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LEAN MANUFACTURING SYSTEM: AN EFFECTIVE TOOL FOR ORGANIZATIONAL MANAGEMENT**S. K. RAJENDRA****ASSOCIATE PROFESSOR****DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT****DR. AMBEDKAR INSTITUTE OF TECHNOLOGY****MALLATHAHALLI****R. SUPRABHA****ASST.PROFESSOR****DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT****DR. AMBEDKAR INSTITUTE OF TECHNOLOGY****MALLATHAHALLI****V. M. AKSHATHA****ASST.PROFESSOR****DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT****DR. AMBEDKAR INSTITUTE OF TECHNOLOGY****MALLATHAHALLI****ABSTRACT**

Every organization is striving hard on getting more work done in less time and with greater ease. The fundamental aim of any organization has been to continuously minimize waste and maximize flow which would ultimately lead to customer satisfaction by providing right product at the right time in the right quantity and the right quality at a reasonable price. This can be achieved greatly by adopting lean manufacturing system which is more than a cost reduction program. It aims at eliminating wastes which could be in the form of excess production and inventory, redundant movement of material, waiting and delays, over processing, excess worker motion, rework and corrections. The purpose of this paper is to standardize the process of empty bin collection at the logistics department of the firm. The bins are collected by the transporter from various operational points. The study reveals that turnaround time of external milk run vehicles was more, which in turns minimizes the delivery frequency. The primary objective was to reduce the transporters' waiting time by increasing the availability of bins. According to the value chain analysis, different improvement ideas were proposed to eliminate non-value added activities. After implementing these ideas for process improvements, the distance traveled reduced by 54% and process time reduced by 61%.

KEYWORDS

Lean manufacturing system, Lean manufacturing design, Process activity mapping, current state value stream mapping, Future state value stream mapping.

INTRODUCTION

Lean manufacturing has become an integrated system composed of highly inter related elements and a wide variety of management practices, including Just-in-Time (JIT), quality systems, work teams, cellular manufacturing etc. The purpose of implementing it is to increase productivity, reduce lead time and cost, and improve quality. Principles of lean thinking have been broadly accepted by many manufacturing operations and have been applied successfully across many disciplines. Lean manufacturing is most frequently associated with the elimination of seven important wastes to ameliorate the effects of variability in supply, processing time or demand. It is a philosophy of manufacturing that focuses on delivering the highest quality product on time and at the lowest cost. It is the systematic removal of waste by all members of the organization from all areas of the value stream. It is called lean as it uses less, or the minimum, of everything required to produce a product or perform a service. In a nutshell, lean manufacturing can be best defined as an approach to deliver the utmost value to the customer by eliminating waste through process and human design elements. [8]. The aim is to pull products through the value stream quickly and accurately, rather than make a forecast well ahead of demand and sell the resulting stock. It is based on improving operational capability and joint process analysis, rather than relying on supplier auctions and big centralized systems. [1]. Value Stream Mapping can serve as a good starting point for any enterprise that wants to be lean and describe value stream as a collection of all value added and non-value added activities which are required to bring a product or a group of products using the same resources through the main flows, from raw material to the hands of customers. It helps to visualize the station cycle times, inventory at each stage, manpower and information flow across the supply chain. A value stream map provides a blueprint for implementing lean manufacturing concepts by illustration how the flow of information and materials should operate. [6]

IMPORTANCE OF THE STUDY

Value stream mapping (VSM) is a popular visualization method to map the flow of the transformation of raw materials to a final product for a lean manufacturing system (LMS) or a lean system design (LSD). The premise of the VSM is to understand product flow from the customer's perspective, improve throughput, reduce cycle time and help to design a production system [7]. It is performed through the following steps: Select a product family; create a current-state map; create a future-state map using lean techniques; create an implementation plan for the future state; Implement the future state through structured continuous improvement activity

STATEMENT OF THE PROBLEM

The present work was carried out at the Logistics [LOG1 (goods inward)] department of BOSCH Ltd. Presently, each transporter made one delivery per day, collecting supplies of certain lot size from different suppliers. A system of external milk run is followed. As per the production requirements, orders are placed to different suppliers. These orders are picked up by the transporters and delivered to the Logistics Department (LOG1). A route is specified for each of the transporters. The transporter collects the parts from all the suppliers located in that route. After collecting the parts, the transporter reaches the logistics department where the parts are unloaded. A window time is fixed for the arrival of each of the transporters. During every delivery, the transporter will have to carry out a number of activities which are as below

- The transporter arrives at LOG1 and unloads the parts at the dock.
- The transporters need to update the time in the monitoring sheet.

- The transporter needs to put the stickers in the monitoring, it has two types of stickers, they are of green and red colour. Red colour indicates on time delivery and green colour indicates delivery is late.
- Informs the concerned officer and gets the quantity and invoice checked.
- Arranges the parts in specified places.
- Loads the empties required for next delivery.(Bins and wooden pallets)
- Gives the invoice for LOG1 officer for booking.
- Leaves the dock.

Delay in any one of the above processes leads to increase in the turnover time of the transporter since they have to wait. Each transporter needed different types of empty bins for supply of different parts. It was found that the major delay was occurring when the transporter had to load these empty bins as there was no sufficient number of bins available at LOG1. This was mainly due to non-standardized process for the collection of bins. The transporter had to wait until all types of bins in required numbers are collected from different plants and brought to LOG1.

OBJECTIVES

The following are the main objectives of the study;

1. Standardisation of job, to ensure elimination of delays caused due to the above mentioned problems through the implementation of value stream mapping and milk runs.
2. Preparation of standard work sheets. This would be very helpful for a new worker to understand the process and follow it accordingly.

RESEARCH METHODOLOGY

The basic metrics for production and logistics were recorded and an overview of the material that has to be supplied and removed for all points of use was made. The stations in production which have to be supplied with the materials and the route to be followed were identified.

STAGE 1: COLLECTION OF DATA

The worker collecting the empties was observed and the following data were recorded:

- The different types of Bins and places from where the bins were collected was identified.
- The Present route that is followed was observed and sketched.
- Time taken for all activities was noted down.
- Distance traveled was measured.
- The number of bins collected from different location was noted down.

The present route is as shown in Fig. 1.. It was observed that there was no fixed route that was followed. The person just moved around the plant, and wherever an empty bin was found it was picked up. The different places from where bins are picked up are also shown. A hand pallet truck is used to collect the bins and pallets. The distance travelled and time taken in the present route is as in Table 1. The above activities are done twice in each shift, which results in a total distance travelled of 4120m and the total time taken is 140min. The different types of bins collected and its weights are shown in Table 2.

TABLE 1-PRESENT ROUTE DETAILS

Sl. No	Activity	Distance Travelled	Time Taken
1	Collection of wooden pallets	740m	30min
2	Round1:Collection of Bins	660m	20min
3	Round 2:Collection of Bins	660m	20min
Total		2060m	70min

TABLE 2-TYPES OF BINS COLLECTED

Sl. No	Type of Bins	Weight (kg)	Sl. No	Type of Bins	Weight (kg)
1	Big Steel Bins	3.5	11	D.V. Pin Bins	1.5
2	Small Steel Bins	2.5	12	Barrel Bins	1
3	Big Plastic Bins	2.5	13	Feed Pump Bins	1
4	Small Plastic Bins	2	14	Bearing Bins	1.5
5	Bearing Flange Bins	1.5	15	D.V Holder Bins	1
6	Pin Bins	4.5	16	Pump Housing Bins	2.5
7	Roller Ring Bins	2	17	D.V. Pin Bins(steel)	1
8	F. P -Screw plug Bins	1	18	Mono Block	1.5
9	L.D.A Bins	1.5	19	P.F. Bins	1.5
10	Tension Lever Bins	0.5	20	P.D.M Housing Bins	4

STAGE 2: DRAW THE CURRENT STATE MAP

With the data collected current state value stream mapping was done as in Fig. 2. Value stream mapping shows all the activities involved in the process of collection of bins, both value added and non-value added activities. It helps to visualize the entire process at once. It forms a basic implementation plan, that is, becomes a blue print for implementation.

FIG. 1: EXISTING ROUTE

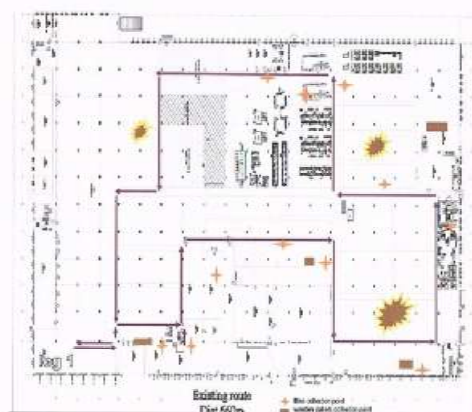
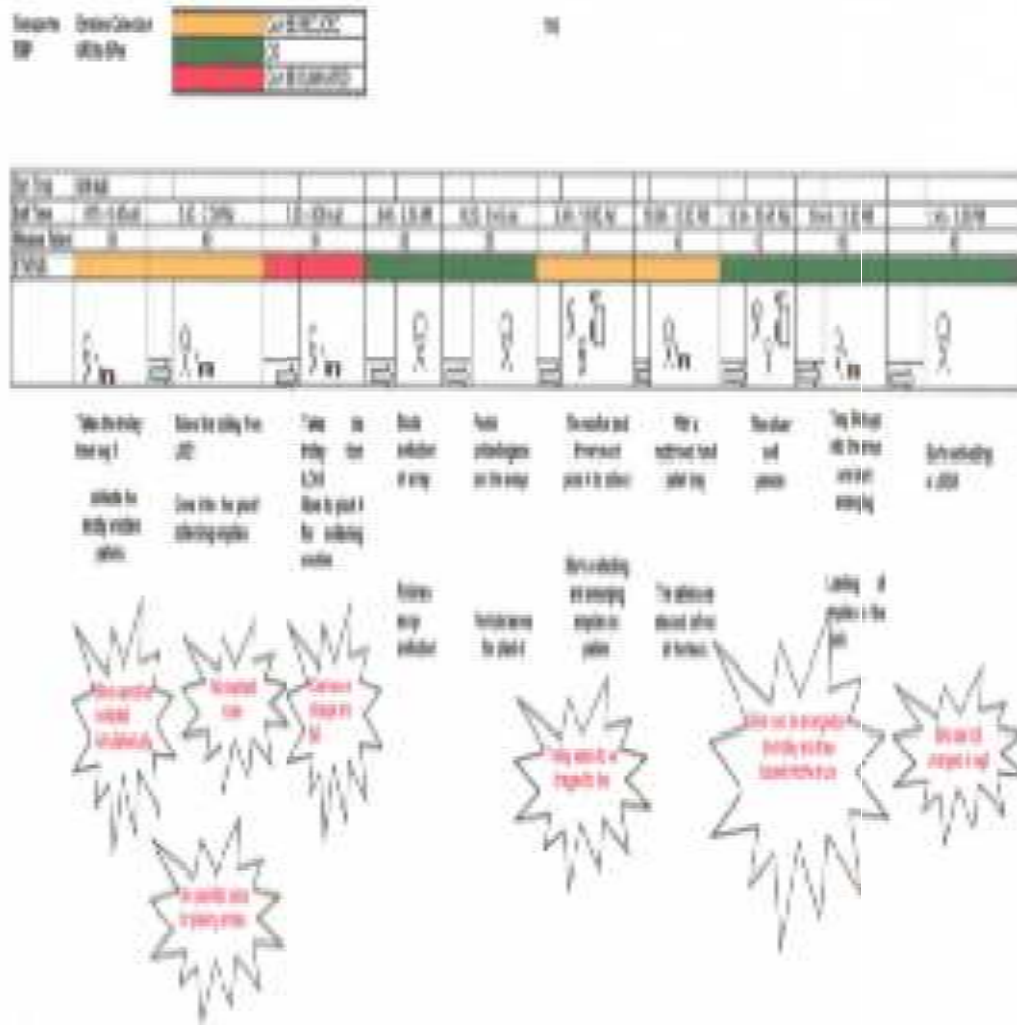


FIG. 2: CURRENT STATE VALUE STREAM MAP



STAGE 3: OBSERVATION AND ANALYSIS

When the present system was observed, it was found that there were no specific halt points defined; it was observed that trays were collected from the entrance and dragged till the end of the plant. There was no specific time allotted because of which there were clashes with milk run vehicle, coolant vehicle and material delivery trolleys etc. In case of other plants, a truck is used to get the bins. The truck works twice daily once in each shift. The same worker goes to the other plants along with the truck to collect the bins. Some of the bins which were brought had oily waste which was not cleaned. There were no safety precautions taken. At few workstations though empty bins were placed at a particular place, they were placed on ground and not arranged on a wooden pallet, this also caused delay. There was no standardized route being followed which lead to waste of time. When distributor enquired for the empties, only then the collection was being done hence the distributor has to wait until the bin was brought. To collect the bins from other plants, the trolley was taken from LOG1 to other plant which leads to the wastages (energy and time).

STAGE 4: DRAW THE FUTURE STATE MAP

After mapping current state, the next is to improve the present situation to achieve a future state, which would prove most optimal. The purpose of value stream mapping is to highlight the sources of waste and eliminate them, there by implementing an optimum future state that can become a reality within a short period.

PROPOSED STATE

When the current state map was analysed in detail it was found that the main drawback was not having a standardized route that could be followed. In order to overcome this, a standardised path was proposed considering the present path followed; workstations from where bins are to be picked up; average number of bins to be collected in each workstation; different types of bins that are to be picked up; different bins weights; distance covered. With a proposal for a new route as in Fig. 3, a suggestion was made on the specific places that could be allotted in the plant near every halt point such that it easy for the operators in the workstation to place the empty bin as well as for the collecting person to pick them. It was also suggested that the bins should be arranged in the specified places after collections so that it will be easy for the transporter to locate it. The distance travelled and time taken in the present route is as in Table 3.

FIG. 3: PROPOSED ROUTE

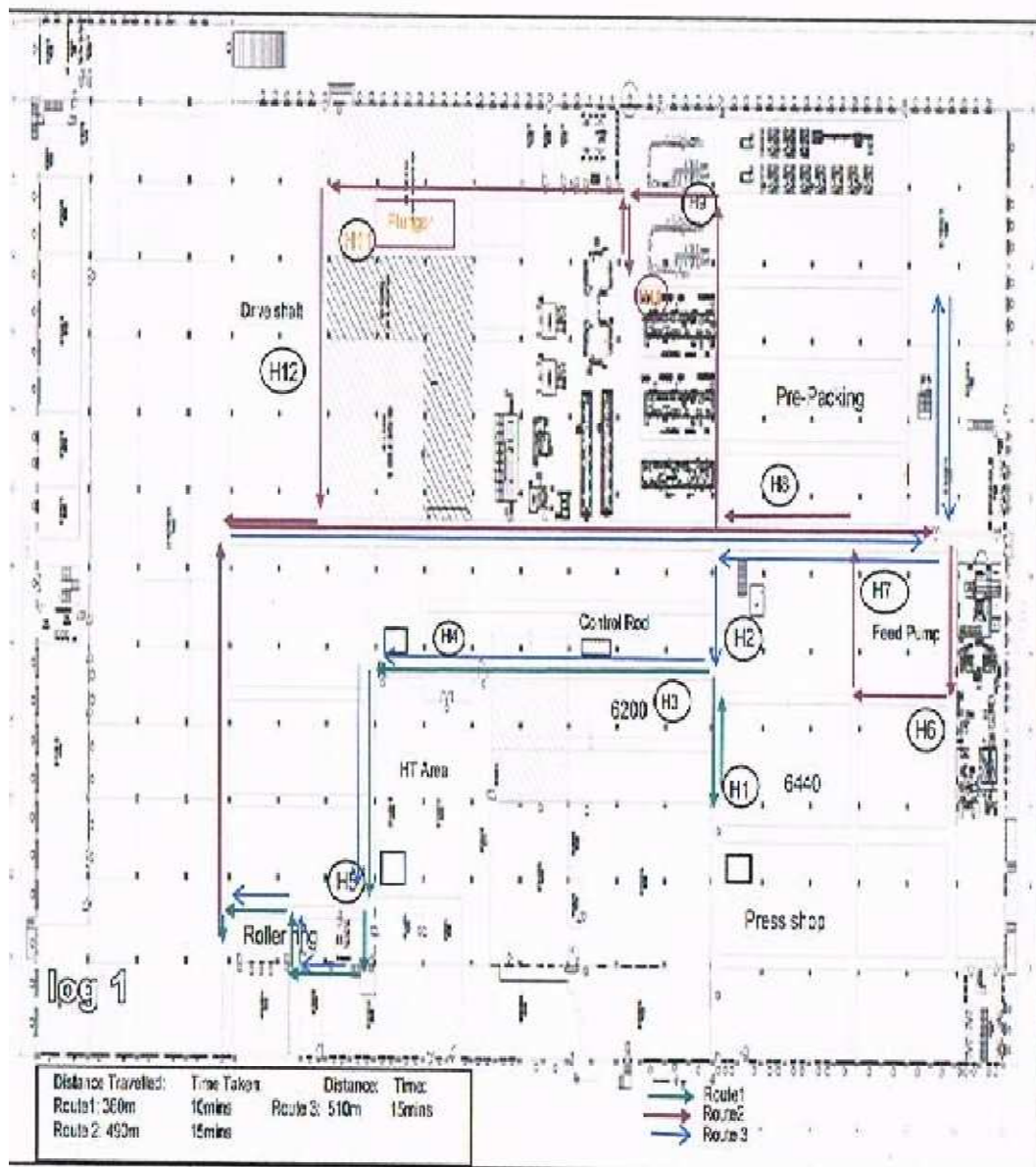


TABLE I-PRESENT ROUTE DETAILS

Sl.No	Activity	Distance Travelled	Time Taken
1	Collection of Bins from Plant 1(Route 1)	360 m	10min
2	Collection of bins from Plant 1(Route 2)	490m	15min
3	Collection of wooden Pallets from Plant 1(Route 3)	560m	15min
4	Collection of bins from Plant 1(second time in a shift)	480 m	15 min
Total		1890m	55min

RESULTS & DISCUSSIONS

Standard Works Sheet: Standardized work basically ensures that each the job is organized and is carried out in most effective manner. No matter who is doing the job the same level of quality should be achieved. The standard activities that are to be done in each route and at every halt points were listed and a standard work sheet was prepared. This is very helpful for a new worker to understand process and follow it accordingly. This even helps to monitor the process and any changes or improvement in the process in the future can be adopted easily.

ALLOCATION OF TIME

If the bins are brought to, the logistics department within the time the of arrival of the external milk run vehicle, then, it will be easy for the transporters to load it and it also reduces the waiting time. Based on this, the time was allotted for the activities in different shifts. Time was also allotted to arrange the bins in the racks, to make it easy for the transporters to locate them.

A CHART FOR MONITORING

Any process implemented must be monitored to know its progress. Monitoring also helps to know any deviations happening from the actual planned. It also helps to improve the process in the future. Hence, a deviation-monitoring chart was designed, which shows the activities to be carried out in each shift and the corresponding window times. The distance Travelled in the existing system was 4120m which was reduced to 1890 m in the proposed system which results in a savings of 54%. The time taken in the existing system was 140min which was reduced to 55 min in the Proposed system which results in a savings of 61%..

CONCLUSION

It can be concluded that by improving the process by standardizing the work, recommending new route, allocating time, specific halt points for the collection of the bins, the distance to be travelled can be reduced and thereby time taken is also reduced. Reduction in time and distance travelled leads to faster collection of bins because of which more bins will be available at the department. Arranging the bins in specified places makes it easy for the transporter to locate them and load it. Availability of sufficient number of bins reduces the waiting time of the transporter, thereby, reducing the transporter turnaround time. Further, reduction in transporter turnaround time helps to increase the delivery frequency; there by smaller lot sizes deliver can be achieved.

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