International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 07 | July -2017 www.irjet.net p-ISSN: 2395-0072

Application of Lean Concepts in Molding Department

Premananda R[1], Dr. M Shilpa[2]

[1] *MTech Student, Ramaiah Institute of Technology, Bengaluru, Karnataka, India*
[2] *Assistant Professor Professor, Ramaiah Institute of Technology, Bengaluru, Karnataka, India*

Abstract - *The Kaizen and 5S management originated in the best Japanese management practices and is dedicated to the improvement of productivity, efficiency, quality and, in general, of business excellence. The KAIZEN methods are internationally acknowledged as methods of continuous improvement, through small steps, of the economical results of companies. The small improvements applied to key processes will generate the major multiplication of the company's profit, while constituting a secure way to obtain the clients' loyalty/fidelity. The KAIZEN management represents a solid, strategic instrument, with a view to reach and surpass the company's objectives. The "5S" technique represents a fundamental technique which allows the enhancement of efficiency and productivity, while ensuring a pleasant organizational climate. The scientific paper presents in a concrete way a study regarding the application of these concepts in a real organization.*

Key Words: *5S , Continuous Improvement, Kaizen, Moulding Division*

1. INTRODUCTION

1.1 Kaizen

Kaizen is a japans word means "continuous improvement". In business, kaizen refers to activities that continuously improve all functions and involves all employee from CEO to assembly line worker
Kaizen as some guiding principles:

- Good processes bring good results
- Go see for yourself to grasp the current situation
- Speak with data, manage by facts
- Take action to contain and correct root causes of problems
- Work as a team
- Kaizen is everyday's business

1.2 5S

Seiri (Sort): The first step is doing Seiri, i.e.; separating the necessary items. This helps in removing clutter, reducing inventory, piling up of stuff. The unnecessary items must be disposed off.

Seiton (Set in order): Seiton means putting things in order, maintaining them so that they are fit for use when required. Good Seiton implies each item and work area has identification, tag or label, and address to enable anyone to quickly search and retrieve the item, and put it back in the same place after use.

Seiso (Shine): Seiso is cleaning. Seiso is to be done to make the equipment, structure, piping, floor, walls; roof, fixtures, lighting, stairs, etc look new like they were when purchased originally. Seiso does not mean simply painting the equipment without doing the cleaning and repairs. Seiso is to keep the work place spotlessly clean, shining equipments, clean containers, clean garbage bins and clean uniform of employees.

Sieketsu (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.

Shitsuke (Sustain): Shitsuke means discipline, without shitsuke, 5S is not possible. This means commitment to time, to promises, to systems, to standard operating process. It means sticking to the rules of the company.

2. PROBLEM STATEMENT

The lean implementation is the key to success of improving quality, being competitive in the market place, reducing wastes, reducing costs and etc. So the concepts that come in lean implementation are Kaizen and 5S. Kaizen 5S is methodology will enable company to continuously improve process and 5S will help to sustain the improvements. In the present study of the industry show the criticality of improving the process and improving production environment. So the industry industrial productivity and competitiveness will enhance.

Problems faced in Manufacturing Facilities, Which will be considered for improvement;

- Materials or stock piled up on floor resulting in congested movement of materials as well as workers.

- Searching of items or materials taking more than 30 seconds.
- Work tables or other equipments not cleaned daily resulting in a shabby look as well as small accidents taking place.
- Waste motions of workers and material.
- Limited flexibility of robots used for automation.
- Fanuc robot or Epson robot stops without any alarm.
- Epson robot does not pick up all the parts and the Fanuc robot puts the next parts on top of the left-over parts.
- Fanuc robot does not pick up the parts from some cavities and the Machine stops.
- Out of cycle work: Feeding regrind to granulator, Feeding mix to the hopper, Writing shift-end reports, Green weight checking and entry, Bringing SS trays to the Machine, Reporting problems to the supervisor, Mould cleaning
- Operator movement high as the loading / unloading trays for the Machines is far apart.
- Tray feeding / removing point from the conveyor is high (difficult for shorter operators).
- Possible injury to operators when trying to remove stuck trays.

3. OBJECTIVES

The lean concepts implemented should sustain for a long time to achieve some benefits from it. Benefits may be like improving the quality of the product, improving customer service and satisfaction, reducing the rejections or wastes.

Primary Objectives

- Improve ergonomics, safety and reduce operator movement
- Find causes of robot stoppages and implement countermeasures
- Convert out-of-cycle work to in-cycle work
- Ensure all 4 Machines are able to run continuously without any operator attention for at least 30 minutes.

Production Requirements

- The 4 Machines should run without stop 24 x 7
- Only 1 operator

4. METHODOLGY

Plan-Do-Check-Act Approach to 5S

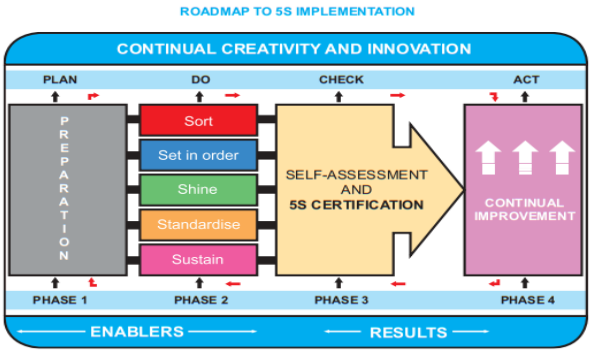

Fig 5.2 Methodology of 5S

Methodolgy of Kazien

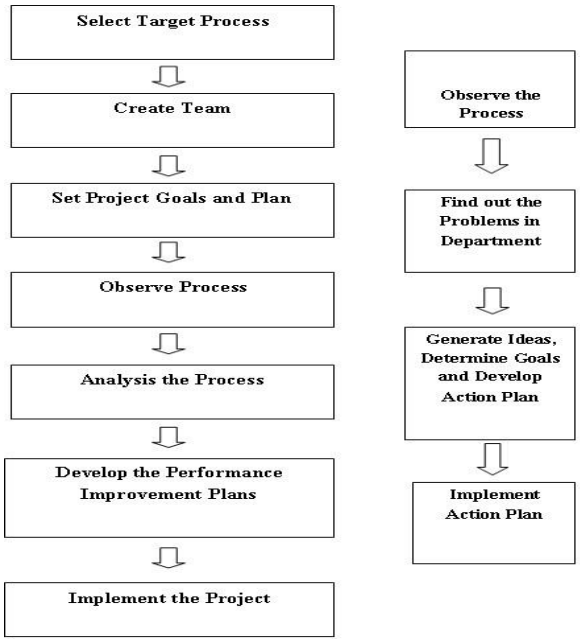

Fig 5.1 Methodology of kaizen

5. Data Collection and Analysis

Moulding department is considered for the study and for implementation of contentious improvement, as the departments have loading issues which is causing damage to the work piece. As the department is considered for improvement the process was studied for a period of 1 month. The data collected as shown below Table 6.1

Table 5.1 Data Collected over a period of one month

Date 18.2.2017		Machine:DM-46	
Mould hours time in minutes		Idle time in minutes	Remarks
Shift-1	Moulded hour-0	Idle hours-480 minutes	Shortage of ceramic trays, supervisor unavailability, power failure
Shift-2	Moulded hour-480 minutes	Idle hours-0	No stoppage
Shift-3	Moulded hour-480 minutes	Idle hours-0	No stoppage

Date 19.2.2017		Machine:DM-46	
Mould hours time in minutes		Idle time in minutes	Remarks
Shift-1	Moulded hour-300 minutes	Idle hours-180 minutes	Supervisor unavailability
Shift-2	Moulded hour-420 minutes	Idle hours-60 minutes	Shortage of trays
Shift-3	Moulded hour-405minutes	Idle hours-75 minutes	Work relieving, power failure

Likewise the data is collected for each day.

In moulding department some of the Machines are manually staged and some are semi-automated. The parts staging is the biggest task. Even care has to be taken while staging the part to avoid damages to the parts. For staging of parts the required man-power is high. So the main aim of the automation department is to reduce the man power. To automate the process, using of robots is suitable option. The below picture shows the manual staging of the moulded parts in Fig 5.1.

Fig 5.1 Manual Staging of Parts

The aim of the department was to increase productivity of the process by making the single operator to operate on four Machines. As the four Machines high production rate, The Machines that were selected are BAT 12,13,14,15. These Machines have a automation with 6 axes Fanuc robot to take the part from mould and place on the conveyor but from conveyor parts where manually staged on trays as shown above figure. Summarized data collected over a period of one month also suggest that there is a have rate of delay and breakdown in job due to the manual staging.

Safety Auditing Score Calculation and 5S Auditing Score Calculation is done by using standard template.

The collected data of Safety Audit score, 5S Audit score from the shop floor and Time lost due to the Robot issues are collected. It shows the significant deviation from the expected to the data collected. As the aim of the project was to improve productivity and improve the workspace ergonomics by introducing the robot, results show the strong evidence to implement the corrective measures. Summarized data is as shown in Table 5.2.

Table 6.4 Summarized data present state

Impact Measures	Pre-Event	Objective
5-S Score	6 / 10	9 / 10
Safety Audit Score	335	100
Time lost due to want of mix	6.3%	0
Time lost due to robot problems	4.1%	1%
Operator work content to run 2 Machines for 150 min	92 min	36 min

5.1 Corrective measures

Results show that the time lost due to the robot is about 4.1% and the company aim was to eliminate manual handling. Epson 6 Axis robot is proposed as solution for eliminating the manual handling.

Fig 5.2 Epson 6Axis Robot and Teaching Pendent

Specifications of Epson 6 Axis Robot

Model specifications	C3-A601S
Weight	27kg
Max payload	4 kgs
Reach max	700mm
Motor power	Axis 1,2: 400w Axis 3: 150w Axis 4,5,6: 50 w
Controller	RC 70+

Epson Robot was installed for eliminating the manual handling as shown before, Figure 6.3 shows the Epson Robot installed in line for picking and placing parts manufacture on the plates for storing.

Fig 5.3 Epson Robot

Sweeping mechanism installed for eliminating the automation of conveyor system by eliminating the fall of green part from the try and collecting the green parts which are misplaced as shown in Fig 5.4

Fig 5.4 Sweeping mechanism

Spring plunger is added to the robot for eliminating the tray height variation as shown in fig 5.5.

Fig 6.5 Spring Plunger

Safety gates are installed for controlling the movement of worker inside the work is of the robot arm as shown in Fig 5.6.

Fig 5.6 Control structure of conveyor

5.2 5S Implementation

5s audit scores shows that the 5S level of implementation is 6 out of 10 by the shop floor workers and supervisors. As the objective of the management is to increase it to 9 out of 10. Methodology of implementations of 5S as follows:

5.2.1 Sort

Step 1

Primarily the current situation was assessed by auditing in knowing the status of the 5S. Proper sorting activities on time-time basis were not done and unwanted items were piled up and also mixed up with the wanted and necessary items. So the items were sorted out from unwanted materials as shown below in fig 5.7

Fig 5.7 Sorting out necessary items as per frequency of usage

Fig 5.8: Moving away unwanted materials and panels

Fig 5.9: Discarding unwanted materials

5.2.2Set in Order

After sorting out the necessary items with unnecessary items the necessary items were set in order according to the frequency of usage. The items which will be daily like tools and other assembly items were kept and named near the work area or the work table. The items which were used on a weekly basis and monthly basis were kept away from the work area so that space was very well utilized. The items were set in order and named as per the frequency of usage. Empty SS trays stored near Machine. These will be loaded once in every 2 hours by a separate person.
Staging trolleys provide for standardise the storage and reduce the operator fatigue.

- Staging trolleys kept near Machine at identified location: 1 for each Machine.
- Additional 10 green trolleys have been arranged in an identified location close to Cell.

5.2.3 Shine

After the items were set in order the floor, walls, racks and etc were cleaned and wiped.

Fig 6.13: Cleaning the racks

5.2.4 Standardize

After the cleaning process the work area was standardized by colour coding for specific areas and also naming them. Also standard procedures and rules were set to maintain the first three 5's.
Standardization of the shop floor and effectively controlling the signal system incorporated for better visual control and improve the response.
Advantages are

- Supervisor can concentrate more on this cell.
- Reduces the stoppage of Machine due tool correction, mix, trays ceramics & trolleys and trouble shooting.

Red tap marking for indicating bin space and it will standardise the storage by specifying the storage area. Yellow tap marking for dividing workstations.

5.2.5 Sustain:

The sustenance of improvement activity carried out in first 4S is critical. Factors are implemented for sustainability they are:

- Safety: For the safety purpose of the workers some of the electric hazardous place in the zone was cleared and marked so that anyone in the plant would be cautious hereafter. Some safety equipments such as fire extinguisher and for the people working in the electrical assembly zone, shock resistant gloves were recommended to the workers as well as management people.
- 5S infrastructure: During the re-implementation of the 5S some materials were arranged in plastic boxes and also a separate place for the materials used on monthly basis was arranged.
- Individuality: The activities of each S have been divided and individual roles and responsibilities have been explained.
- Group norms: It has been recommended to hold a zone specific 5S related meetings so that

brainstorming can be done on continuous improvements in 5S and thus leading to a sustainable 5S practices.

- Control: As the time allotted for the 5S activities was not enough on a daily basis, the time for the 5S activities was increased from 10 minutes to 15 minutes.

5.3 The present situation after Re-implementing 5S:

Before After

Before After

Before After

6. CONCLUSIONS

The projects aim was to improve the process using lean tools Kaizen and 5S.

As a part of Continuous improvement (Kaizen) the Epson robot was installed to eliminate operator fatigue. 5S principles were effectively implemented throughout the department for improving the shop floor design and develop ergonomically design of layout.

The Safety audit and 5S audit are performed after the improvement and implementation of 5S as shown in Table 6.1

Table 7.1 Results of audit after improvement

Impact Measures	Pre-Event	Objective	Post-Event
5-S Score	6 / 10	9 / 10	8/10
Safety Audit Score	335	100	150
Time lost due to want of mix	6.3%	0	0
Time lost due to robot problems	4.1%	1%	1
Operator work content to run 2 Machines for 150 min	92 min	36 min	36min

Tables show the clear deviation between results for process before improvement and after improvement.

- 5S score increased to 9 out of 10.
- Safety Audit Score reduced from 335 to 150.
- Robot problems reduced from 4.1% to 1%.
- Operator work content reduces to 36min from 92 min.

REFERENCES

[1] Mohd Norhasni, Mohd Asaad1 , Rohaizah Saad, Rushami Zien Yusoff "5s, Kaizen and Organization Performance: Examining the Relationship and Level of Implementation Using Rasch Model in Malaysian Automotive Company", International Academic Research Journal of Business and Technology, 1 1(2) 2015 Page 214-226.

[2] Mihail Aurel Titu Constantin Oprean and Daniel Grecu ,"Applying the Kaizen Method and the 5S Technique in the Activity of Post-Sale Services in the Knowledge-Based Organization", Proceeding of international multi conference of engineering and computer scientists 2010 ,vol1, IMECS 2010.

[3] Rahul1 and J. S. Kaler, "IMPLEMENTATION OF LEAN MANUFACTURING IN COMPUTER INTEGRATED ENVIRONMENT", International Journal of Advanced Engineering Technology, E-ISSN 0976-3945.

[4] Vibhor Kakkar, Vijay Singh Dalal, Vineet Choraria, Ashish S. Pareta, Anmol Bhatia, "Implementation of 5S Quality Tool in Manufacturing Company", International Journal Of Scientific & Technology Research Volume 4, Issue 02, February 2015 Issn 2277-8616.

[5] Jignesh A. Bhoi,Darshak A. Desai,Rohit M. Patel," The Concept and Methodology of Kaizen" International

journal of development and research, ISSN 2321-9939, Volume 2.

[6] Aman Gupta,Sanjeev Verma and Shaman Gupta "An Application of 5S concept to organize the workplace at a small scale manufacturing company". International journal of engineering sciences & research technology, Vol 4(1), Jan 2015.

[7] R.T Salunkhe, G.S.Kamble and Prasad Malage "Inventory Control and Spare part Management through 5S, Kanban and Kaizen at ABC Industry". IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) ISSN: 2278-1684, PP: 43-47.

[8] Bwemelo, Gordian, "KAIZEN as a Strategy for Improving SSME's Performance by assessing its acceptability and feasibility in Tanzania" ,European Journal of Business and Management, ISSN 2222-1905 (Paper) , ISSN 2222-2839 (Online) Vol.6, No.35, 2014

[9] Dilek Acar Gurel "A conceptual evaluation of 5S model in hotels", African JournalBussines Mangement, Vol. 7(30), pp. 3035-3042, 14 August, 2013.

[10] Mihir K.Shah,Vivek A.Deshpande and Ramachandra M.Patil "A Review on Lean tools and Techniques as well as continuous improvement in industry", International Journal of Advance Industrial Engineering ,Vol.3, No.4 (Dec 2015).

[11] Asayehgn Desta, Hadush Berhe Asgedom, Alula Gebresas& Mengstu Ashebe "Analysis of KAIZEN Implementation in Northern Ethiopia's Manufacturing Industries" ,International Journal of Business and Commerce Vol. 3, No.8: Apr 2014[39-57].

[12] Muhammad Saleem, Nawar Khan, Shafqat Hameed, M Abbas Ch "An Analysis of Relationship between Total Quality Management and Kaizen" Full life Journal 2012;9(3): 31-40.

[13] Helena Cierna, Erika Sujova and Miroslava Tavoda "Application of the KAIZEN philosophy especially it is more useful as a road to a learner business" ,Technical University in Zvolen ISBN 978-80- 265-0029-2.

[14] Suhaiza Zailani,Mohd Rizaimy Shaharudin "Impact of kaizen on firm's competitive advantage in a Japanes owned company in Malaysia" ,Int. J. Productivity and Quality Management, Vol. 16, No. 2, 2015.

[15] Mrs.S.Maidhili, Mrs.G.Meenambika and Dr.K.Nithyanandam "Application and Usefulness of 5S and KAIZEN for Library Space Management", International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056 Volume: 03 Issue: 04 | Apr-2016.

[16] Brad Raluca "Textile industry application of the 5S method", International Journal of Quality & Reliability Management, vol. 27, issue 2, pp. 217 – 230, 2010.

[17] Grateila Dana BOCA "KAIZEN method in Production Management", International Scientific Conference YOUNG SCIENTISTS 2011, 2010, 29-34 p., ISBN: 978-963-661-916-3.

[18] PrashantS.Kuklare and Dr.M.N.Hedaoo "Feasibility of Application of 5S Methodology in Construction Industry" , 2017 IJSRST, Volume 3, Issue 1.

[19] Jay R Patwa,Nilesh G.Patel,Rinkal Viradiya and Mitesh K Patel "Assessment of implementation of '5S' in phc of Ahmedabad", International Journal of Applied Research 2015; 1(9): 408-410.

[20] Katarina Teplicka, Katarina Culkova "KAIZEN and its applying during cost decreasing in process of production firm maintenance", International journal of Engineering Tome9(year2009), Vol 3, ISSN 1584-2763.