

Analysis and Implementation of '5S' Technique for Continuous Improvement of the Manufacturing Process



Dhara Goswami, Ravi Kant Gupta, Bharmal Choudhary

Abstract. *Lean manufacturing is the way of continuous improvement, provide support and execution of lean production system. This technique focused on improving quality of products, minimum cost, customer satisfaction and eliminating waste in industry. This research helps out to find out the various strategies of lean manufacturing. The main objective of this research paper is to study and analysis of improvements in waste reduction as well as improving productivity using 5S technique for an automobile ancillary unit for its production shop floor producing components from where the entire data is abstracted by applying 5S evolution methodology. Furthermore, the features and classification of 5S technique is discussed.*

Keywords: *Lean manufacturing, productivity, kaizen*

I. INTRODUCTION

Lean manufacturing help in creating quality products to accomplish the ultimate goal of smooth and high sustainable products to satisfy the consumers. Implementation of lean manufacturing is very important to compete in today's environment to manufacture the products based on customer's demand and it helps to meet and satisfy the end users also.

It is irrespective of what type of product is manufactured, this technique can be applied to each and every manufacturing plant. It is a workspace management method which was emerged in Japan as a consequence of the application of the kaizen culture [19]. It maintains the quality environment and cleanliness in the workplace providing a healthy environment to work more efficiently for the workers working over there in the particular workplace [1].

Lean manufacturers can provide with low cost and high quality products in a limited time rate of the production and can be increased exponentially when compared to other manufacturing units. Lean manufacturing not only improve the quality of the product, it also reduce the cost and time in all aspect of production with the help of 5S technique [2].

Reducing time effects the productivity of the industry leads to faster delivery that can satisfy the customer as well as improve the performance of the product. In India manufactured products are tested at each and every step in order to maintain the quality so this method helps to maintain the quality check efficiently while working. The main factor that is most important in manufacturing industries to satisfy and improving the production and waste reduction, it is the major concern and the implementation of this technology take a beneficial for safety of the workers as well as machines etc.

Furthermore, in this competitive environment, to achieve the target industries to take best judgment and choose best methods and not to lose very limited opportunities. This is due to lack of effectiveness and scattered system in the industries, to implementing the 5S systems into the workplace. With the help of 5S methodology, leadership can create an environment where quality work is comfortable, clean and safe in the industry and follow the specifications and compliance as per the specified standards and improve continuously. It reduces unwanted waste and improve productivity by maintaining system continuously in the workplace [3]. Continuous improvement effort and participation from top leadership is a main factor, determines the success rate of the 5S methodology. Main obstacle in 5S implementation is communicant between top, middle management and shop floor employees [15]. Before implementing 5S system in the industry, management or leadership should understand the meaning of 5S, such as why-why, how-how, when-when the 5S methodology to be implement. To implement this technology all the members of the manufacturing unit should be involved in implementing "5S" method in the manufacturing unit in order to maintain active performance and survive the competitive environment.

II. 5S METHOD

'5's' is a Japanese methodology to improve the workspace in a clean, efficient and soft manner. The implementation of '5's' minimizes the time and unnecessary movement as well. In the particular review we find that the main goal is to reduce the waste and increase the production rate to meet the customers demand. This method is very helpful economically and environmentally. It increases the worth value of the industry. The implementation of the particular technique can make the company a world class manufacturing company.

Revised Manuscript Received on August 30, 2019.

* Correspondence Author

Dhara Goswami*, Manipal University Jaipur, Jaipur, India.

Ravi Kant Gupta, Manipal University Jaipur, Jaipur, India.

Bharmal Choudhary, Manipal University Jaipur, Jaipur, India.

© The Authors. Published by Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP). This is an [open access](http://creativecommons.org/licenses/by-nc-nd/4.0/) article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

The growth of the industry can be improved exponentially from a small unrecognised to world Class Company. There are the steps which can reduce the timings and improve the quality and manufacturing cost along with the target of reduction in the cost. From small scale industries to large scale industries this method can be implemented successfully [4] [12][18][20].

The main motto is to keep the things in the correct place and position to avoid the waste and unwanted actions but before the implementation of this process in any manufacturing unit it is very important for the top leaders of the industry to understand the method very briefly. It eliminates the waste like: over production, defects, over processing, transportation movement etc [5] [14]

2.1 '5S' What is it?

A Japanese method introduced by Takashi Osada in 1980s, method of workplace management which includes the improvement of working environment, human capabilities and productivity. The word 5S means 5 disciplines for maintaining ideal workplace, reduce the unnecessary movements and waste material [6].

These are the 5S in achieving the better quality requirements and high performance in increasing the standards of the manufacturing unit.

SEIRI = (SET-IN-ORDER)

Many times it also means sorting, removing the unwanted things that you don't need, while working, first of all go through all the tools, machines, equipment, materials etc. Then identify the items that are required and the items which are not required. Then separate out the wanted and unwanted ones. Now only keeping the wanted ones, remove the unwanted items from the workplace or store them in a particular place if they might be of use in future [13]. This makes the clean and clear idea to the workers at the time of machining / operations of what to use and making the workplace more spacious by removing the unwanted ones. Thus making the workplace neat and clean and creating the healthy environment leads to the more efficiently working of workers in the workplace [7] [9].

SEITON = (SET-IN-ORDER)

In 2nd step after sorting it comes to set in order the wanted items are set in order and set the place of all the wanted things that will be needed while performing operations. Proper place must be decided which is in reach and near the working area, so that unwanted movements can be minimized. The workers involved also play an important role, which results in saving time and increasing the efficiency and that helps in lowering the risk of important items getting lost/ found missing / searching during the operation performing time [8].

SEISO = (SHINE)

The 3rd step is to make the workplace shine by regularly cleaning the workplace, by regularly calibrating the machines/devices, by regular maintenance of machines appearance, by keeping the equipment's in good working conditions. Cleaning must be performed after the completion of every cycle in order to remove the unwanted scrap and leftovers of the materials. By doing so the hygiene is maintained in the workplace which leads to the healthy- happy and friendly surrounding for the workers to work for long run without falling sick. This increases the motivation of the workers to work in the manufacturing unit [10].

SEIKETSU = (STANDARDIZATION)

The most important S among 5S it is the standard way in which the operations are to be carried out [11]. Discipline is the main goal of standardization. It governs the above three S in proper decorum and increases the safety concerns of the worker, and with the help of this worker can work without any types of confusion if proper set of instructions are provided. Thus decreasing the over machining the products.

SHUTSUKE = (SUSTAIN)

Generally known as self-discipline that every manager/worker has to maintain with some principles along with procedures and with the help of this rules the entire 5S System is maintained.

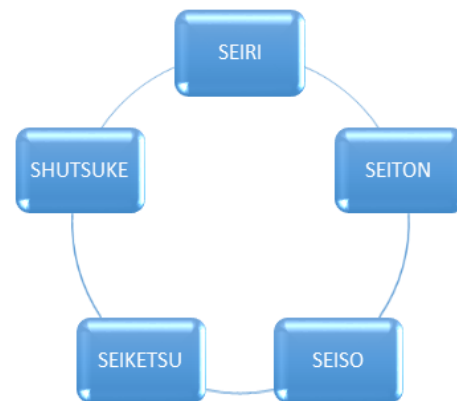


Figure 1. Implementation steps of '5S' method

III. PROBLEM STATEMENT

Discussing the problems that can be resolved by using the 5S techniques:

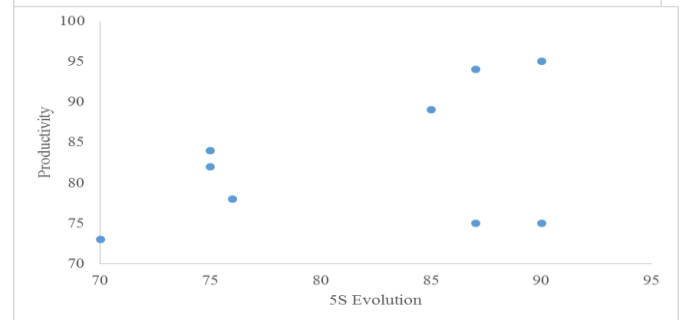
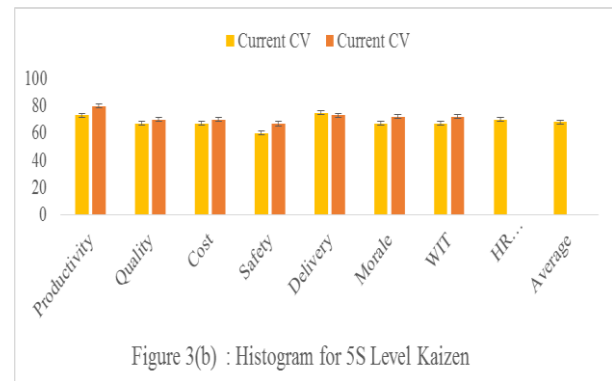
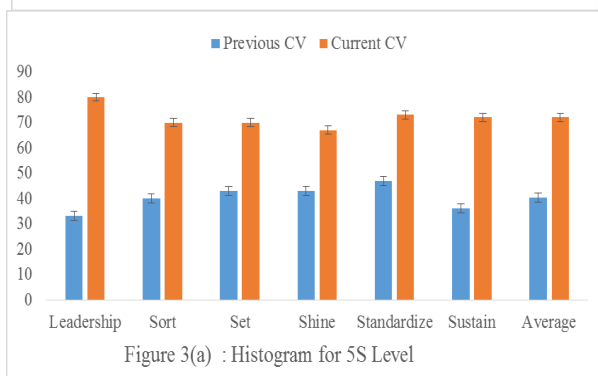
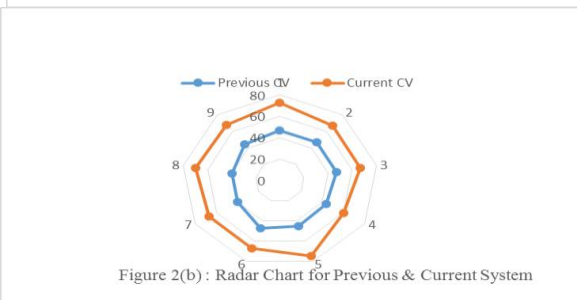
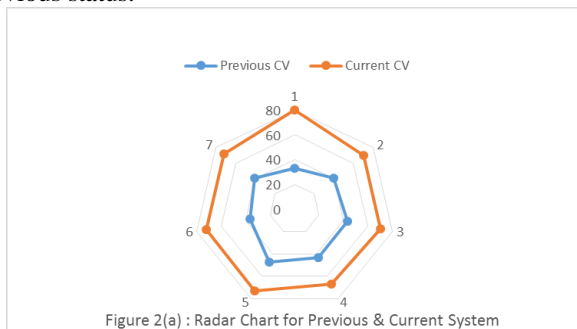
- Proper utilization of space of space by sorting out the items and storing the useful items near the reach while working to reduce the unnecessary movements
- Storage of both wanted and unwanted items is done so that unwanted items can be sell or use it somewhere else, hence reducing the waste
- Time can be saved by keeping the things at proper places so that items don't go missing during the time of operations or important items don't get lost
- Cleaning of the workplace after every cycle which maintains the hygiene in the workplace
- Time can be saved by regularly maintaining the machines or operation machine so that any mechanical problems doesn't arrive.
- Safety of the workers can be ensured, by maintaining the healthy and good hygiene of workplace can reduce the risk of workers falling sick.
- Discipline and regulations are maintained.
- A proper system is maintained for the operations to be carried out.

IV. CURRENT STATUS

The awareness regarding the 5S terminology is not that high in the manufacturing units due to lack of training and communication gap between board top members and shop floor workers.

The present status of the company named EECL limited involved in manufacturing the automobile components and has production units in India. Its turnover in 2017 is 50 million dollar and supply parts to major car manufacturing company in India. The present production system in the company is not smooth line and company and management wants to improve the current system to improve its productivity. So implementation 5S evolution techniques find suitable to improve the existing system of the organization. To improve this in first phase employee is first trained and spread awareness among all employees throughout the organization. As EECL defines the continuous improvement formula, monthly a 5S evolution audit report is prepared throughout the company and employees are given incentives for maintaining established procedures. Being guided by the 5S principles, the company improved its results each year since 2017. This case study covers the data collected for the year 2016.

A 5S evolution checklist audit is prepared based on the 16 questions, is done in all production departments of the company and rated on 5 point scale in which a point is given by special committee and all these points are sum up and radar chart [2a & b] were made. Based on the rating calculation were made and histograms depicts fig. 3 shows the current & previous status.



V. IMPLEMENTATION OF '5S'

The implementation of 5S requires the thorough understanding of the system among all the members from top board members to shop floor workers. It requires lots of planning although it might seem simple.

For the very 1st step the top members should understand about the system and among the members the one person having a brief knowledge about 5S should lead and make the other members understand the same. Then this top leaders should be divided into various shop floors production system and should be made in charge of the particular shop floor. They should be regarded with the responsibility of implementing the 5S method in the particular shop, for that one should discuss the process with shop floor workers and help the workers in implementing the method in daily practice. As per the checklist assigned weightage were calculated and these weightages and Statistical analysis was performed with the help of SPSS that is free software readily available with the goal to identify effectiveness of 5S implementation on the organization performance.

The experimental design is made from two different steps that were put in practice with the help of statistical SPSS. Results should be noted before and after applying 5S method and by using this technique significant improvement in productivity is recorded. Due confidentiality of data we are unable to present the data in this paper.

VI. RESULT AND DISCUSSION

Data were collected for past one year and correlation analysis were tested and found that Pearson correlation (0.62). The results and findings of the research study are that 5S Level has a positive moderate Pearson correlation (0.62) with Productivity, with a significance of 0.032. The table 1 represents the result analysis as well as scatterplot graphic for the two analyzed parameters and can observe the positive correlation between the variables. Result showed that relationship between 5S level and productivity improved. Among the successful projects we should mention - Scrap Reduction, eliminating internal sorting, Improving productivity and Strengthening quality.

Table 1 : Result of the study		
Productivity	5 S Level	
	Pearson Correlation	0.62
	Significance	0.032
	N	10

VII. CONCLUSION

After going through the analysis and through study and implementation of 5S a noticeable change can be seen in the efficiency of the outputs and reduction in time, increment in production rate. The growth of industries can noticeably seen from small developing industry to top world class industry. Hence 5S technique is overall useful for growth rate of any manufacturing industrial unit. This means that implementing and maintaining 5S method and standards in the organisation leads to improvement in efficiency of the organisation. The need of 5S in any manufacturing organisation is highly important. The requirement of 5S method implemented represent one of the first step taken in the Lean Management strategy and increase the productivity of the organization. Moreover, due to 5S, the whole industry is clean, safe and better environment and the product quality is increased. The errors are easily identified and removed, waste and costs are reduced. The product or service fulfils the customer needs in most efficient and significant manner. Due to lack of such wonderful system, lack of efficiency, workplace lead to waste of time and resources, low quality products, mismanagement, safety issues, delays in delivery and so on. 5S technique is a starting point for any industry who wants to achieve their goals and reputation and position in the market.

REFERENCES

1. Jiménez M, Romero L, Dominguez M and Espinosa M 2015 Safety Science 78 163-172
2. Alefari M, Salonitis K and Xu Y 2017 Procedia CIRP 63 756-761
3. Veres C, Marian LP, Moica S and Al-Akel K 2018 Procedia Manufacturing 22 900-905
4. Houa S, Haslinda M, Muliati S, Miri A and Rahim A 2018 MATEC Web of Conferences 150,05034

5. Patel V and Thakkar H 2014 Bonfring Int. J. Ind. Eng. Manag. Sci. vol. 4 no. 3 132-139
6. Ashraf S R, Rashid M M, and Rashid A R M H 2017 Int. J. Sci. Technol. Res. vol. 4 no. 3 1791-1796
7. Gupta S and Jain S K 2015 Int. J. Lean Six Sigma vol. 6 no. 1 73-88
8. Wilson L 2009 How to Implement Lean Manufacturing (McGraw-Hill Professional)
9. Patel V C, Thakkar H 2014 International Journal of Engineering Research and Applications Vol. 4 Issue 3 774-779
10. Khedkar S B, Thakre R D, Mahantare Y V and Gondne R 2012 International Journal of Modern Engineering Research Vol.2 (5) 3653-3656.
11. Ghodrati A and Zulkifli N 2013 International Journal of Business and Management Invention vol.2 (3) 43-49.
12. UGC Care List of Journals, www.carejournals.in
13. Salonitis K, Tsiniopoulos C. 2016 Procedia CIRP 57 189-194
14. McMahon T. 2014 http://www.aleanjourney.com/2014_09_01_archive.html
15. Kaushik K and Sanjeev K 2012 International Journal of Management, IT and Engineering Volume 2(6) 402-416
16. Khamis, N., Abraham, M.N, Jamaludin, K.R., Ismail, A.R., Ghani, J.A and Zulkifli, R 2009 Proceedings of the World Congress on Engineering, vol. 1, 978-988.
17. Mann D. 2010 Creating a lean culture: Tools to sustain lean conversions (New York: Productivity Press)
18. Dombrowski U and Mielke T 2014 Procedia CIRP 17 565-570
19. Dhingra, A.K., Kumar, S., Singh, B. Cost reduction and quality improvement through Lean-Kaizen concept using value stream map in Indian manufacturing firms (2019) International Journal of Systems Assurance Engineering and Management, DOI: 10.1007/s13198-019-00810-z
20. Kumar, S., Dhingra, A.K., Singh, B. Process improvement through Lean-Kaizen using value stream map: a case study in India (2018) International Journal of Advanced Manufacturing Technology, 96 (5-8), pp. 2687-2698.
21. Kumar, S., Dhingra, A., Singh, B. Lean-Kaizen implementation: A roadmap for identifying continuous improvement opportunities in Indian small and medium sized enterprise (2018) Journal of Engineering, Design and Technology, 16 (1), pp. 143-160.