International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 10 Issue 9 ǁ September 2022 ǁ PP. 557-565

Productivity Improvement of Shopfloor Process Through Lean Management

[1]Vishal R, InaKakal, KiranV, Anusha Y,[2]Shruthi MN
[1]Students, [2]Assistant professor
[1]Industrial Engineering and Management
[1]R.V College Of Engineering, Bengaluru, India

Abstract: *All across the world, manufacturing industries have been influenced by lean management. Lean management, in actuality, is a methodology that emphasizes the utilization of resources to create value for clients as well as measures to reduce waste. Increased production decreased lead times and costs, improved quality, and increased customer value are the major goals of implementing lean management. By reducing 8th waste, the technique seeks to boost productivity. Lean management focuses on getting rid of wasteful work, procedures, and inventories, automating operations, cutting down on downtime, and eliminating product defects.*

Quality and productivity are given top priority in an organization. Since a problem arises as a result of material flaws, incorrect trash management, working conditions, and housekeeping. In this industry, 5s was not implemented properly and it was not practiced regularly. In material route, has not being mapped and quantity in bin was not allocated properly due to which company lost around 8,000 Rs. Parts produced by CNC (pave machine) were directly falling on the shop floor and the parts were getting tangled. There was 9 customer rejection in the past 3 months and the company lost around 90,000 Rs, final inspectors are not allocated to particular part inspection and their skills were not up to the required skill levels.

After implementing Lean tools and technique as the 5S is effective to manage tools and materials which can improve housekeeping, environmental conditions, and health and safety standards and increase productivity. The previous score was around 48%, after implementing 5S and by assigning team leader to practice regularly the improvement came up to 82%. To solve mapping material route and quantity in bin was done by implementing bin management. By implementing part collecting fixture abnormality parts have been reduced. Kaizen implementation allows a continuous improvement on the shop floor. We have implemented 4M change and Jidoka board to achieve "0" customer rejections and inspection stations can be known by and individual (management, auditors, QC members, etc.) by just observing the 4M change and Jidoka board. As lean management philosophies approach is to standardize, 4M analysis is helpful for the increase in productivity. Before implementing lean tools and techniques the productivity is 40%. after implementing the overall productivity improved by 86%.

Key words: Lean management, Toyota production system, Quality control.

Date of Submission: 15-09-2022 Date of acceptance: 30-09-2022

I. Introduction.

MACHO Engineering Industries has been delivering the finest quality of precision springs, stampings and wire forms since last 26 years. Founded in 1989, Macho Engineering Industries has been catering to a different section of the industries which including OEMs, Multinational companies and other companies Manufacturing has been identified as the primary driver of economic expansion. All components of the economy face challenges related to survival and competition in today's constantly evolving globalized world. All around the world, the lean manufacturing (LM) approach has crept into the manufacturing industry. In reality, lean manufacturing is a technique that emphasizes the utilization of resources to create value for customers as well as approaches to reduce waste. There are several tools available to reduce waste in business. Among the ways we can do this is by applying the 5s principles. In order to find and eliminate waste and boost productivity, the 5s principles are particularly helpful. The 5s approach is a systematic procedure that, when used correctly, establishes and maintains an orderly, secure, and clean workplace. Everyone from senior management to lower management participates in the Kaizen system. Everybody is urged to regularly provide tiny recommendations and improvements. Kaizen is based on implementing adjustments wherever there is room for improvement.

Final inspection is the most flexible kind of alternative product control, classifying the product into one of two or more quality groups based on its evaluation of measurable or non-measurable aspects. Visual inspection is mostly used to check that the product will not have any flaws or non-conformities before moving on to the use or subsequent stages of the process. Visual inspection is especially crucial when evaluating the quality of processes whose repeatability and reproducibility are restricted and whose results vary and necessitate an individualized approach.

II. Literature Review.

R.Sundara, A.N.Balajib, R.M.SatheeshKumarc[1] Lean Manufacturing Implementation Techniques Lean manufacturing and this study concludes from this literature survey on various lean tools applied in different industries according to their requirements. However, value stream mapping techniques and 5S tools are highly effective and professional tools for detecting waste and improving processes. Lean manufacturing methods are also used in every industry to derive benefit from it. Ghazi Abu Taher& Md. Jahangir Alma [2] "Improving Quality and Productivity in Manufacturing Processes Using Statistical Process Control and Quality Control Charts Including Sampling and Six Sigma", Accomplishing Objectives Through Better Utilization of Factory Space This document to modify plant layouts, process layouts, apply work and motion studies, reduce idle time, and apply ergonomics to different work positions.Eric S. Richter and Arthur L. McClellan[3] Process Approach for Determining Quality Inspections Systems and Operations Assurance Department Mission Assurance Department Adjusted by applying weights to surveys. Each tool weights the specific analyzes deemed important in each situation and allows the user to input the required investment and return on investment for each analysis.Prof S S. Pande [4] Inspection and Quality Control We understand that quality control is a product-oriented process whereas quality assurance is a process-oriented practice. Quality assurance can therefore be viewed as a proactive process and quality control as a reactive process.Case Study R.S. Agrahari, P.A. Dangle, K.V. Chandratre [5] Implementing the 5S methodology in small industries: research has shown that the changes brought about by 5S were mostly positive. No area reached the overall score, but the improvement in each area was remarkable. The survey was conducted on only 8 respondents, which of course does not represent the complete opinion of all employees.Dr MS Dhuttargaon, Prof. S.V. Lingaraju, Mr. ShreyasShirke[6] Implementation of 5S in small industries. This collects and compares the process times for all intake and exhaust manifold related operations before and after implementation.Malacca SanchiHua 1, M. Haslinda , A. F. Rahim [7] Implementing 5S in Manufacturing: Evolving Processes by Reducing Costs Growing Processes Improving Working Conditions for Workers The company's standards have reached the next level. Improved safety has helped reduce worker injuries.R. Sundara, A.N. Balajib, R.M.SatheeshkumarC [8] Lean Manufacturing Implementation Techniques Lean manufacturing and this study conclude from this literature review of different lean tools applied to meet the needs of different industries, but with value stream mapping techniques and 5s. The tools are very effective and use complete tools to identify waste and improve the process. Lean manufacturing is also applicable to all industries and offers benefits.Dr. VasdevMalhotra and Samer Kumar [9] This treatise aims to examine lean practices. The goal is to learn more about it. research shows that waste reduction is the most practice. Lean is powerful strategies for achieving operational and service excellence in any organization today.MehulMayatra, Mr.N.D. Chauhan [10] Implementing Lean Manufacturing Techniques. The management concept of an organization is not to impose a certain form, procedure, management style, or to copy a certain scheme. This process is the result of long-term strategy and hard work. 5S and lean methods are at the beginning of every improvement program in a company.

III. Problem Statement.

Small and medium-sized businesses must constantly overcome the difficulties of transitioning to a lean environment. A considerable decline in errors and reliable execution of common practices and processes result from routinely identifying and improving any problematic areas. The flawless operation of the production cycles immediately results in a decrease in overhead and wastage for the organization. In the top company, setup took up more time than actual machining or handling of materials and equipment. Therefore, it was required to cut down on tool handling and non-productive time on the production line in order to increase productivity.

- 5S was not implemented properly and it was not practiced regularly.
- Bin material route was not mapped and quantity in bin was not fixed.Which cost the company around 8,000 Rs
- Parts produced by CNC (pave machine) were directly falling on the shop floor and the parts were getting tangled.
- There were many customer rejections as Final inspectors are not allocated to particular part inspection and their skills were not up to the required skill levels.There was 9 customer rejection in the past 3 months and it cost the company around 90,000 Rs.





Fig3.1 Before 5S Implement Picture.Fig 3.2 Before Bin Management Implement Picture

IV. Objective.

The objective is to produce waste-free manufacturing that is accurate, efficient, error-free, and as exact as is practical, which is superior but impractical. The pursuit of constant improvement stems from the possibility of room for growth.

- To achieve zero customer rejection, it is important to.
- Ensure that supplies are routed properly on the shop floor.
- Effectively channel processes and procedures on the floor.
- Schedule materials, labour, and other resources.
- Monitor for any deviation from established procedures and processes and correct it right away.

V. Research Methodology.

5.1 5S:-A work environment can be organized, cleaned up, standardized, and continually improved using the 5S method. It is one of the Lean Manufacturing process' effective tools. The five exercises that start with the letter S and were taken from five Japanese terms are what give the programme its name. The terms are Sort, Set in Order, Shining, Standardize, and Sustain, respectively. They are Seiri, Seiton, Seiso, Seiketsu, and Shitsuke. Sorting makes it easier to get rid of everything but what is required. Set determines the locations and numbers required for effective operation. Shine is a symbol of inspection-based cleaning. Implementing visual controls and displays is standardizing. Through training and full staff participation, Sustain helps to maintain the organizational effort.

1S-SORT

- Identification of Necessary and Unnecessary Things.
- Creating Of Red Tag Area.
- Marking Of Things in Red Tape.

2S-SET IN ORDER

- Identifying Of Position of Machines and Others.
- Layout Mapping for Each and Every Machines
- Labeling.
- Tapping Of Positioning.

3S-SHINE

- Cleaning.
- Painting and Repainting.
- Employee Neatness.

4S-STANDARDIZATION

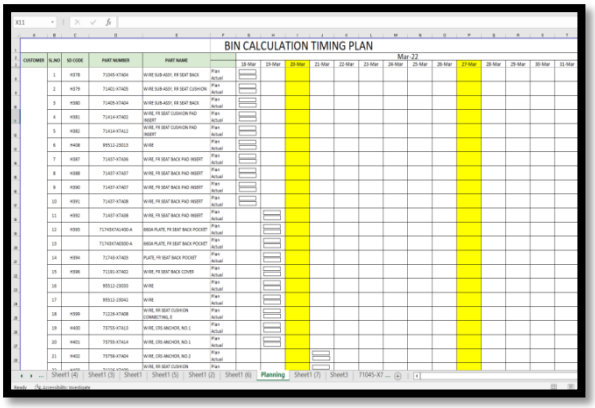
- Assigned Responsibility To Team Leaders.

5S-SUSTAIN

- Check sheets.

5.2 Bin management:-Kanban is a very visual method of managing workflow, inventory, and other things. For businesses that make physical products, kanban is the ideal production strategy since it encourages the use of visual indicators to improve production flow and efficiency. One of the most well-known tools used in Kanban manufacturing is a bin Kanban system.

- Requirement Data.
- Calculation of Bins (Excel).
- Creating Of Labels.
- Sorting Bins & Pasting of Labels.
- Planning Schedule.



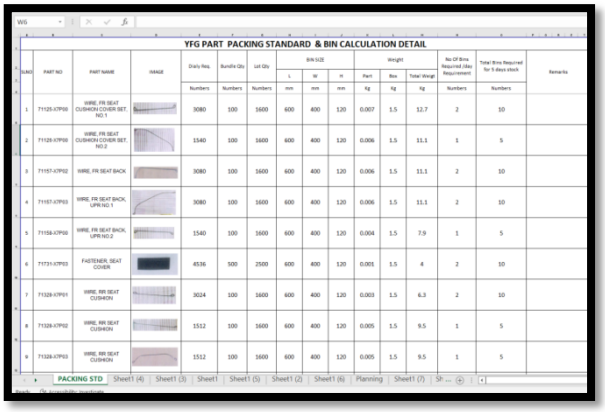


Fig 5.1 Production Plan ScheduleFig 5.2 Excel Calculation Of Bins

FORMULA USED :[(No Of Bins Required/day)*(Total Bins Required for No of days stock)]

5.3 Kaizen:-Kaizen (Continuous Improvement) is a method where personnel from all levels of a company actively collaborate to enhance the manufacturing process on a regular basis. In a sense, it brings together all of the abilities within an organization to produce a potent engine for growth.

- Problem Identification.
- Observation.
- Concept Selection.
- Concept Evaluation.

Concept selection

SELECTION CRITERIA	A BELT CONVEYOR	B PICK AND DROP (MECHANISM)	C STRING RAMP	D WORK PIECE COLLECTION STAND
EASE OF HANDLING	5	3	1	4
MAINTAINCE	2	1	4	4
DURABLITY	4	4	2	5
ACCURACY	4	4	3	3
PORTABLITY	4	3	1	4
COST	2	2	4	4
TOTAL	21	17	15	24

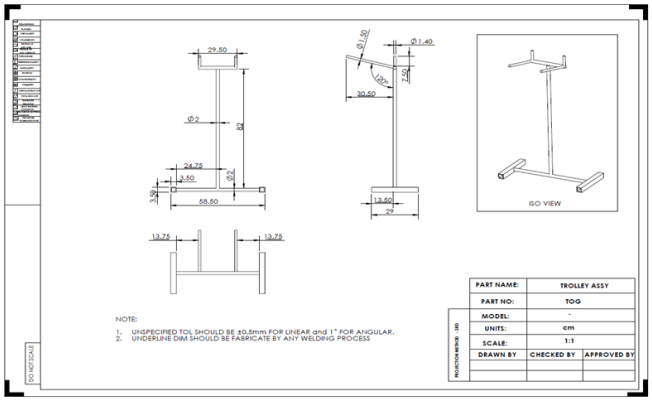
Fig 5.3 Concept Selection

Evaluation matrix

EVALUATION CRITERIA	Weight	A BELT CONVEYOR		B PICK AND DROP (MECHANISM)		C STRING RAMP		D WORK PIECE COLLECTION STAND	
EASE OF HANDLING	(10%)	5	0.5	3	0.3	1	0.1	4	0.4
MAINTAINCE	(15%)	2	0.3	1	0.15	4	0.6	4	0.6
DURABLITY	(20%)	4	0.8	4	0.8	2	0.4	5	1
ACCURACY	(10%)	4	0.4	4	0.4	3	0.3	3	0.3
PORTABLITY	(15%)	4	0.6	3	0.45	1	0.15	4	0.6
COST	(30%)	2	0.6	2	0.6	4	1.2	4	1.2
TOTAL		21	3.2	17	2.7	15	2.75	24	4.1
RANK		2		4		3		1	

Fig 5.4 Evaluation Matrix

In an effort to reduce the risks and uncertainties of early-phase design ideas and help individuals in developing decisions, concept selection techniques have been heavily included into engineering design education. In concept selection work piece collection stand(Part Holding Fixture) is rated more than other concept so it selected for evaluation matrix. The evaluation matrix is a method for having ideas evaluated according to various criteria. The criteria can be pre-defined individually. In evaluation criteria work piece collection stand(Part Holding Fixture) rate more than other concept and proceed to drawing.



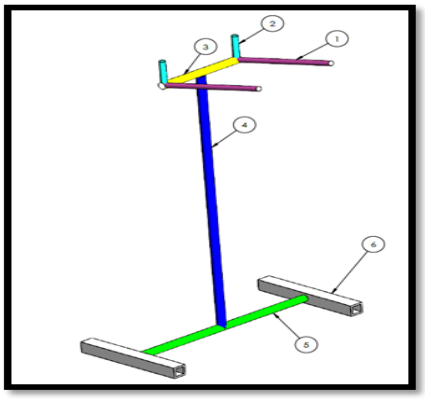


Fig 5.5 2D diagram of fixture (Stand) Fig 5.6 3D diagram of fixture (Stand)

5.4 Quality (Final Inspection Standardization):- Quality is one of the most important aspects of the industry to maintain and satisfy the customers and also to build a good brand. To ensure and maintain good quality any industry must keep a check on quality from the start of the process i.e. from raw materials till the product reaches the customer. There are 4 quadrants in the industry for quality control checks that are RAW MATERIAL, IN PROCESS, FINAL INSPECTION, and CUSTOMER. Steps we have take to achieve quality are as below

- Data collection.
- Data analysis.
- Counter measure plan.
- Counter measure implementation.

SL.NO	DATE	CUSTOMER NAME	PART NO	PART NAME	REJECTED QUANTITY
1	03-01-2022	KTTM	R2518-11020	PROTECTOR SEPERATOR	2
2	03-08-2022	L&P	1607/1608	1607/1608	4000
3	15/3/2022	L&P	1607/1608	1607/1608	
4	18/3/2022	TBI	78950-0K180	HOLDER	98
5	24/3/2022	MICRO PLASTIC	71421-X1703	CUSHION WIRE	600
6	04-11-2022	KTTM	R251211010	RING	580
7	20/4/2022	IFB	KC300400	LEVER ROD	5
8	14/5/2022	KTTM	R220361040	BRACKET	1
9	27/5/2022	TBI	71401-X7A05-A	WIRE SUB ASSY RR SEAT CUSION	1

Fig 5.7 Customer Rejection Data

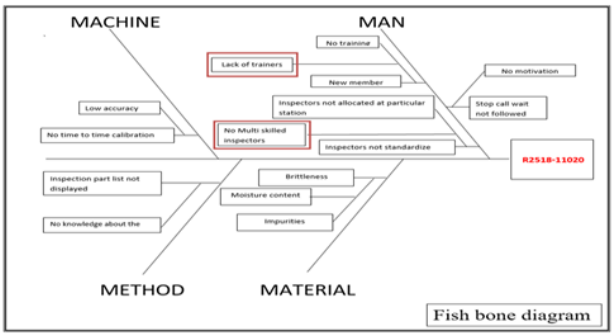


Fig 5.8 Fish Bone Diagram

Fig 5.9 OK Part and NG Part

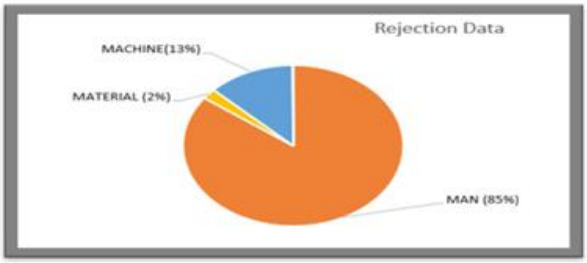


Fig 6.0 Rejected Data Analysis

The above part shown in Fig5.9 is the protector separator and the rejection was that the customer standard limit was not met.
STD LIMITS (3.75-3.95) ERROR: 3.50 MM.
When we analysed we found out that one of the major problems for the parts to get rejected was final inspection (MAN) among other causes.
The final inspection is the most important section of an industry as it's the final gate where the parts are inspected before the customer receives the parts, therefore any problem or defects in the parts must be checked.

VI. Result and Discussion

6.1 5S –

The previous score was **48%** and we have improved to **82%** by implementing 5S and by assign team leader to practice regularly. Fig 6.1 shows after & before 5S check sheet used evaluate pervious and current state and assign score. Fig 6.2shows before & after 5S implement picture

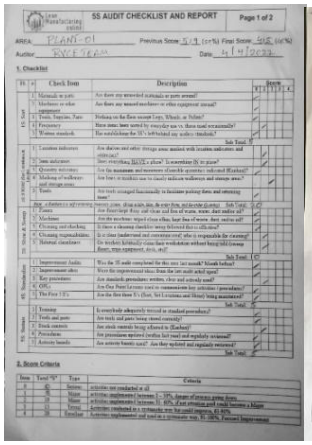


Fig: 6.1 before & after 5s check sheet

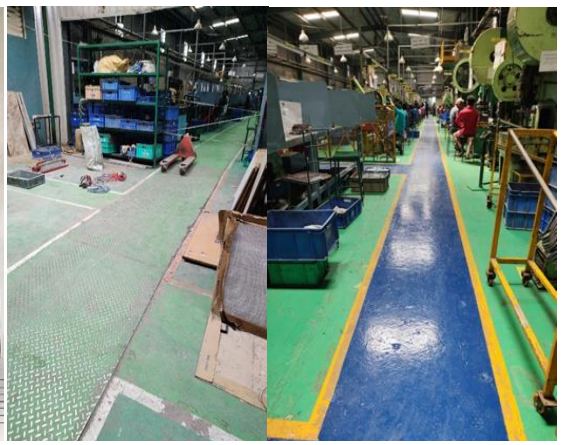


Fig: 6.2 before & after 5s implement picture

6.2 Bin management –

Bin material route was not mapped and quantity in the bin was not fixed due to this there were many bin damages and shortages of the bin and which cost the company around 8,000 Rs and by implementing bin management this problem has been solved. Fig: 6.3 before shows the differ in dimensions for same use, No standardization and no part information. In Fig: 6.4 after Bin management Implementation picture shows the standardization, proper route movement, part information, number of items to be carried in a bin.

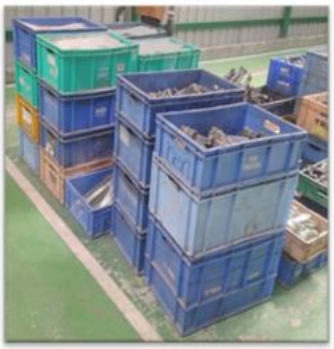


Fig: 6.3 before & after Bin management Implement picture.

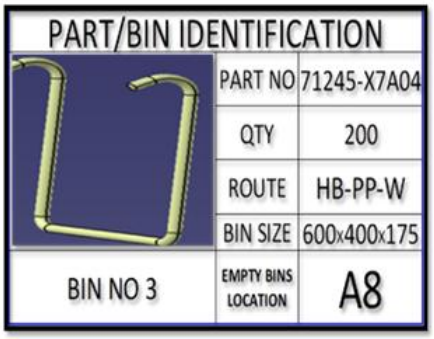


Fig 6.4 bin card

6.3 Kaizen –

Before Parts produced by CNC (pave machine) were directly falling on the shop floor and the parts were getting tangled due to this there were more abnormality parts are produced and by implementing part collecting fixture this problem has been solved. Fig 6.5shows the part collecting fixture.

Fig: 6.5 Part Collecting fixture (Stand)

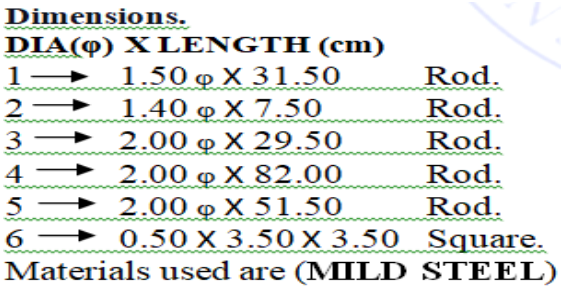


Fig: 6.6 Dimensions of part collecting fixture (Stand)

6.4 Quality (Final Inspection Standardization):–

There was 9 customer rejection in the past 3 months and it cost the company around 90,000 Rs, as we have implemented 4M change and Jidoka board to achieve "0" customer rejections.The inspection stations can be known by and individual (management, auditors, QC members, etc.) by just observing the 4M change and Jidoka board as shown in Fig 6.7.we have also standardized the station and displayed the inspection part list, inspection instruction sheet, Checking fixture(CF) and proper part and abnormality part as shown in Fig 6.8.

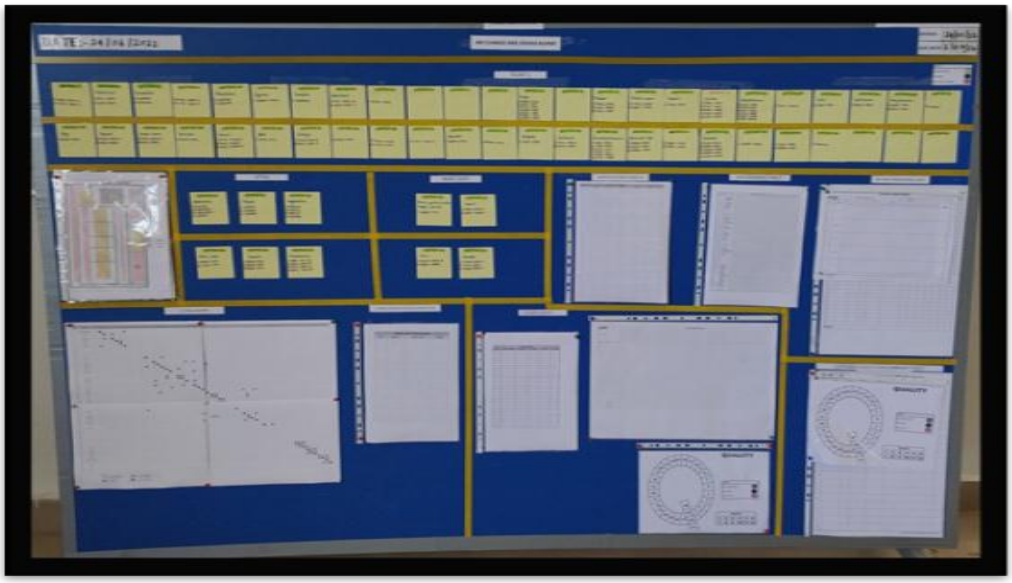


Fig: 6.7 4M change and Jidoka board

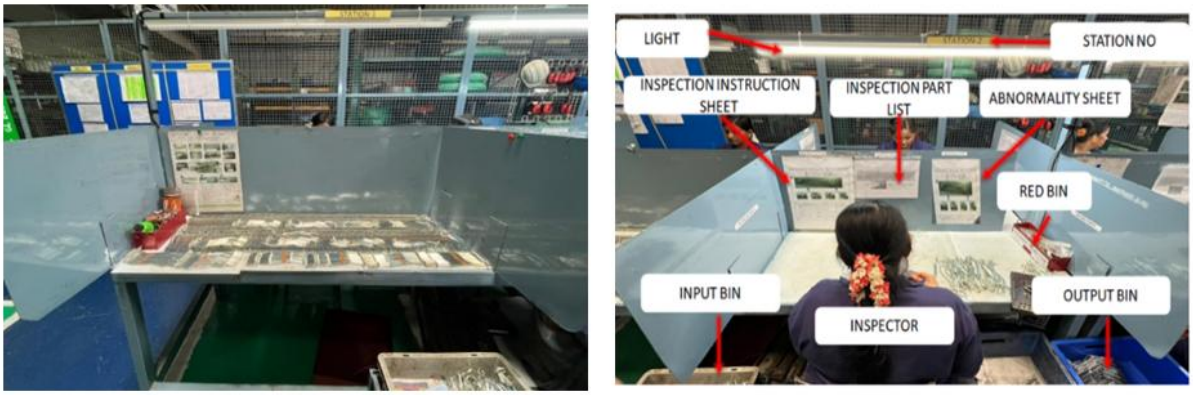


Fig: 6.8 before & after inspection station

6.5Productivity Improvement:-

Before implementing lean tool and technique The productivity was **40%.**after implementing lean tool and technique The overall productivity improved by **86%.**After the implementation of lean tools & techniques. Fig 5.5.1 shows the improvement area data individually by check list before and after data as been obtain. Fig 5.5.2 shows the Improvement Area Data Analyses(in %

Improvement Area	BEFORE	AFTER
5S	48%	82%
Kaizen	25%	85%
Bin Management	55%	80%
Final inspection std	30%	95%
Total productivity	40%	86%

Fig: 6.9 Improvement Area Data.

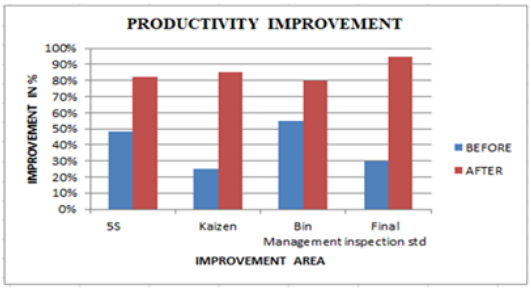


Fig: 7.0Improvement Area Data Analyses.

7.0 Conclusion and Future Scope.

Several factors affect productivity. Mainly the workflow is improper, unnecessary operations, unskilled workers and 3:1 skill matrix are not defined, and improper material handling. To come out of this problem In the literature review, the most frequently employed lean tools and approaches across all industries were used by us. After the effective deployment of the quality tool, productivity is boosted. The 5S, kaizen, and 4M analyses are parts of lean techniques and tools.

One of the management theories that is changing the manufacturing industry is lean production. Toyota is where Lean first emerged, and other industries, like supply chain, product development, healthcare, etc. have adopted its concepts and way of thinking.

The 5S is an efficient tool for managing equipment and supplies that can enhance housekeeping, environmental conditions, health and safety standards, and production. This is known as the lean technique. Implementing kaizen enables shop floor improvements to be made continuously. As standardization and the 4M analysis are important for increasing production, lean management philosophies take these approaches. Lean tools and procedures are the sole means by which a business may survive during a financial crisis.

Future scope:-

Process-oriented techniques include lean management. The future of lean calls for a focus on:

- Product quality & life cycle.
- A substantial return on investment.
- Implementing Effective changes while making the most use of the resources at hand.

Lean employs a straightforward system of continual testing and improvement while maintaining the same life cycle and the project's scope or process.

Reference.

[1]. J. W. Davis, Lean Manufacturing: Implementation Strategies That Work: a Roadmap to Quick and Lasting Success, New York: Industrial Press Inc., 2009

[2]. Prathamesh P. Kulkarni, Sagar S. Kshire, Kailas V. Chandratre (2014), Productivity improvement through Lean development & Work study methods, International Journal of Research in Engineering and Technology – IJRET.

[3]. Rajesh Gautam, Sushil Kumar, Dr. Sultan Singh (2012), Kaizen Implementation in an Industry in india : A Case Study,IJRET.

[4]. Yang, M.G., Hong, P. and Modi, S.B. (2011), "Impact of lean manufacturing and environmental management on business performance: An empirical study of manufacturing firms", Vol1, No. 1, pp. 45-56.

[5]. Dinesh B. Shinde, Prashant N. Shende (2014), Improvement of Plant Layout by using 5S technique-An industrial case study, International Journal Of Modern Engineering Research (IJMER).

[6]. Jagdeep Singh and HarwinderSingh,Kaizen Philosophy: A Review of Literature, The Icfai University Journal of Operations Management, Vol. VIII, No. 2, 2009

[7]. Chauhan et al., ―Measuring the status of Lean manufacturing using AHP‖ International journal of Emerging technology vol.1 no.2, pp.115-120. 2010.

[8]. Miller et al., ―A case study of Lean, sustainable Manufacturing‖ journal of Industrial Engineering andManagement, vol.3 no.1, pp.11-32. 2010.

[9]. Implementation Of 5S In Manufacturing Industry: A Case Of Foreign Workers In Melaka San Chee Houa1, M. Haslinda1, Sedek Muliati2, Abdullah Mariam Miri1 , A. F. Rahim MATEC Web Of Conferences 150, 05034 (2018).

[10]. Dr. M. S. Dhuttargaon 1 | Prof. S. V. Lingaraju 2 | Mr. ShreyasShirke 3 "Implementation Of 5s In Small Scale Industry" E-issnNo : 2455-295x | Volume : 4 | Issue : 11 | November 2018.

[11]. Ahmed S and Hassan M (2003), "Survey and Case Investigation on Application of Quality Management Tools and Techniques in SMIs", International Journal of Quality and Reliability Management, Vol. 20, pp. 795-826.

[12]. Bhasin S and Burcher P (2006), "Lean Viewed as a Philosophy", Journal of Manufacturing TechnologyManagement, Vol. 17, pp. 57-72.

[13]. Ahuja, I. P. S., &Khamba, J. S. (2008). Total productive maintenance: literature review and directions. International Journal of Quality & Reliability Management,25(7), 709-756.

[14]. Ahmed, S., & Hassan, M. (2003). Survey and case investigations on application of quality management tools and techniques in SMIs. International Journal of Quality & Reliability Management, 20(7), 795-826.

[15]. Ansari, A., &Modarress, B. (1997). World-class strategies for safety: a Boeing approach. International Journal of Operations & Production Management, 17(4), 389-398.

[16]. Khamis, N., Abrahman, M. N., Jamaludin, K. R., Ismail, A. R., Ghani, J. A., &Zulkifli, R. (2009). Development of 5S practice checklist for manufacturing industry. In Proceedings of the World Congress on Engineering (Vol. 1, pp. 978-988).
[17]. Rahman, M. N., Khamis, N. K., Zain, R. M., Deros, B. M., &Mahmood, W. H. (2010). Implementation of 5S practices in the manufacturing companies: A case study. American Journal of Applied Sciences, 7(8), 1182-1189.