International Journal of Advance Engineering and Research Development
Scientific Journal of Impact Factor (SJIF): 4.72
Special Issue SIEICON-2017,April -2017
e-ISSN : 2348-4470 p-ISSN : 2348-6406

Productivity Improvement by Implementation of Kaizen-5S in Small Scale Industry: A Case Study

Mayank Dev Singh[1], Rathod Ronak[2], Panchal Nisarg[3], Prajapati Rajesh[4], Patel Shivam[5]
[1]*Assistant Professor, Mechanical Department, Sigma Institute of Engineering, Vadodara, Gujarat, India.*
[2,3,4,5] *UG Student, Mechanical Department, Sigma Institute of Engineering, Vadodara, Gujarat, India.*

Abstract —*This research paper carried out to apply the kaizen 5S methodology of Lean manufacturing to solve the problems of industry in India with the aim to increase the efficiency of all processes and elimination of losses in the company. In the global markets is continuously changing and demanding product of high quality and low cost. Kaizen is continuous improvement through small steps to achieve economical result of the organization; 5S is tool to ensuring systematic organizational environment. Research clearly show that very essential is training of workman about the 5S rules. It also intends to build a stronger work ethic within the workers and engineer who would be expected to continue the good practices.*

Keywords- *5S, Kaizen, Productivity, Continuous Improvement*

I. INTRODUCTION

Kaizen is Japanese Word, where "Kai" = change and "Zen" = good, simply means "change for better". In English kaizen is applied to measures for implementing continuous improvement. In Japan, the concept of Kaizen is so deeply engrained in the minds of both managers and workers that they often don't even realize they are thinking Kaizen as a customer driven strategy for improvement. It applies to processes such as purchasing and logistics that cross organizational boundaries into the supply chain.

Kaizen management practices, the main priority is given to the manufacturing process, as the process of achieving results is not less than the final result. The reason for this focus is that imperfect processes could potentially not lead to achieving the goal. A corresponding task of kaizen is to become a part of market by improving processes within the organization instead of pushing products into the market. Kaizen forms an umbrella that covers many techniques including Kanban, total productive maintenance, six sigma, automation, just-in-time, suggestion system and productivity improvement, etc. (Imai, 1986) as shown in Figure.

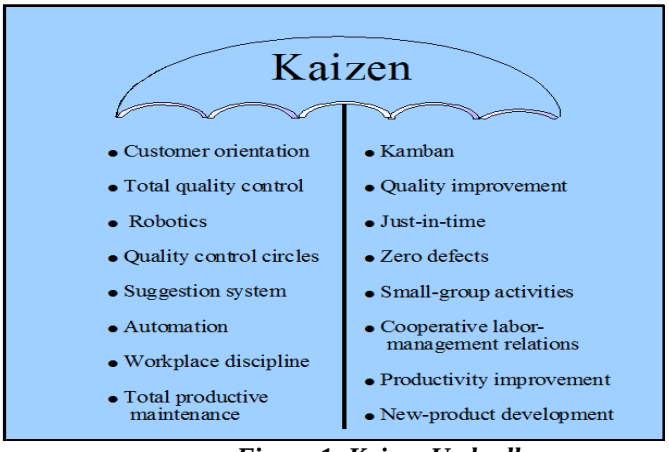

Figure 1: Kaizen Umbrella

5S was invented in Japan, and stands for five Japanese words that start with the letter 'S': Seiri, Seiton, Seiso, Seiketsu, and Shitsuke. Table 1 shows what these individual words mean. An equivalent set of five 'S' words in English have likewise been adopted by many, to preserve the 5S acronym in English usage. These are: Sort, Set (in place), Shine, Standardize, and Sustain.

Figure 2: Explanation of 5S

For proper housekeeping a valuable tool or methodology is used, the 5S methodology. Five S evaluation contributes to how employees feel about product, company, and their selves and today it has become essential for any company, engaged in manufacturing, to practice the 5S's in order to be recognized as a manufacturer of world-class status. A 5S program focuses on having visual order, organization, cleanliness and standardization.

Kaizen refers to any activities that continually improve all business functions or processes and involves every employee from the chief executive officer to the assembly line workers. Through the 5S improved profitability, efficiency, service and safety in industry.

II. LITERATURE REVIEW

Tonic et al (2014), was described that the implementing lean methods and tools in order to improve the efficiency of the overall system. The first step in implementation is one-hour training - meeting with all employees in the company and employees of the company are divided into teams which consisted of 3 or 5 members, and each of the three production plants are divided into zones. In order to monitor the effectiveness of work teams in certain areas, monthly audits are carried out, for each production unit. Also are designed yellow cards for introduction of total productive maintenance; workers put cards on the machine/device which has been observed the need for interventions maintenance services. To lean had the full effect it is necessary to adjust the whole company's philosophy of continuous improvement of manufacturing processes and eliminate unnecessary costs.

Grecu et al (2010), was describe the kaizen principles presumes a practical approach and low costs of improvement. Basically they identify the problem in industry. Due to this problem, the profit margin of the organization is not fulfilling so they arrange a meeting in industry. In this meeting they give basic information about the kaizen to the workers .somehow they convince the workers to implement it in the industry. So, after convince, they separates the workers and employees into 3 to 4 groups And trying to solve the all problems. After the interpretation of the results obtained in the Kaizen – 5S workshops, it has been confirmed that the implementation and application of the Kaizen concepts need no investments or major expenses, but only more attention paid to details and practical means to work intelligently. The application of the Kaizen principles involves no major expenses, but only more attention to details and practical ways to do things better and more efficiently; Problems should not be connected to people because blaming people does not solve the problem.

Agrahari et al (2015), explain that the implementation of 5S methodology in the small scale industry. Due to the time consumption to find the tools are more and work flow is improper. To solve this problem, he implements a Red-tag process and separate unwanted items. In this process three questions ask and determined the items are necessary or not. After the separation dispose the unnecessary items. Then the divide area of cleaning in the industry and give the responsibility of the employs or clean the equipment and machines. Once the 3S are in place, the next step is to concentrate on standardizing best practices. They also implement of Plan Do Check and Act cycle to manage this process. They also intend to build a stronger work ethic within the management and workers who would be expected to continue the good practices.

Kakkar et al (2015), explain that the implementation of 5S in a manufacturing company & 5S rating system was used to audit all changes in the company which enhanced the efficiency of the workers & ultimately the productivity of the company is enhanced to 91 %. Get right object for right work every time & in shortest span of time after Time analysis the Average time was reduced by around 11 seconds. Assign a proper place for keeping raw material, bin and waste. They implement standard methods so Safety guards were placed for every machine and reduce the chance of accident. By implementing 5S, they achieved time reduction for hunting down objects (like raw material, tool, sub-assembly etc.). They put tag names after every component in a company and for tool box; we showed results by time analysis. The company got some troubles while implementing 5S and there was issues because rejection rate was bit increased near 4 to 5 week of 5S but after few weeks of implementation, rejection rate was reduced.

Shinde et al (2014), was describe the primary objective of 5S is to create a clean, orderly environment- an environment where there is a place for everything and everything is in its place. All unneeded tools, parts and supplies are removed from the area. The company layout is fixed according to process but the company does not consist of a systematic arrangement for various material handling and storage. Cleaning and identification methods are consistently applied also 5S is a habit and is continually improved the company culture. By using "5S"technique improved visibility of problem conditions, improved safety, reduced waste, improved morale, an increased sense of ownership of the workspace, improved productivity, improved quality, improved maintenance, shorter lead times, and a better impression on customers.

Rojasra et al (2013), was demonstrated the available various Lean manufacturing techniques, 5S offers good potential for required improvement. 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) Discipline in the employee. (7) Increasing of awareness and moral of employee. (8) Improvement in the internal communication. (9) Improvement in the internal human relation. The results after the 5S implementations states that production system efficiency is improved from 67% to 88.8% in the successive week. This implies that up to 60% of the activity at a typical manufacturing company could potentially be eliminated. All Lean manufacturing tools are not possible to implement in small scale industry because of limited resources.

Singh et al (2015), explain that how the practical implementations of lean concepts take place. There is improper visualization of machining process at end facing machine. Due to sprinkling of oil over the glass it is not possible to examine the process which is they solve by them and Poor maintenance of wiring and alkaline tank. As the alkaline tank is not properly maintained there is chance of tank to get bust up for this they arrange weekly and monthly performance of maintenance activity can be easily analyzed by section engineer. Ergonomics problem, there was no ventilation facility due to which fumes and temperature affects the worker's performance, which indirectly affects the productivity of the firm. There improper handling of scrap at scrap yard. There are no proper regulations to place scrap as per different materials. Improve safety of bars and saved them from getting damage at inventory. By providing proper provision for placing air gun, we reduce the fatigue of worker which improves worker efficiency.

Khandelwal et al (2014), concluded that the time consumed and energy expenditure was drastically reduced after the implementation of There are two highly skilled workers were chosen for the analysis. Time and energy is wasted while looking for the next component to be machined because the components are kept in a highly disorganized manner on the shop floor therefore a tool rack or tool stand was created and placed next to the operator with name tags on each tool and also a large trolley with customized organizational facilities was placed near the operator to store recently machined parts and were later moved to the storage shelf so to find the required items quickly and efficiently, while saving time and energy. In assembly shop worker search of multiple packages until he finds the part he desires for solve this they can segregated packages based on their type of material, size, requirement etc. and stored in shelves so that they are easily accessible. After the implementation of 5S they can save 35% and 30% of time and energy respectively.

Patel et al (2014), was describing that they can reduce the process wastes, smooth the process flow, maintain proper quality, and improve storage, security through implement of 5S. There storage are disorganized and untidy for that they red tagging of unnecessary materials and moved it out from the department so extra space is generated in the store. After this organize the needed item as per the specific job requirement in each station so it was increasing efficiency of job performed, reducing the run time, and increasing the productivity. After the successful implementation of the 5S process, the discipline to sustain is of the most importance so prepare the observation sheet and observation was done on a monthly basis or the results are analyzed. The result of implementation of 5S is 12.91% sq. ft. space saving in the storage department, so that movement of men, material is reduced also the workplace became efficient and effectiveness.

Khedkar et al (2012), explain that the 5S is a tool for cleaning, sorting, organizing and providing the necessary groundwork for workplace improvement. There is utilization of stored space for finished product is not proper so they sort listing then eliminate the waste material (raw materials and materials), nonconforming products, and damaged tools. It helps to maintain the clean workplace and improves the efficiency of searching and receiving things, shortens the time of running the operation. They regular cleaning in industry to identify and eliminate sources of disorder and to maintain the clean workplaces. Worked out and implemented standards in the form of procedures and instructions permit to keep the order on the workplaces. Standards should be very communicative, clear and easy to understand. It is also important to understand the need of executing the routine inspections of usage the 5S rule also safety increasing and reduction of the industry Pollution.

Maidhili et al (2015), explains about the various aspects of kaizen, its meaning, history, PDCA cycle and 5S in detail. In this, there are problems are occurs while finding a book. In consumes lot of time. To eliminate this problem, they establish a Kaizen method to reduce the waste of time. Benefits for any organization like Library is give standards and disciplines to the employees, Space reduction is the main advantage and so on.

Gurway et al (2016), explains about kaizen implementation in small manufacturing industry & also focuses on the scenario of Indian manufacturing company while implementing Kaizen. They are represents the implementation of Kaizen in a pipe manufacturing company which is facing the problem of increased lead time & stock out situations in seasons. In short the paper evolves in manufacturing company which practice Kaizen & 5S methods in its production arena. They basically work on the small scale industry to increase the productivity and reduce the lead time.

Dandin et al (2015), explained that successful and proper implementation of kaizen applications has reduced ambiguity, over burdens on the operator and unevenness in the workplace. This study focuses on reducing the cycle time of a manual assembly line for the first two stations, manufacturing four variants of light commercial vehicle at XYZ firm. Dedicated compartment for each part has removed uneven arrangement of parts in kitting trolley. Results showed that with introduction of fastener tray and two kitting trolleys as counter measures, there was significant reduction in cycle time.

III. LITERATURE SUMMARY

Implementation of kaizen 5S is to improve the safety in industry. Kaizen is based on making little changes on a regular basis: always improving productivity, safety and effectiveness while reducing waste. Kaizen suggestions are not limited to a specific area such as production or marketing. Kaizen is based on making changes anywhere that improvements can be made. 5S becomes a fundamental key drive for kaizen. Improve communication between employee and workers. Productivity increases through better performance of the workers. There is systematic approach of teams to organize their workplace in the safest and most efficient manner. Total scrap recovery value is near above Rs: 75945, Time saving, Productivity improvement.

IV. PROBLEM STATEMENT

The case study was carried out all types of precision light & heavy duty job work & fabrication works related to engineering & other industries. Basically this company (Meetal Engineering) is located at Por GIDC Industrial area. This is a small scale industry. The manufacturer provides a wide variety of advanced Valves along with several customizing options. This involves a large number of different components. The management perceived the morale of the shop floor workers to be below usual standards. An overall discussion was carried out with the shop floor workers, asking them about the different problems they face. The problems faced by them were taken into account, as our primary focus is on improving the productivity of the manufacturing plant. After we choose the company, we find a number of problems, which reduce the overall productivity.

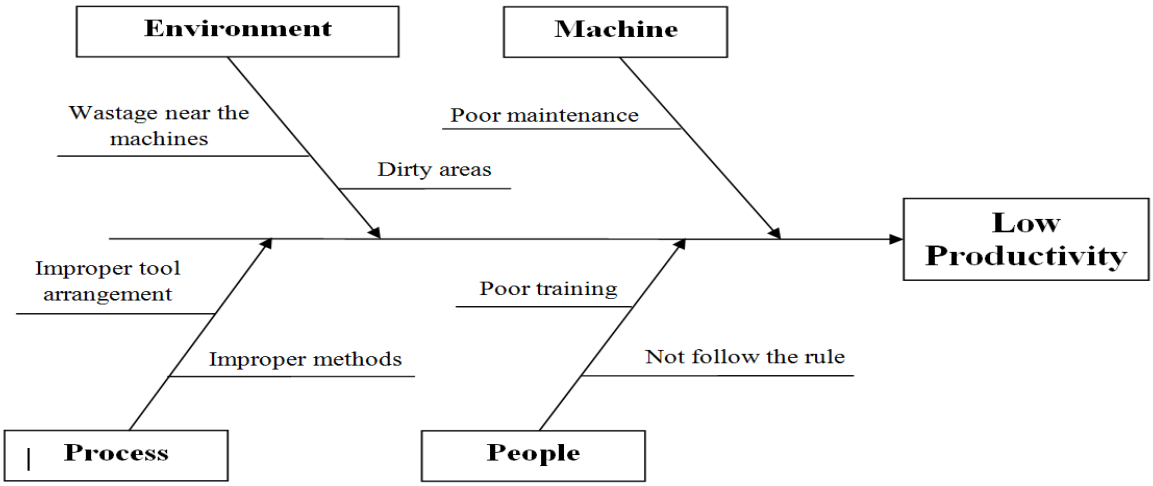

Figure 3: Fishbone Diagram

V. IMPLEMENTATION WORK

In this company, we focus on five major points, i.e. as below.

1. Sort.
2. Shine.
3. Set in Order.
4. Standardize
5. Sustain

1s-Seiri (Sort)

The purpose of red tagging was to identify unnecessary items that occupied space in the storage department. The strategy is to create more space by better organizing the items and equipment in permanent storage places or disposing of

the item if it is not needed. After all the red-tagged items and equipment are moved out of from the department, extra space is generated in the store. These areas are then utilized for smoother materials and traffic flow.

Figure 4: Red Tagging

Before

After

Figure 5: Eliminate Unnecessary Items

- Fig. 4 represents the red tagging Process.
- After Red Tagging, The floor area is increase which show in Fig 5.
- The chances of accident of workers are reduce.
- The overall scrap recovery value is Rs: 75945.
- The overall space saving is 1407 Sq. Mt.

2s-Seiton (Set In Order)

The basic focus of this part of 5S is to create efficient and effective storage systems such that anyone can find the tools, materials, and supplies they need, and anyone can return those tools, materials, and supplies to their proper storage locations.

Before

After

Figure 6: Set In Order of Tools

Figure 7: The "Shadows" Match the Shape and Size of the Tools

- It was making easy to see which tool goes where.
- Efficiency of worker is increase due to time of seeking necessary things.
- Store tools in place people would logically look to find them.

Before

After

Figure 8: Label Filing Of Files and Stored At A Proper Location

- Before implementation, it is difficult to find out the files at desire time.

- After implementation, it is very to find out the files at right time.
- This process allows for stored files to be easily identified and returned to their proper place.

3s- 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.

Before After

Figure 9: Maintenance the Clean Workplace

- Maintenance the cleanness of devices.
- Improvement of the work environment.
- Elimination of the accidents' reasons.
- Clean machines, floors, walls and ceilings also paint walls and ceilings

Before After

Figure 10: To Clean the Working Area So the Movement of Worker Is Safe and Easy

The purpose of individual work areas will be more apparent, leading to a highly efficient workflow.
Workers will be more satisfied with their environment.
They give full attention can be paid to them work.

4s- Seiketsu (Standardize)

5S standardization will help to ensure the first three steps are maintained. In this step Maintain orderliness, maintain everything in order and according to its standard.

- Easy to understand the machine operating.
- To reduce the accident.
- To reduce defect on job.

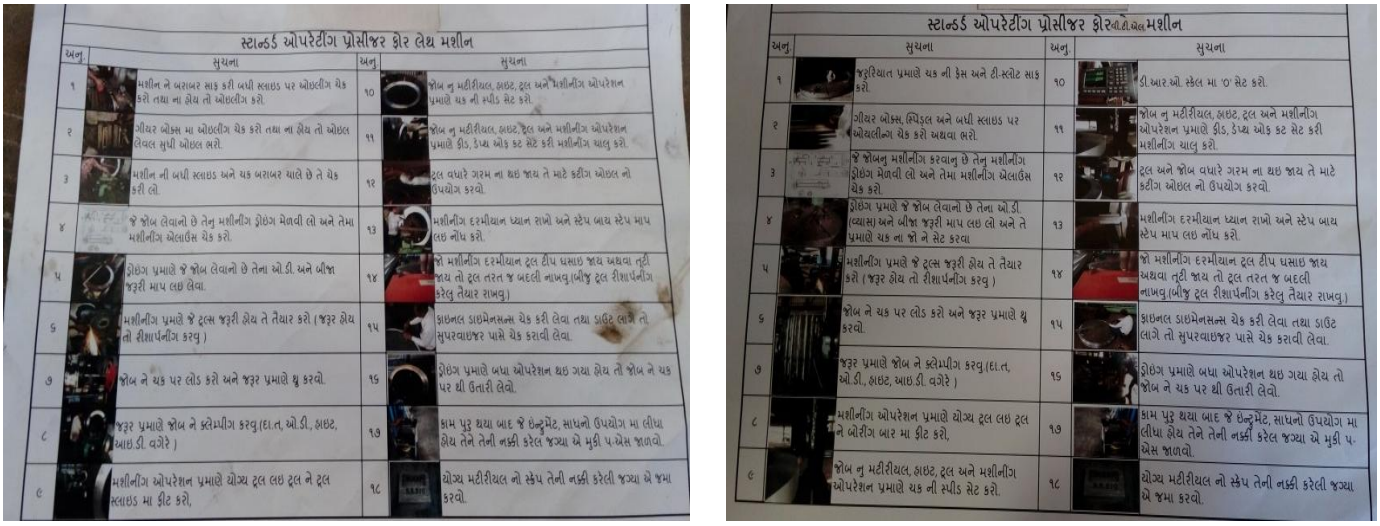

Figure 11: Standard Procedure For Operate the Machine

5S- Shitsuke (Sustain)

Every worker was given duty to maintain above steps and maintain a habit to perform above steps regularly at their own levels. A weekly audit was done in order to keep an eye on workers. The audit was done for 10 weeks and it was ensured that the workers should follow 5S strictly because it is generally seen that workers jump back again to old ways of working because they don't accept the change easily. After this it was found that workers and employer were boosted with great satisfaction and morale.

- **Profit Analysis**

Sr No.	Details of Products	Before Implementation 5S/per month	After Implementation 5S/per month
1	Machining Of Butterfly Valve(Body)	150	152
2	Machining Of Butterfly Valve **(**Plates**)**	100	101
3	Flange	60	62
4	Total	310	315

Figure 12: Profit Analysis

The product done by before implementation 5S is 310/per month and after implementation 5s product done 315/per month.

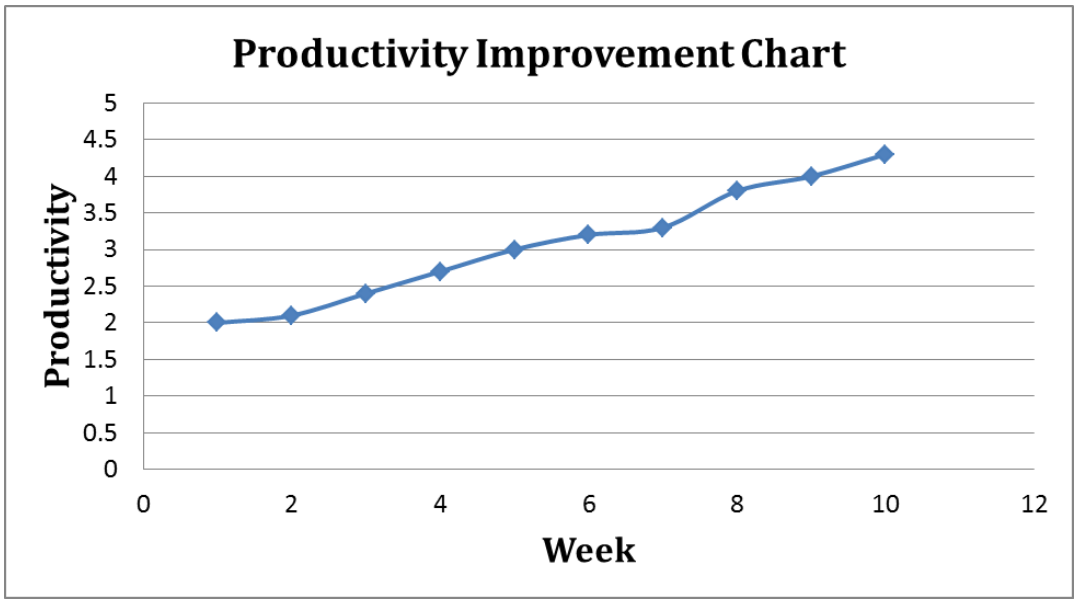

Figure 13: Productivity Improvement Chart

VI. CONCLUSION

5S and kaizen should not be considered as a house keeping exercise. For achieving potential benefits from it one should develop a habit of not blaming people. 5S and kaizen implementation cannot be achieved if we are forcing people to work harder and faster. Implementing kaizen events presumes a practical approach and low cost of improvement. Kaizen found problems as an opportunity to improve. Kaizen creates an atmosphere where employee suggestions are valued. In order to make successful 5S and kaizen system most important factors are participation, commitment and support from top level management. By implementing first 'S' first change seen will be unwanted items are eliminated and searching time is reduced. Thereby there is improved working environment and space utilized is maximized. Implementing 2nd 'S' results in easy storage and retrieval of the items. There is a place for everything which prevents misplacing. 3rd 'S' helps in having a clean, safer environment and making good impression on the visitors. Implementing 4th 'S' will ensure better workplace standards and visual control systems. Development of team spirit and discipline can achieved by implementing 5th 'S'. By implementing kaizen-5S in this industry the profit margin is increased about 5 products/per month.

REFERENCES

[1] Nikola Tonic, Slavko Arsovski, Marko Djapan and Ivan Macuzic, 'Manufacture Effectiveness Improving Using Lean And 5S Method', 8th International Quality Conference, pp. 417-426, (2014).
[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 the International multiconferance of Engineers And computer scientists, Hong Kong, Vol. 3, (2010).
[3] R.S.Agrahari, P.A. Dangle and K.V.Chandratre, 'Implementation Of 5S Methodology in the Small Scale Industry a Case Study' International Journal of Scientific & Technology Research, Vol. 4, Issue 4, pp.180-187, (2015).
[4] Vibhor Kakkar, Vijay Singh Dalal, Vineet Choraria, Ashish S. Pareta, and Anmol Bhatia , 'Implementation of 5S Quality Tool in Manufacturing Company', International Journal of Scientific & Technology Research, Vol. 4, Issue 2, pp. 208-213, (2015).
[5] Dinesh Shinde, Prashant and N. Shende, 'Improvement of Plant Layout by using 5S technique-An industrial case study', International Journal of Modern Engineering Research, Vol. 4, Issue 2, pp. 141-146, (2014).
[6] P. M. Rojasra and M. N. Qureshi, 'Performance Improvement through 5S in Small Scale Industry: A Case Study', International Journal of Modern Engineering Research, Vol. 3, Issue. 3, pp. 1654-1660, (2013).
[7] Mayank Dev Singh, Swati Singh, Abhishek Chokshi, Harshad Chavan and Dhrudipsinh Dabhi , 'Process Flow Improvement through 5S, Kaizen and Visualization', International Journal of Innovative Research in Science, Engineering and Technology, Vol. 3, Issue 3, pp. 1103-1112, (2015).
[8] Ayush Khandelwal, Prathik R., Rahul P. Kikani and Vigneshwaran Ramesh, '5S Implementation and Its Effect on Physical Workload', International Journal of Research in Engineering and Technology, Vol. 3, Issue 9, pp.437-440, (2014).

[9] Vipulkumar C. Pateland and Hemant Thakkar,'5S Implementation in Ceramics Manufacturing Company', Bonfring International Journal of Industrial Engineering and Management Science, Vol. 4, Issue 3, pp. 132-139, (2014).
[10] S. B. Khedkar, R. D. Thakre, Y. V. Mahantare and Ravi Gondne , 'Study of Implementing 5S Techniques in Plastic Moulding', International Journal of Modern Engineering Research, Vol. 3, Issue 5, pp. 3653-3656, (2012).
[11] S. Maidhili, G. Meenambika and K. Nithyanandam, 'Application and Usefulness of 5S and Kaizen for Library Space Management', Library Space and Content Management for Networked Society, Bangalore, pp. 1-8, (2014).
[12] Shubhangi and P. Gurway, 'Implementation of Kaizen as Productivity Improvement Tool in Small Manufacturing Company', Journal of Information, Knowledge and Research in Mechanical Engineering, Vol. 4, Issue 1, pp.760-771, (2016).
[13] Samuel V Dandin and R.G. Mench, 'Development and implementation of Kaizen activities in an Automobile manufacturing firm', International Journal of Innovative Research in Advanced Engineering, Vol. 2, Issue 6, pp. 60-65, (2015).