

Lean manufacturing through standardized work: a case study of a press manufacturing industry

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Abstract

Standardized work plays a very important role in a lean manufacturing environment. It makes the process precise and well organized which results in the safest, easiest, economical and most effective way of doing work. This research work is based on the standardization of the work process of the casing manufactured in a press industry to reduce the cycle time by eliminating waste from the process. The study has reduced 50 min in the total cycle time of the casing through the implementation of standardized work.

Keywords Standardized work, Lean manufacturing, Cycle time reduction, Template marking.

1 Introduction

The standardization of work is necessary in order to achieve a smooth work flow, high quality, rejection-free production, cycle time equal to takt time and optimum efficiency. The systematic determination and documentation of the work element sequence lead to standardized work. The motive is to eliminate unnecessary waste from the processes by communicating the worker about the correct way of doing a particular work. It eliminates the variability from the processes resulted from several causes such as unnecessary movements, search for tools, operator skill variation and adjustments and thus makes the work predictable.

The simple procedure to apply standardized work has six main steps:

- a) Data collection related to the current processes. This forms the base of the whole process where maximum information is gathered regarding the methods and procedures adopted in the current processes.
- b) Identification of variations. In this step, the collected data is examined carefully to identify the variations in the current processes. For example, identification of variation in the time taken to perform the same task by different workers, time taken by some workers to perform the task is more than the takt time, identification of the tasks that can be performed parallel and identification of the sections regarding quality and safety issues.
- c) Developing efficient solutions. In this step, the motive is to find a way to perform the process which can use all the resources more efficiently and produce quality products with safety. The focus is on optimizing the work sequence and procedures through the use of different lean tools depending upon the situation.

- d) Documentation. The next step is to document the standardized work procedures developed in the previous step so that workers should follow these properly and repeatedly.
- e) Training of the concerned personnel. The newly developed methods or procedures must be familiar to the concerned personnel. For this purpose, thorough training of all the concerned personnel is required after the documentation and before the implementation stage.
- f) Continuous improvement. After the implementation of the standardized work, it is necessary to constantly work for further improvement of the developed standards. The work should be reviewed daily to find out the abnormalities and issues which can be eliminated in time to achieve more precise work procedures.

2 Literature review

Marri and Shaikh improved the productivity of the textile industry through the use of work study techniques. The aim was to eliminate the wastes from the current processes. The study used the method study technique to understand in detail the current operations of the industry to identify bottlenecks and waste. The time study was also used in the research work to set the time standards for certain operations. The method study mainly contains the following steps: 1) Select the area, 2) Record the necessary information, 3) Examine the recorded facts carefully, 4) Develop the improved methods, 5) Define the developed solutions, 6) Install the proposed methods, 7) Maintain the result obtained. The data collection tools used in this method was operation charts, flow charts, string diagrams, man-machine charts. The critical examination tool was used along with the 5W2H tool for the identification of facts and developing new solutions. The study improved the material handling equipment, developed the proper instruction charts for workers, manuals for machine inspections, installed racks for the different tools, improved the utilization of space through new layout, and developed incentive rewards for labor [1]. Barbole et al reduced the cost of manufacturing through cost control techniques. The study was conducted at Piaggio vehicles to reduce the material cost of the production process. The cost reduction techniques used in the study were value engineering, kaizen costing and inventory management. The study concluded that the cost reduction techniques like quality control, budgetary control and value engineering play a vital role in the low-cost manufacturing for the industries where the material cost is 70% of the total cost [2]. Khan developed a quality control model in the apparel industry for productivity improvement by minimizing the rework in the production process. The study was focused on the identification, quantification and elimination of the variations and their sources in order to ensure the production right for the first time. The model developed also achieved a reduction in cost and throughput time. The methodology used in the study includes the following steps: current quality system mapping, identification of defects at different stages, ranking the defects through Pareto analysis, categorization of the defects through cause and effect, and developing quality inspection model. The study achieved 40%, 50% and 55% reduction in the rework for sewing section, stitching section and thread section respectively [3]. Kumar and Mahto optimized the assembly line of the packaging industry through the process analysis technique. In the process analysis technique, the focus is on finding the wastages and non-

value addition activities in the existing processes of the production for the sake of improving the current productivity. The ABC classification was employed in the study for selecting the items which are important for customers in the analysis process. The study identified bottlenecks in the production line in terms of workstations. These bottleneck workstations were rearranged in order to eliminate the waiting time [4]. Kayar and Akalin improved the efficiency of the assembly line and production through the use of method study. The study was conducted in the textile company. The method study helped in increasing the production of blouses by 30 numbers per day. The study reported an increase in the efficiency of the assembly line by 7.83%. Through method study, new and improved methods were developed for the production of blouses which lowered the manpower and number of machines required than the previous methods. The study also improved the utilization of work floor area. The research showed that method study is a very important tool for increasing the productivity without increase in the production cost [5]. Kumar and Kumar used the concept of standardization in order to implement the lean manufacturing in the automotive parts manufacturing industry. The study was focused on the importance of standardized work for eliminating and reducing waste in the manufacturing processes and thus in improving the productivity. The methodology adopted in the study has the following steps: study of current processes and flow of material, documenting the work in proper order through various data collection tools, critical examination of the recorded facts, use of work standardization techniques to develop new standards, implementing the proposed standards, and monitoring the results obtained. The study reported the decrease in the manpower from 4 to 3, reduction in work-in process inventory by 26% and setups reduced by 66.68 % [6].

3 Methodology used

The standardized work is used to reduce the marking time of the casing. The methodology used is shown in figure 1. Firstly, the complete process of casing manufacturing is mapped through an outline process chart. This step is followed by the measurement of the time taken in each activity by different workers for the same process. For this purpose, the time study of different casings is done. In the next stage, the detailed analysis of the collected data is done to find out the variations in the process.

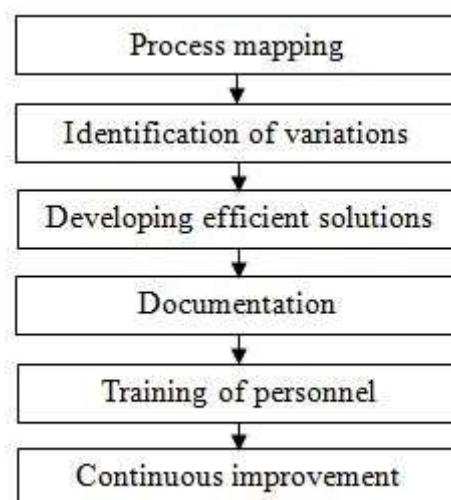


Fig. 1 Methodology used

It is found through analysis that different workers take different time in the marking activity. And the variation of time taken between different workers is significant. The marking activity is studied further in detail and it is observed that this activity is completely manual and depends upon the skill of the worker. In this activity, the worker has to develop a marking on the surface of the casing as shown in figure 2.



Fig. 2 Marking on the casing surface

The geometrical instruments and chalk are used to develop a pattern on the surface of the casing which later on helps the welder to gas cut the marked portion on the surface of the casing as shown in figure 3.

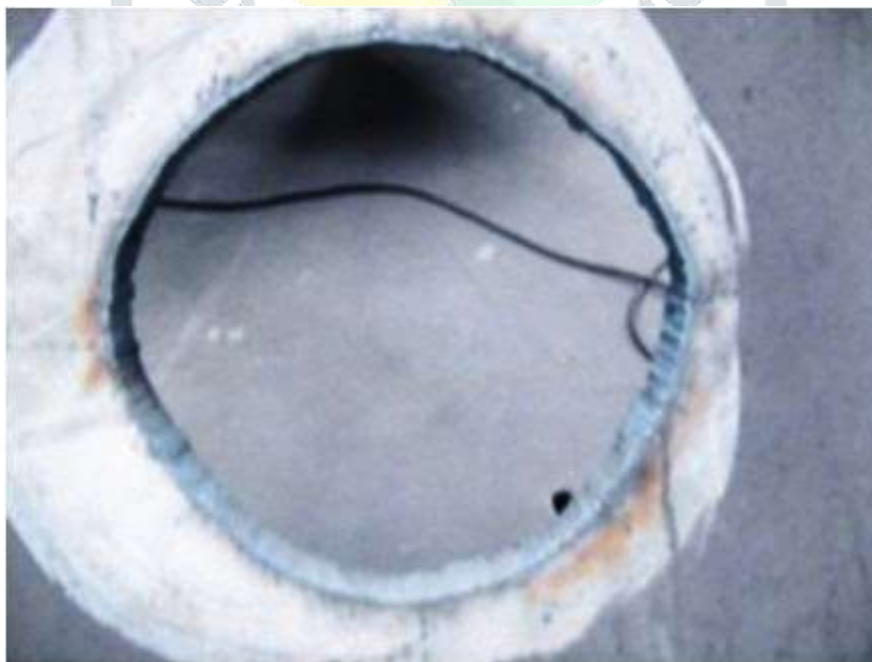


Fig. 3 Gas cut on the casing surface

A qualified worker on an average takes 60 min to mark the pattern on the surface of the casing. In the next stage, it is decided to standardize this marking activity to eliminate the variations in the process. With the help of a qualified marker, a standard template has been prepared as shown in figure 4.



Fig. 4 Marking template

This standard template has changed the marking process. The worker has to just place the template on the marked center of the casing and make an outline of the template on the surface of the casing to develop the required marking. The process is documented in the form of standard instructions and training has been provided to the concerned personnel regarding the use of the template. This newly developed standardized work process has resulted in the saving of 50 min in the total cycle time of the casing manufacturing process.

4. Results and discussion

The template has reduced the marking time significantly. Earlier the complete development of the marking was done on the surface of the casing by using geometrical instruments and chalk. The time taken by the qualified worker for that activity was 60 min on average. Now the use of template has reduced that marking time to 10 min only. In the new process, the worker has to just align the template with respect to the center of the surface marked in the previous step of the manufacturing process and take the tracing of the outer boundary of the template to develop marking on the casing surface.

The savings achieved through the new process are given in Table 1:

Table 1 Savings after the use of template

Sr.	Operation	Old process	New process	Time saved
		Time (min)	Time (min)	(min)
1	Setting of the job	30	30	0
2	Location of reference	10	10	0
3	Manual marking	60	0	60
4	Marking with template	0	10	(-10)
Total savings				50

5. Conclusion

The standardized work has a significant effect in achieving precise and organized work which helps in improving the cycle times of the processes. The study concluded that the manual marking work on the jobs can be converted into a precise and standardized work with the use of standard templates. The standard template used in the new method developed in the manufacturing process of the casing has reduced the cycle time by 50 min.

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