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Redesigning the Layout Through Application of Kanban Principles in the Assembly Line (A Case Study)

KEYWORDS: Kanban, VSM, VSD

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ABSTRACT *The objective of this paper is to provide a background on application of tools and techniques such as kanban system, value stream mapping(VSM) and value stream design(VSD) that are used for redesigning the layout in the finishing line in a leading auto industry in India for the movement of buses between two workstations. This includes detailed study and analysis of the existing storage system in the finishing line, study on the different types of storage systems, proposal of new kanban storage concepts. The research includes emphasis on analyzing characteristics of Kanban, map the current operating state for the assembly line and to highlight sources of waste and eliminate them by implementation of future state value stream. The implementation of kanban card and kanban flags made easy for information flow between workstation and stores which led to reduction in waiting time of the operators.*

INTRODUCTION:
Most of the manufacturers are now critically evaluating every process to determine their effectiveness in bringing maximum value to customers by time. The use of Kanban technique has been a revolution in this regard. It aims at reducing lead times, optimize inventory, increases output and reduces total cost [1]. The kanban system is a pull planning system that authorizes manufacturing based on the state of the production system. VSM is a technique to gain a holistic view of how a company functions. It is a lean technique used to analyze the flow of materials and information currently required to bring a product or service to a consumer [2]. It is a process mapping method used to document the current and future states of the information and material flows in a value stream from supplier to customer. The work objective was to use the above tools to improve production process, reduce lead times, reduce inventory, and improve product and process quality.

METHODOLOGY:
The following steps were used for implementing the above principles:
- Detailed study and analysis of the existing storage system
- Collecting and studying the parts name and activities
- Study the different types of storage systems
- Calculation of Optimum number of Kanban cards for the components of the finished line
- Proposal of new kanban storage concepts.
- Mapping the flow of materials and information and how it is operating.

KANBAN:
Kanban, literally sign board or bill board is a scheduling system for lean and Just-in-time (JIT) production [3]. Kanban is a system to control the logistical chain from a production point of view. Kanban system is used to improve and maintain the production at a better level.

Current state of implementation
- The storage of hardware parts were combined with two different work centre (Figure 1)
- This led to increase in the operator movement and identification of parts was difficult which caused delay in the activities
- There were no proper details of the parts which caused the miss placement of parts and also it was difficult for store person to fill right parts in the right bins.
- Due to the unavailability of the parts or materials the idle time of the operator was increased.

Disadvantage of the present system
- First-In-First-Out method was not followed
- No information flow
- If shortage of hardware parts occurs, then there is delay in the process

Proposed state of implementation
A proposal of two-bin kanban system for hardware parts was made and implemented in the workstation as indicated in Figure 1.

Figure 1 – Present System

Figure 1 – Proposed work

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It is that technique of material control in which two bins are used, one is used for minimum stock and second bin is used for reserve stock or to keep the remaining quantity of material

- Each part was stored in the bins as much required for the assembly of 10 buses.
- A kanban card for was placed in each bin as a signal about the availability of parts as in figure 2

Figure 2- Kanban flag indicating bin empty and line stoppage

Advantages of proposed work

- Operators find it easy to identify the parts and carry out their activities quickly rather than searching for the parts which reduce the morale of the team members.
- Implementation of flags reduces the waiting time of the workers as the stores person will replenish the parts whenever required based on the flag indication.
- Displaying of the part details on the rack & the bins simplifies the stores person job to replenish the right parts in the right bins, which avoids mixing of the parts.
- Implementation of kanban cards resulted in filling of right quantity of parts in the bins avoiding dumping of excess parts as done in the old racks.

VALUE STREAM MAPPING (VSM):

Value stream mapping becomes a blue print for lean implementation. A value stream is all the actions which includes both value added and non value added, required to bring a product through the main flows [4]. VSM is a simple visual representation of every process in the material and information flow. Since the focus of this paper is only on the supply chain system, the concentration is channelized towards mapping the processes and information flows that occur when a part is between the two different workstations.

Current state mapping steps:

- Current – state information was collected while working along the actual pathways of material and information flow.
- Mapping was started at the shipping end and worked upstream, instead of starting at the receiving end and working downstream.
- Use of stop watch was preferred and not to rely on standard times
- Mapping was done by a single person, even if several people are involved. If different people are involved in mapping different segments, then the clarity of the picture cannot be reached.
- The whole information flow and material flow from the stores to the work centre was studied properly and with the help of the various value stream symbols, a value stream mapping was done in which the current state was mapped.
- In the VSM it was seen that there were many value adding and non value adding activities in the whole supply of materials between the stores and work centre.
- It was seen that the store person used to fill the hardware parts completely into the bin without allowing the operator to empty the bin and in line, a single hardware rack was maintained for both work stations.
- It was observed that the store person used to replace the components only when information was passed on from the operator to general leader (GL) as shown in Figure 3

VALUE STREAM DESIGN (VSD):

After mapping the current state the next step is to improve the present situation to achieve a future state which should prove most optimal and must fulfill all the lean thinking concepts as much as possible. VSD is a primary tool to eliminate waste in the system [5]. Value stream mapping is used to highlight the sources of waste and eliminate the same by implementation of future state value stream that can become a reality within a short period of time. The goal is to build a system where the individual processes are linked to their rest of the processes either by continuous flow or pull, and each process gets as close as possible to add maximum value to the final product reaching the next work centre.

Value stream design at the finishing line

When the Value Stream Design was mapped, it was suggested to implement few concepts that are followed in a production system such as establishment of kanban system, adoption of improving 5's system [6].

- The first step taken in value stream design was to find out the movement of the stores person between the work centres in the finishing line. The stores person is the only person in the cycle to have an information flow from the general leader.
- Since the information flow was only between the general leader and the stores person there was delay in the assembly activities due to unavailability of the parts as in Figure 3
- Most of the information flow, which added no value, has been eliminated resulting in faster and better information flow.
- A kanban system was introduced in the given work stations separating the parts of the two different work stations and easing the operator's job by avoiding mixing of the parts and also eliminating the delay time which was caused due to improper storage system.

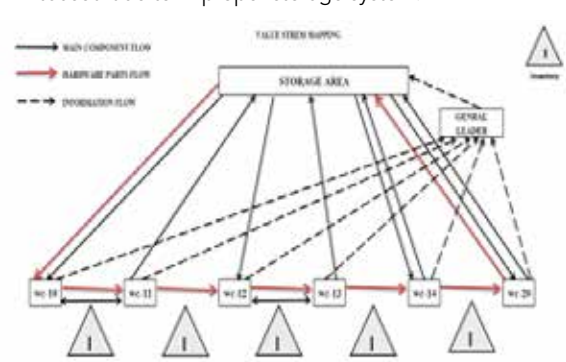

Figure 3- Current state mapping in finishing line

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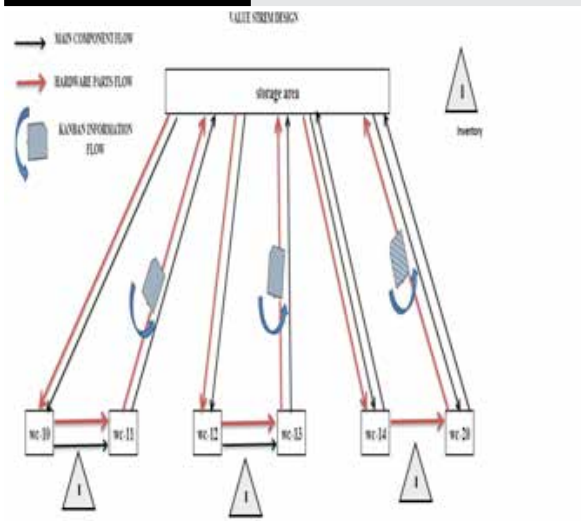

Figure 3- Future state mapping in finishing line

- The kanban system implemented in the work centres resulted in on time replenishment of the parts and also proper storage, finally improved 5s system which led to
- FIFO (First In First Out) method of the parts.

Advantages of VSD:

- Kanban system is the only entity in the system that receives information about the parts in the work centre, rather than general leader intimating the unavailability of parts.
- Establishing kanban system at work centre led to a drastic reduction in inventory. Only 2 days inventory was stored in the bins.
- Implementation of Kanban system resulted in proper implementation of FIFO – First in First Out concept.

CONCLUSION:

- Implementation of 2-bin system indicated the stores person to replenish the parts whenever required rather than making operators wait for the parts.
- For hardware rack, the implementation of kanban card and kanban flags was for the easy indication/information flow between workstation and stores.
- At the outset, implementation of the kanban system resulted in reduced inventory, movement, time and non value adding activities.
- It marginally increased the productivity and also the morale of the team members which also resulted in improved quality.

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