LEAN IMPLEMENTATION IN ELECTRICAL PANEL BOARD MANUFACTURING INDUSTRY

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ABSTRACT
The main objective of this paper concentrates on the implementation of lean philosophy in assembly section of the Electrical panel board industry and layout optimization. The main purpose is to eliminate the non value added activities present in the assembly section and also to reduce the material handling time. Identification and methods to eliminate the Ideal time present in the assembly process. This paper describes an application of value stream mapping (VSM). The present and future state of value stream map are constructed to improve the production process by minimizing the non value added activities which are identified from the VSM.

KEYWORDS – *Lean Manufacturing, Value stream mapping (VSM), 5s, visual systems.*

I. INTRODUCTION

Time to delivery is one of the major competitive concerns in today's business environment. Among that one promising method for addressing this problem is the application of lean manufacturing principles and techniques. Lean principles came from Japanese manufacturing industry. Lean Manufacturing is a systematic approach to reduce seven waste present in the production process. The principles of 'lean' focus on reducing non-value added activities and it also try to reduce human effort in a process while maximizing the production efficiency.
Lean Manufacturing focused on pinpointing the major sources of waste and then using various Lean tools to eliminate those waste. Elimination of non valve added activity is addressing the process of reduction in various manufacturing steps. Elimination of manufacturing wastage and implementation of proper lean tool is the major goal of this paper.Value stream mapping (VSM) is two types namely current state VSM (CSVSM) and future state VSM (FSVSM).First CSVSM is used to plot the existing state of assembly process. This map is then used to identify sources of waste present in the plotted process. And it try to identify lean tools for reducing those waste. A future state map is then developed for the system with lean tools applied to it for eliminate those wastages. The ultimate goal of VSM is to identify all types of waste present in the value stream and to take necessary steps to eliminate the waste. A variety of techniques exists to support these activities which include value stream mapping (VSM), 5S, and visual systems. Madras Radiator Pvt limited is one of electrical panel board manufacturing industry in India. Electrical panel board having more number of small assembly parts. Absence of lean in this firm was creating more number of non value added activities. The industry was unable to process the entire customer order due to the presence of high takt time.

II. PROBLEM DEFINITION

The electrical panel board supplier industry is currently producing 134 products per month, but it has the average customer order of 150 products per month. The industry was unable to process the entire customer order due to the presence of high takt time. Which was the problem present in the industry.

III. PROCESS DETAIL

The process of making Electrical panel board is shown below in the Fig1. The design of the product is given by customer himself. This design document is get examined by the planning department and gives suggestions, or modifications to the design if needed. Then the quotation is sent to the customer if he/she finalize it and give the design document back to design department. Then design department communicate the manufacturing order to the manufacturing department and assembly section department. Initially raw material which is nothing but sheet metal of thickness of 8mm is sent to punching, after which the bending operation is performed by CNC machines. Then the machined parts are sent to fabrication process where fabrication process is achieved by welding, riveting. After completing the fabrication process the part is get moved to the pre-treatment section. In the pre-treatment section the parts are get cleaned

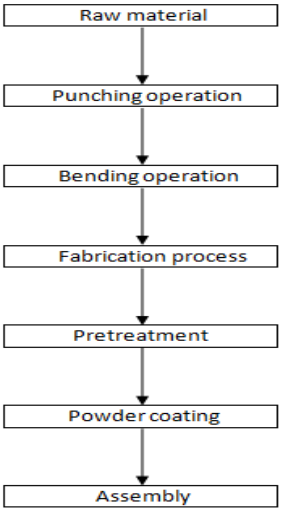


Fig 1. Process Flow Diagram

The Assembly section has 4 different operational stages. Namely stage1, stage2, stage3 and stage4 after these four stages in the assembly section the inspection is performed on the final output after successful inspection the parts are then moved into the dispatch department. Where packing is performed and the output is get dispatched to the customer.

IV. DATA COLLECTION

A. Assembly process time.
Time taken for Material handling process in all four stages like stage 1, stage 2, stage 3 and stage4 of the assembly process is also done using stop watch method.
B. String diagram
Using the string (or) flow diagram trace and measured the path of workers, material or equipment during a specified sequence of events
C. Takt time.
The customer demand and the amount of available time in the shop floor for processing is obtained which is then used for calculation of takt time.

V. METHODOLOGY

To reduce the time taken in the assembly process and the total material handling time which is the primary goal of this project .Which is done by utilizing the various Lean tools and the other lean techniques to remove the NVA activity present in the selected process. The methodology followed in this project is shown below in Fig. 2

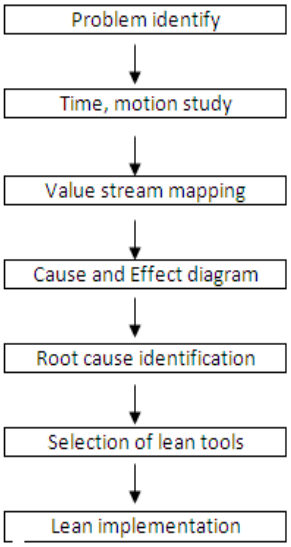


Fig. 2 Methodology flow chart

VI. CURRENT STATE VSM (CSVSM)

Current state VSM (CSVSM) is the basic Lean tools which are utilized to plot the existing values and used to identify the various Non Value added (NVA) activity present in the system.

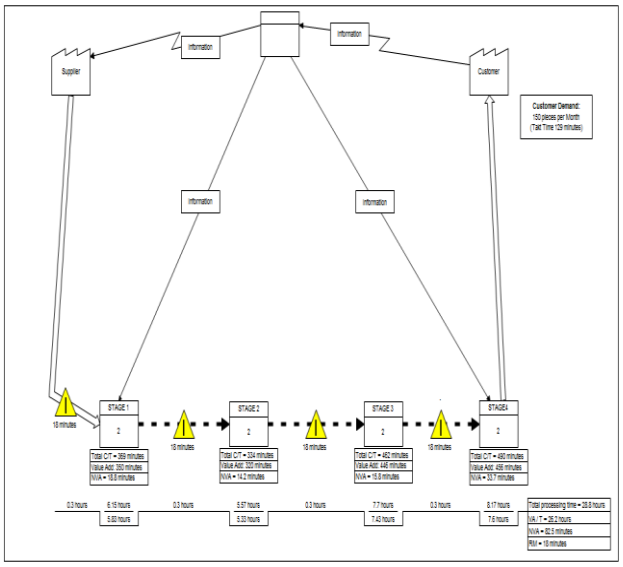


Fig.3 current state value stream map

The current state VSM (CSVSM) is created using a predefined set of standardized icons it, is a mapping tool that is used to map the entire production process. There is also step by step procedure to perform a VSM analysis in any layout.

The first step consist of the selection of a product family as the target for the improvement and this initial step is flowed by in the construction of the current state map (CSM) for the selected product value stream. The CSVSM must be based on a set of time data collected directly on the assembly section and it should be drawn using the set of standard icons. The next step consists of the identification and analysis of the wastes encountered along the value stream .Takt time calculation is the first step in value stream mapping. Takt time is defined as the total operating time per month by customer demand per month. The current state Value stream mapping is below shown in Fig.3 and result are shown in Table1.

Table I CURRENT VSM SUMMARY

Total processing time	28.8 hours
Value Added Time	26.2 hours
Non value added time	82.5 mins
RM	18 mins

VII. CAUSE AND EFFECT DIAGRAM

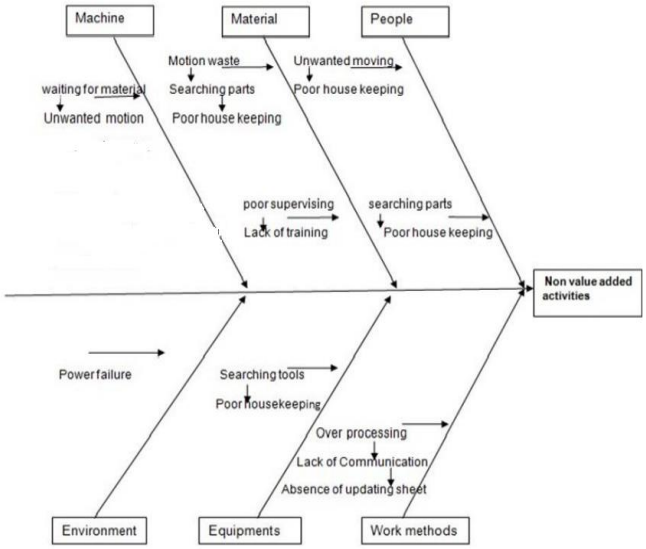


Fig 4 Cause and effect diagram

VIII. IDENTIFY THE NON VALUE ADDED ACTIVITIES

From the cause and effect diagram non value added activities are identified.

Root cause of the problems:

A. Absence of 5s in assembly section.

In the assembly section labours search for tools and other work elements, due to the absence of 5S.This result in motion loss which creates non value added activities(NVA's).

B. Lack of communication

Customer requirement is get varied from day to day which makes manufacturing decision process. It creates lack of communication between the customer and the shop floor personnel, which cause huge rework on the already manufactured products according to customer specification. Example of lack of communication error is shown below in Fig .4

Fig. 5 (Example) communication error in assembly section

IX. CALCULATION FOR NVA TIME

- No of teams in assembly section = 3 teams
- No of labors in each team = 8 labors
- Total non value added activity time for one team (current state VSM using time study) = 82.5mins
- Therefore NVA time for total teams = 3 times of NVA

X. LEAN TOOLS SELECTION

Lean tools selection based on types of non value added activities (NVA) and lean manufacturing related journals. Lean tools and encounter the problems are list out below in table 2

Table ii lean tools and encounter the problem

S.no	Type of NVA	Lean tools	Encounter the problem
1	Motion waste	5s	Reduce the tools, parts identification time
2	Communication error	Kaizen daily updating sheet	Reduce the over processing
3	Other wastes	Kaizen newspaper	Identify the wastes and reduce.

XI. LEAN IMPLEMENTATION WORK

A. 5S implementation.

In the first stage of 5S implementation made to organize the work area, leaving only the tools and materials necessary to perform daily activities. The second stage of 5S involves the orderly arrangement of needed items. Orderliness eliminates waste in production and clerical activities. The third stage of 5S is keeping everything clean. The fourth stage of 5S involves creating a consistent approach for carrying out tasks and procedures. The last stage of 5S is the discipline and commitment of all other stages. Fig.6 shows Absence of 5s in assembly section and Fig.7 shows 5s implementation.

Before

Fig. 6 Absence of 5s in assembly section

After

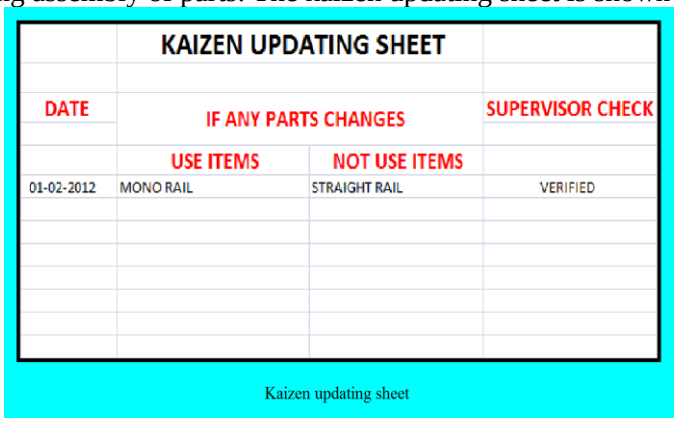
Fig .7 5s implementation

Benefits.

1) Decrease down time.
2) Increase product
3) Identify problems more quickly.
4) Establish convenient work practices.

B. Kaizen activities.

1) Kaizen updating sheet: In electrical panel board assembly, the part number will vary occasionally according to customer requirement. Kaizen updating sheet will keep track of everyday customer requirements and will notify immediately if there is any changes in the part number. This will eliminate the wrong assembly of parts. The kaizen updating sheet is shown in Fig.8



KAIZEN UPDATING SHEET

DATE	IF ANY PARTS CHANGES		SUPERVISOR CHECK
	USE ITEMS	NOT USE ITEMS	
01-02-2012	MONO RAIL	STRAIGHT RAIL	VERIFIED

Kaizen updating sheet

Fig .8 kaizen updating sheet

2) Kaizen newspaper: Kaizen newspaper will show the day to day kaizen events occurring in shop floor which includes problem identified, process idle time and the counter measure took for that problem. The kaizen news paper is shown in Fig.9

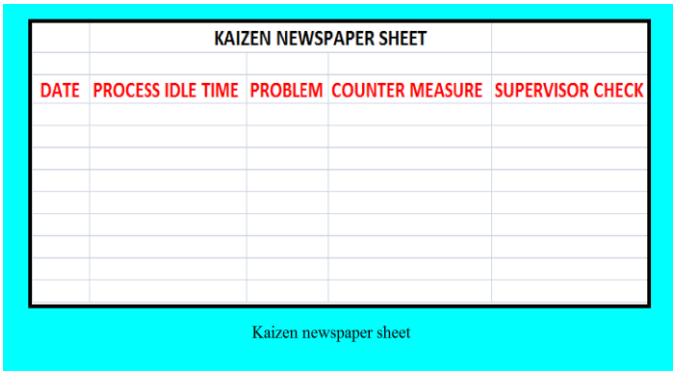


Fig.9 Kaizen news paper

3. Kaizen suggestions.
Visual management system: Using the method maintain effective 5s and safety effectively

XII. VALUE STREAM MAPPING - FUTURE STATE

After lean implementation in assembly section time study had taken in all stages. Based on the time study future state map created. Future state mapping is below shown in Fig.10 and Table 3 shows result of future state values.

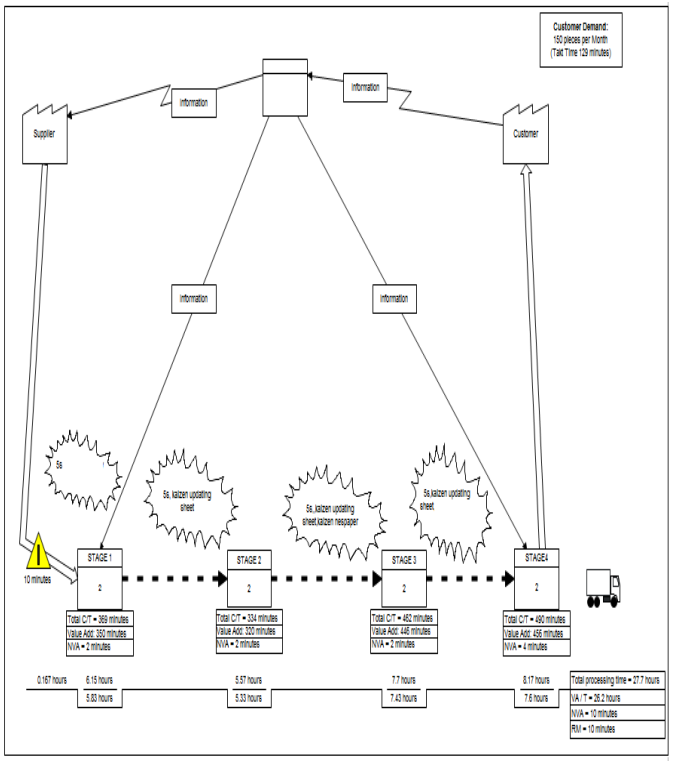


Fig.10 Future mapping

Table iii Future Vsm Summary

Total processing time	27.7 hours
Value Added Time	26.2 hours
Non value added time	10 mins
RM	10 mins

XIII. FUTURE WORK

1) Lean team appointment and training

2) Implementation of a pull system using Kanban or Supermarkets.
3) Necessary layout and organisational structure changes using VIP-PLA OPT software. VIP-PLANOPT is a powerful general-purpose Facility Layout Optimization software for engineers, industrial planners, facility designers and architects.

XIV. RESULTS AND DISCUSSION

The process time for electrical panel board assembly section has been reduced by implementing lean techniques. The assembly process time before implementing lean principles is 28.8 hrs. This time has been reduced to 27.7 hrs. Comparison of assembly process time below shown in Fig.11

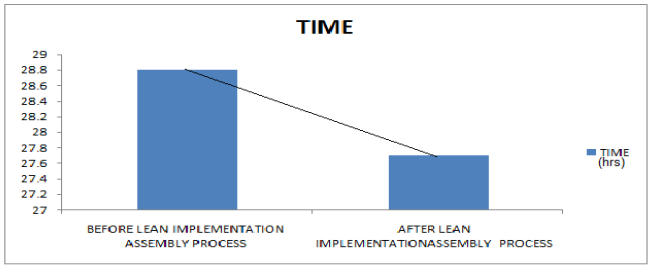


Fig.11 Assembly process time

XV. CONCLUSION

The implementation of lean concepts in electrical panel board assembly section has bring out the following changes.

- The productivity of the assembly section has been increased considerably.
- The motion waste has also been eliminated.
- Formation of kaizen team in the industry helped the industry to sort out problems and solutions quickly.

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