REDUCING THE LEAD TIME BY IMPLEMENTING KANBAN BASED PRODUCTION IN FINISH MATCH GRINDING LOOP OF DELIVERY VALVE

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The aim of the paper is to discuss about the implementation of lean concepts in FMG loop of delivery valve. The objective of this paper is to provide a background on lean manufacturing, present an overview of manufacturing wastes and introduce tools and techniques that are used to transform the company into high performing lean enterprise. Value stream mapping is used to identify the problems and with the help of value stream mapping we can eliminate the problems identified. Kanban cards are introduced to ensure customer satisfaction In this paper we shall see a brief discussion of this steps used in the implementing the Kanban based production.

Keywords: Lean manufacturing, KANBAN cards, VSM, VSD

INTRODUCTION

Many manufacturers are now critically evaluating their processes to determine their effectiveness in bringing maximum value to customers. Lean manufacturing is a whole-systems approach that creates a culture in which everyone in the organization continuously improves processes and production. It is a system focused on and driven by customers, both internal and external. The aim of lean manufacturing is the elimination of waste in every area of production Its goal is to incorporate less human effort, less inventory, less time to develop products, and less space to become highly responsive to customer demand while producing top quality products in the most efficient way.

VALUE STREAM MAPPING (VSM)

VSM is a valuable tool for redesigning the productive systems according to the lean system. VSM gives the current state diagram of the value stream. It gives the linkage between the material flow and information flow.

Steps to draw the current state diagram are:

i. Record the customer information.

ii. Map the process.

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iii. Fill in the data boxes.
iv. Draw the material flow.
v. Draw the suppliers.
vi. Draw the information flow.
vii. Calculate the lead time.
i. The CIP flashes appearing on the VSM visualizes the problems, opportunities for improvements. This was taken as system CIP project during the system CIP workshop.

**SYSTEM CIP APPROACH**

System CIP is the comprehensible derivation and prioritization of focus topics and the definition of target conditions for a value stream based on Key Performance Results (KPR). Input parameters are the business requirements and the ideal state (True North) of a production system. The target of System-CIP is the holistic and continuous development of a value stream. Scope is the value stream from the customer to the supplier and the required indirect areas. The long-term and sustainable business success is achieved by short and efficient improvement cycles in the guided improvement process. the success is verified by suitable Key Performance Indicators (KPI). The implementation is realised in projects (System-CIP Projects) and is stabilized by Point-CIP. The System-CIP approach requires a deep understanding of the business requirements and the knowledge of cause-effect relationships in the entire value stream.

**VALUE STREAM DESIGN**

Value stream design gives the target state of the value stream. How the value stream look in the future is got by the VSD.

- Records and presents flow of materials and information in simple terms.
- Identifies causes of waste.
- Helps design better flows.

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**Figure 1: FMG Loop**

![FMG Loop Diagram](image)
• Standard, structured procedure within the interdisciplinary team.

1. The customer (PE, PF) shops the parts from the supermarket place the kanban cards in the kanban post.

2. The point of use provider takes the cards from kanban post and places the cards in the production chute.

3. The internal milk runner takes the cards from the production chute and shops the parts from the body as well pin supermarket and places the kanban cards in the respective kanban post.

4. Then the milk runner gives the shopped pin and Body parts to the assembly line.

5. The parts are then placed in the supermarket along with the respective kanban cards.

**VISUALIZATION**

Super Market: A supermarket is the “shock absorber” between two processes that cannot be linked closer at this point in time. Its purpose is to buffer the fluctuations of demand and supply so that neither partner is causing problems for the other. Replenishment (i.e., production) is controlled by consumption of the customer. Wherever possible it should be located at the source (i.e., the supplying process) as it is responsible for the uninterrupted supply of its customer.

- Defined place for all Types
- FIFO principle for all Types
- Defined inventory with Min and Max qty.
- Replenishment through Kanban = Pull-Principle
- Responsibility lies with Supplier

**Milk runner:** A milk run is a cyclical of providing materials to production at the consumption location:

- At right time
- In the right quantity and quality
- At the right place

The milk run is used to provide production with materials, collect finished goods/empties and real information between processes.

Main benefits of milk run are:

1. Reduction of stock level in production.
2. 100% service level of material supply.
3. Standardized information and material flow as basis for continuous improvement.
4. Clear separation of production and material supply.
5. Less accidents due to dangerous fork lift transports in production.

**Kanban Post:** Clearly visible storing positions and identification of the Kanban post, Regular collection, so that replenishment lead time remains constant. Kanban's are again brought into circulation after being collected.

**Production Chute**

1. Four Kanban per box.
2. Number of cards in a formation box results in the production lot size.
3. Implement sequence chutes for Kanbans in the production process, in order to ensure the correct production order and FIFO.
4. Good visualization.

**Determining the manufacturing lot size:** The minimum lot sizes caused by technical reasons
must be considered when determining the manufacturing lot size. Considering the minimum lot size, lot sizes can be calculated as follows (the calculation always is done for a defined period):

- Same lot size for all part numbers
- Max. number of changeovers for runners = Max. number of possible changeovers – number of planned changeovers for exotics

The lot size must be rounded up to whole NPK.

Runners are those part numbers that contributes 70% of the total volume

Exotics are those part numbers whose total volume might be less.

**KANBAN**

KANBAN meaning “signboard” or “billboard”, is a concept related to lean and Just-In-Time (JIT) production. According to Taiichi Ohno, the man credited with developing Just-in-time, kanban is a way through which JIT is achieved. "Kanban" uses the rate of demand to control the rate of production, passing demand from the end customer up through the chain of customer-store processes. Kanban is part of an approach of receiving the ‘pull’ from the demand. Therefore, the supply or production is determined according to the actual demand of the customer. Kanban creates transparency of material flow systems and enables employees to improve the system continuously.

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K = \text{RE} + \text{LO} + \text{WI} + \text{SA}
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K = Number of Kanban, Number of Kanban for part number in the Kanban loop

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\text{RE} = \text{Replenishment time coverage, Demand based on customer tact within replenishment time of 1 Kanban.}
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\text{LO} = \text{Lot size coverage, Lot size formation}
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\text{WI} = \text{Withdrawal peak coverage, Planned customer withdrawal.}
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\text{SA} = \text{Safety time coverage, Fluctuations, problems and unknown risks.}
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RASIC chart was developed to give the people’s role in the defined activities.

**DEVIATION MANAGEMENT**

Deviation management is a systematic method of reviewing true North projects which are still at

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**Figure 2: Layout in the Shop**

- **Oiling station**
- **Inspection area**
- **AA supermarket**
- **Internal Milk run**
- **LOT FORMATION**
- **PE supermarket**
- **PF supermarket**

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system CIP project level. The team members of the project discuss on the defined agenda at the defined time to address the deviations from the defined standard.

- To adhere and improve the defined Standard.
- To bring the involvement of all responsible team members to realize a standard.

Deviation management is done in all Pull loops with customers, suppliers and internal upstream loops.

The major deviation was found to be pin not available in the supermarket and hence we initiated with the pull even in the DV pin loop in order to eliminate this failure.

CONCLUSION

Before implementation

- Multiple lot size concept.

- Inadequate visualization of finished parts.
- No systematic discussion on customer production fulfillment.
- No clarity on individual responsibility w.r.t a Pull system.
- No approach w.r.t to repeated failures to Customer.
- Lead time was found to be 19 days

After implementation

- Visualization of all part numbers in the Supermarket (95% of requirement).
- RASIC chart prepared with Manufacturing, CLP, BPS
- Common lot size (200 no.'s)
- Kanban calculation sheet for common lot formation concept developed.
• Deviation management initiated.
• Pull initiated to ensure consumption based production.
• Customer fluctuation capturing is initiated.
• Lead time was reduced to 16.5 days by implementing the kanban based production in the FMG loop.

Implementation plan in the assembly
• Educate and train the workers, supervisors (also to point of use provider and milkrun).
• Decrease the changeover time.
• High overall equipment efficiency.
• Introduction to FIFO.

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