

Lean Manufacturing Achieved by Implanting Kanban at Supplier End

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Abstract

Planning for the delivery of a product to customers becomes more efficient and demand from customers becomes more stable. Lean manufacturing is a set of tools and techniques and has been widely adopted by many production companies. A more continuous flow results in items being moved immediately from one workstation to the next as soon as they are ready. Lean manufacturing is a performance based process used in manufacturing organizations to increase competitive advantage. The basics of lean manufacturing employ continuous improvement processes to focus on the elimination of waste or non-value added steps within an organization.

We had shown the problems what can be appear in a M.S Industrial Components Pvt. Ltd company because of the overproduction. To affect inventory reductions, it is important to understand that inventory is created largely due to the variation that exists in the manufacturing system and that this variation. The Kanban lean manufacturing tool lets a company not only to save money but also allows reducing the lead time. All that finally, will make flexible and responsive as a business.

Keywords: Inventory; Continuous flow; Plan for delivery; Elimination of waste; Lean manufacturing

Introduction

The Kanban is used to signal the need for replacing or refilling materials necessary for production. There are a variety of ways that the signal can be sent. Actual cards, that a company goods though the production process can be used to keep track of current inventory [1]. However, something as simple as the arrival of an empty container at an upstream processing station is a clear signal that the parts that were in the container have been used and more. Kanban can be used in manufacturing systems where the product is manufactured to the pull of market demand.

It is the pull signal to produce. Once the product is withdrawn by the customer, at that moment the Kanban tells us exactly what the customer is using, and hence what the customer will need later. This Kanban is sent as fast as possible to the production line. In essence, the Kanban system is doing the “talking” to the production system, telling it to produce because some product has been removed. This system easily bypasses all the accounting and planning systems that tend to not only delay this signal but also add variability along the way. The Kanban system is dealing real time with the realities of what is happening on the line. Second, Kanban creates an absolute limit on total inventory. Since each Kanban represents a certain amount of stock, and the number of Kanban are strictly controlled and limited, this creates an upper limit on the inventory [2].

Pull production focus

A Kanban card can be generated to identify production of part(s) to replenish in-house inventories, a withdrawal of product for shipment to a customer, or to signal the replacement of raw materials and components. Using Kanbans there must be a purchase or an order to generate the card. The product is pulled through the production sequence based on the order from the customer. Pull Kanban is a part of the Lean Production or Just-in-time (JIT) manufacturing process, applying Lean principals to eliminate waste. Reduction of waste ensures lower costs, higher quality products, and delivery of waste ensures lower costs, higher quality products, and better service and delivery [3].

Pull vs. push

The pull system is the center of any synchronized factory; it works by working backwards, using signals or cards to trigger or start production. The process starts at the finished products warehouse or the shipping area. When a customer orders a product, the process triggers the previous operation to replace it; signaling more products is needed. The process continues backward through the factory to where raw materials are withdrawn which in turn triggers the supplier to ship the raw materials [4].

Production challenges

In today's global economy consumer are demanding quicker turnaround times along with a larger variety of quality products and specific features. Being able to predict variations in customer demands makes forecasting a complex process. This makes it nearly impossible to provide the products, or predict, what the consumer will request. The pull system eliminates the guesswork by making the consumers order the trigger to start production [5] (Figure 1).

Purpose

If the demand for products always stayed the same, companies could operate at maximum efficiency, producing only what was required and no more. When there is a smaller batch of work to be done, one of two things can happen; the underutilization of people, machines, or materials or overproduction. The board below shows a situation where the developers and analysts are being prevented from taking on any more work until the testers free up a slot and pull in the next work item.

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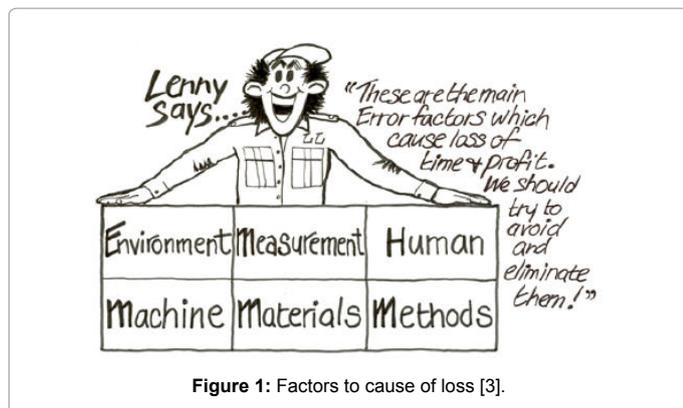


Figure 1: Factors to cause of loss [3].

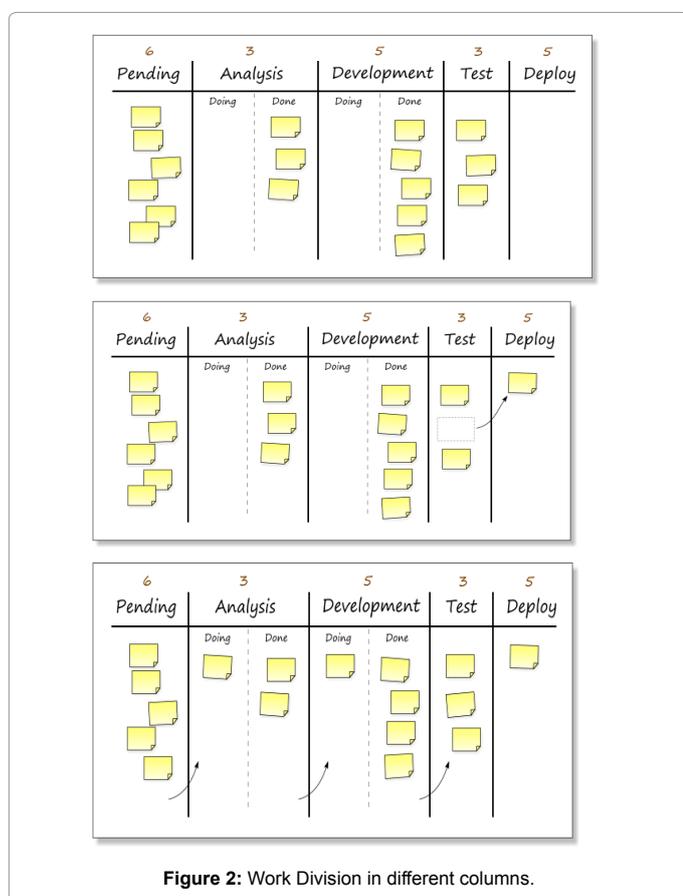


Figure 2: Work Division in different columns.

Notice that we've split some of the columns in two, to indicate items being worked on and those finished and ready to be pulled by the downstream process. Once the testers have finished testing a feature, they move the card and free up a slot in the "Test" column [6].

Now the empty slot in the "TEST" column can be filled by one of the cards in the development "DONE" column. That frees up a slot under "Development" and the next card can be pulled from the "Analysis" column [6] (Figure 2).

Case Study of Reliable Auto-tech Pvt. Ltd.

Company requirement

The part which is bought out from the supplier of M.S Industries for

this parts company wanted to set up kanban system at M.S Industries i.e. at supplier end (Figure 3).

Seven rules for using Kanban effectively

1. Start with a Plan.

The PFEP (Plan for Every Part) is the cornerstone of the Kanban Card Implementation.

2. Order Only What You Need.

Customer processes order goods in the precise amounts specified on the Kanban.

3. Make Only What is Ordered.

Supplier processes produce goods in the precise amounts and sequence specified by the Kanban.

4. Kanban is Official.

No items are made or moved without a Kanban.

5. Material w/o Info is Trouble.

All parts and materials always have a Kanban attached.

6. Quality is #1.

Defective parts and incorrect amounts are never sent to the next process.

7. Goal is EOQ=1.

The numbers of Kanban is reduced carefully to lower inventories and reveal problems.

Step 1: PFEP – Plan for Every Part: Bought out parts supplied by M/S M.S Industries to Reliable Auto-tech Pvt. Ltd (RAPL) (Table 1).

Rules Considered While Implementing Kanban is shown in Table 2.

Step 2: Part selected for Kanban implementation: Maximum repetitive required part which are selected for implementation of Kanban (Figure 4).

Required data collection

1. Average Daily Demand (D)
2. Lead Time (L)
3. Safety Coefficient (S)
4. Container Capacity ©

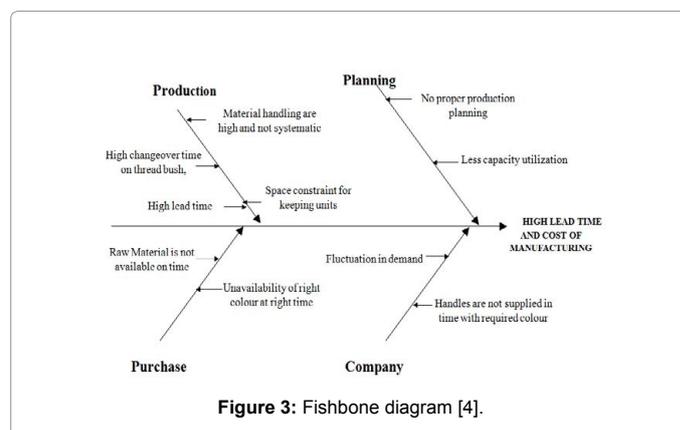


Figure 3: Fishbone diagram [4].

Description	Average Monthly Demand	Average Daily Demand
PIN HING FOR HOD Flapper(5550320R1)	2500	100
Threaded Bush(008000304B1)	15200	608
Axe Emeltur	10000	400
Boss Tapped JD-4	200	8
Counter Shaft JD-4	200	8
Hub JD10	160	6
Hub JD10	520	21
Hub JD10	620	25
Bushing Pivot JD10	640	26
Hub Jd10	580	23
HUB JD10 P1 (Without Keyway)	216	9
HUB JD10 P1 (With Keyway)	216	9
Bushing Stepped (JD6)	1500	60
Actuator (JD6)	1500	60
Step Bush For JD06 Assembly	4000	160
Bushing For JD06 Assembly	2000	80
Bushing For JD06 Assembly	0	0
Washer Hinge(JD12)	400	16
Pin For Jd-6	100	4
Roller	2000	80
Roller	2000	80
Sleeve	2000	80

Table 1: Bought out parts supplied by M.S Industries.

Rule No.	Rule	Function
1	Later process goes to earlier process and picks up the number of items indicated by the Kanbans	Creates pull, provide pick up or transportation information. The replenishment concept is formatted here.
2	Earlier processes produce items in a quantity and sequence indicated by the Kanbans	Provides production information and prevents overproduction.
3	No items are made or transported without a Kanbans.	Prevents overproduction and cessivetra nsportation.
4	Always attach a Kanbans to the goods.	Serves as a work order.
5	Defective products are not sent to the subsequent process.	Prevents defective parts from advancing; identifies defective process.
6	Reducing the number of Kanbans increases their sensitivity.	Inventory reduction reduces waste and makes the system more sensitive.

Table 2: Rules and Function [7].

Sr No	Name Of Part	Figure
1)	Thread bush	
2)	Step bush	
3)	Axe Emeltur	

Figure 4: Part selected for Kanban implementation.

We saw problems what can be appear in a company because of the overproduction. To affect inventory reductions, it is important to understand that inventory is created largely due to the variation that exists in the manufacturing system and that this variation [7] (Table 3).

Implementation of Kanban

- Value Stream Mapping.
 - Current State
 - Future State
- Planning both material flow and information flow.
- PFEP – Plan for Every Part
- Racks and Bins – Place for Every Part
- Kanban is like the tip of the iceberg; it is the highly visible portion [6].

We considered first thread bush the steps which are shown for the thread bush those are also considered for the STEP BUSH

Capacity calculation of M/S industry supplied parts considering their lead time

Capacity Calculation of M/S Industry Supplied Parts Considering Their Lead Time is shown in Tables 4-6.

Formulae:

- 1) No of Kanban Cards= Avg Daily Demand*(1+α)*Lead Time/ Container Capacity
- 2) Minimum Lot Size= Demand*(1+α)/Avg No of Set Up
- 3) No of Containers = Kanban Quantity/No of Parts Held Per Container
- 4) Kanban Quantity = Weekly Part Usage *Lead Time *No Of Locations *Smoothing Factor [7] (Figure 5).

Part	Part code	Lead Time (days)	Avg Daily Demand	6 Day Demand	Container Capacity
Thread bush	OBO0202A40007	6	350	2100	700
Step bush	OBO113671	9	240	1440	800
Axe emeltur	OBOZ001064X01	9	500	3000	1500

Table 3: Data Collection.

Operation	Cycle Time (sec)	Working Time (hr)	No. of M/C	OEE (%)	Thread Bush 6 day Capacity	Set Up Time (min)
Traub	60	20	1	80	5760	120
ID chamfer	25	8	1	80	2304	20
Tapping	20	8	1	80	2304	20

Table 4: Capacity of thread bush production in 6 days.

Operation	Cycle Time (sec)	Working Time (hr)	No Of M/C	OEE (%)	Step Bush 6 day Capacity	SetUp Time (min)
Traub and Drill	120	20	1	80	2880	120
Stress Relieving	20	20	1	80	17280	
OD Grinding	15	20	1	80	23040	10
Facing Turning	180	20	2	80	3840	90

Table 5: Capacity of step bush production in 6 days.

Operation	Cycle Time (sec)	Working Time (hr)	No of M/C	OEE (%)	Axe emulator 6day Capacity	Set Up Time (min)
Traub Drill	60	20	1	80	5760	120
CNC first Operation	90	20	1	80	3840	90
CNC second Operation	90	20	1	80	3840	90
Drill	60	20	1	80	5760	120
ID Chamfer	35	20	1	80	9874	manually

Table 6: Capacity of Axe Emeltur production in 6 days.

Part Name	Min Stock	Safety Stock Level	Card Qty	Packing Qty
Threaded Bush	2100	4200	700	700
Axe Emelturl	3000	6000	1500	500
Step Bushing	1600	3200	500	50

Table 7: Stock Level Consideration.

Implementation of Kanban

- Value Stream Mapping
 - Current State
 - Future State
- Planning both material flow and information flow
- PFEP – Plan For Every Part
- Racks and Bins – Place for Every Part
- Kanban is like the tip of the iceberg: it is the highly visible portion [8].

We considered first thread bush the steps which are shown for the thread bush those are also considered for thread bush if starting finished good stock is about 9 cards that is 6300 no each week there is 3 card consumption of thread bush in M/S Industry (Table 7).

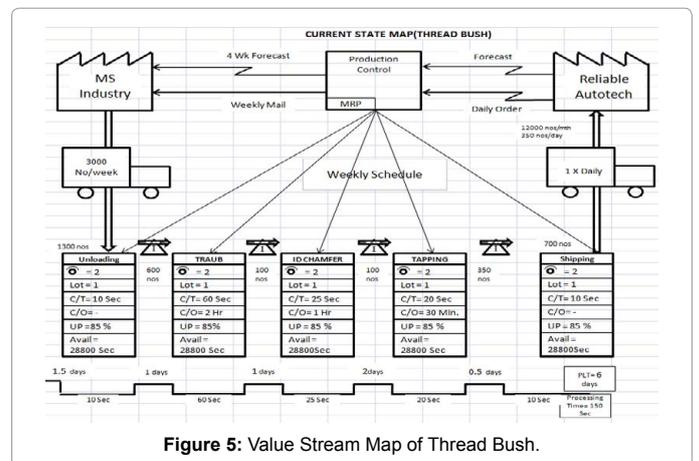
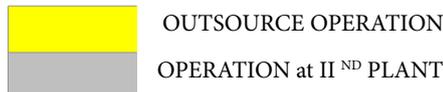


Figure 5: Value Stream Map of Thread Bush.



Kanban for thread bush

1. Avg Daily Demand (D) = 350
2. Lead Time (L) = 6 days for 2100 parts

We considered 2100 parts because of there is tapping operation which is outsource from other supplier and due to transportation, their machine availability, and no of worker required for the loading and unloading the part, and no of set ups we are took the 3 card quantity to production.

And also for the traub operation in M/S industry the setup time required i.e. 2 hours for the traub and machine availability for traub, and capacity to produce the parts in a day is about 5800.

3. Safety Coefficient (S): (±20%)
4. Container Capacity (C)

If card = 9 for thread bush and card quantity is 700.

WIP stock = (Demand of each week) after each 1 week i.e. after 6th card.

Initial stock: At the first stage of implementation of thread bush there is 9 cards stock in 1 finished goods i.e 6300 nos.

After first week: 3 cards are consumed, and 3 cards goes to

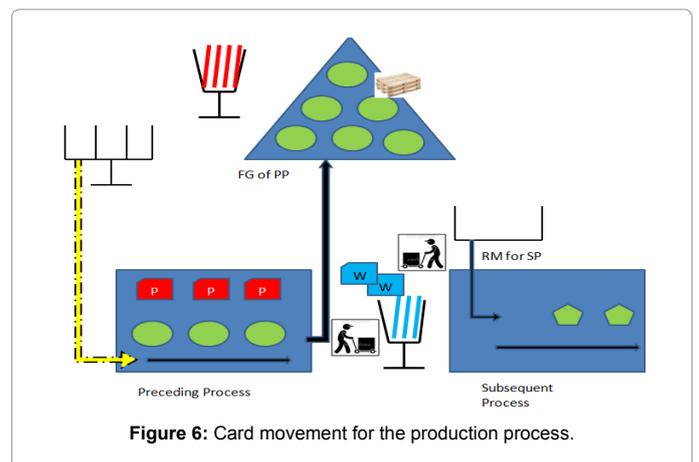


Figure 6: Card movement for the production process.

preceding process then production starts remaining stock = 4200 nos.

After second week: The cards which are goes to preceding process are now ready to replenish and 3 card are to dispatch to customer (Reliable) (Figure 6).

Finished Good kanban card Board is shown in Figure 7.

Conclusion

From the successful implementation of Kanban system of those three parts (Thread Bush, Axe Emulator, Step Bush) the problem



Figure 7: Finished Good kanban card Board.

related with overproduction, or out of stock, lack of raw material, are so reduce. As the system in the Reliable Autotech is going on the major parts which are supplied by M/S Industry is now be implement this system to their other parts. The Kanban system provides a company the following positive results:

- Employees know exactly what is required based on the conditions in the workplace.
- Employees do not need to be assigned a job; they are allowed to perform work when and where it is needed.

- Unnecessary paperwork is eliminated and the possibility of making an error is reduced.
- The skill level of employees is increased and the variety gives them more satisfaction from their work.

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