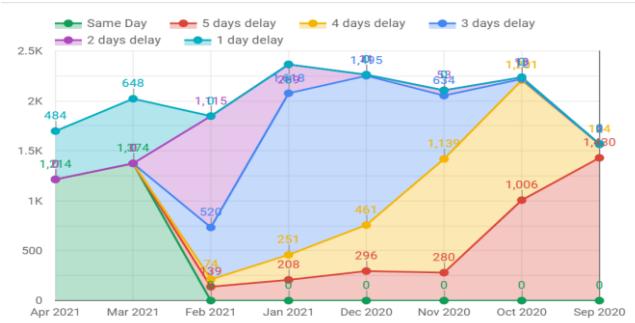


Fig. 15. Putaway Graph

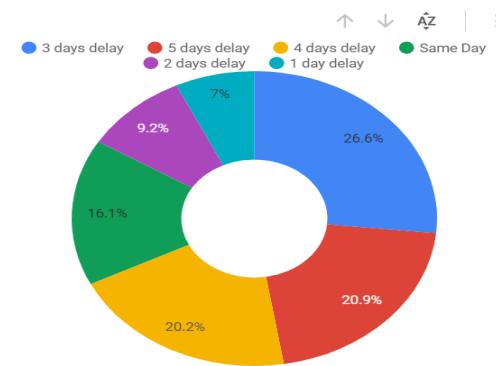


Fig.16. Putaway data pie chart

As we can see from above results, the same day and 1 day delay putaway percentage on the months after the 5s Implementing are more with respect to previous months .it is due to proper floor management and maintaining 5s pillars along with proper colour code system for each and every SKU inward in the warehouse is shown in the pie chart I Fig. 16.

C. Per day QC increase

There Is a Quality Check process is for Each and Every SKU which is Inward in a Warehouse, and then as per Action plan we have Segregate them after QC done. So, it is important to conduct Maximum QC on available time to finish daily QC and there is no lag behind. We need some strategy to increase the productivity, so that we Implement dashboards tracking system, PDCA continuous Increment Charts, Targeted Area and focus Area Boards. Plan and implement those daily plans were help us on increasing the QC Qty per day. Also, we implement Same color Code system which ever SKU's inward on day must be proceed within 1-2 days so that target is achieved is shown the Fig. 17



Fig.17. Per day QC Graph

In above line chart ,we can see that that huge increase in the total no of QC done in the months of Jan, Feb ,March and onwards .as in October no are 642, which are increasing to 1366 in Jan,1817 in feb, and 2195 in March .as per implementing of 5S ,PDCA chart dashboard, and colour code system and proper visual communication and training, Increase in the QC are seen in the chart .

Analysis in below Pie chart, it is seen that the percentage of QC done in previous months i.e. before implementing all tools, the percentages of 7.3% in the month of Nov is going to increase 17.3 ,23 and 27 respectively in the month of Jan, Feb, March respectively is shown in the Fig 18.

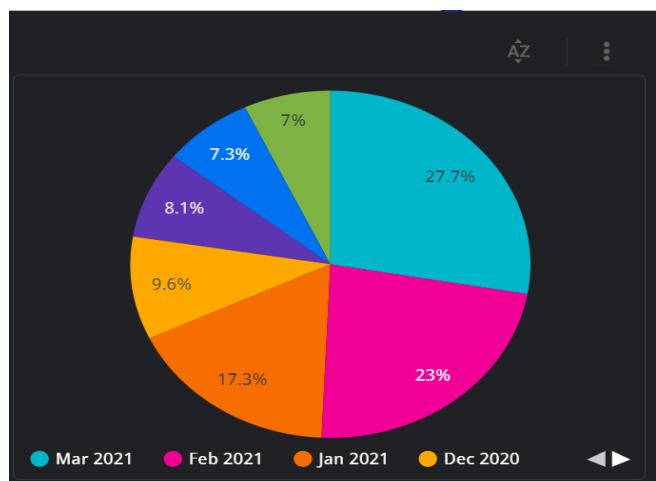


Fig.18. QC data pie chart

D. Repairing of Rejected SKU's /Refurbish SKU's

We have separate Department called Carpentry Area Where Repairing work is done on Damage/dent, or incomplete

SKU's. Repaired Products are help as a Refund Saviour for a company. We apply 5S in sort /set order, increase the Section from 2 to 4 so that productivity in increase. Daily Target Assign and tracking with Dashboards so the results got in favor as per Table 3.

Table 3 Daily Target Assign and tracking with Dashboards

Row Labels	Sum of Qty
2020	681
Oct	228
Nov	218
Dec	235
2021	1177
Jan	270
Feb	330
Mar	399
Apr	178
Grand Total	1858

As seen in above table, it shows total no of SKU's got repaired in the months of 2020 and 2021 .as seen total no of SKU's got repaired in Oct -228, Nov-218, Dec-235 And after 5s, in Jan270, feb-330, March-399 SKU's had been repaired. As we see in below Fig. 19, the no of SKU's repaired in the month of Jan, Feb, and March are 270, 330, and 399 respectively which much higher than the previous year months. The count of SKU is higher after the implementation of 5S, colour code, dashboard system which helps in the improvement in productivity.

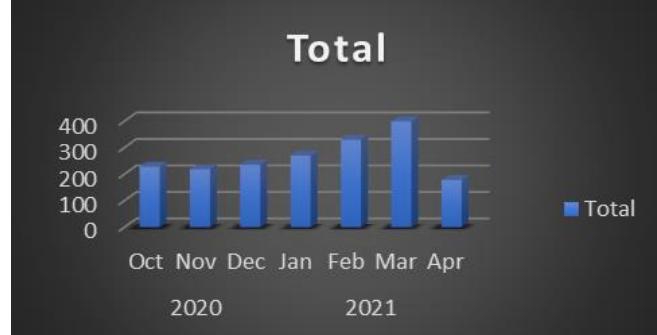


Fig. 19. Repaired SKU's graph

VII. CONCLUSION

5S initiatives offer significant benefits to manufacturing and service organizations to attain drastic improvements at workplace, thereby motivating the organizations to learn more knowledge about 5S technique for its effective implementation in their organizations. The conclusion from the above 5s Implementation, color code system, PDCA Chart, Dashboard Implementation, floor management in the Warehouse are as: Implementation of Sort and Set in order gives appropriate place for everything, it results in proper utilization of floor for raw materials, finish products and transport equipment's also less time required for finding of material due to permanent location as per destination and proper mapping and sorting. Productivity increases due to the time management with the help of dashboards & PDCA CHARTS along with workplace management. Prohibit of unwanted materials at the workplace which affects the

moral of the worker while working. Defined space (Red tag Area) for storing the unwanted or rejected material. Visual communication with the help of charts and guidelines are given on the work floor. Time bound is decided for each and every process for every SKU as there is color code System Implemented. audit is conducted on department basis for improvement. PDCA process is follow for important departments. Time span between Inward and Mapping is coming to same day instead of 2-3 days delay. QC for SKU's increased due to sorting, color code and dashboard process. Repairable SKU's productivity was increased.

ACKNOWLEDGMENT

Author acknowledges the facilities provided by Production Department VJTI, Mumbai and furniture industry for conducting this research and design analysis

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