Implementation of Kanban System

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Abstract: Lean manufacturing has been the buzzword in the area of manufacturing for past few years especially in Japan. The Kanban system is one of the manufacturing strategies for lean production with minimal inventory and reduced costs. The project's objective is to study the role of Kanban in Production system. With the present rate at which the technology is evolving and the competition among the company there is a must among the manufacturer to produce their product at cost efficiency. The theory below hence describes about the impacts of KANBAN in an industry and its basic framework.

Kanban methodology has been reviewed and has been implemented on "JF H/L LENS" of the Minda Rinder Pvt. Ltd. The Kanban system involves the selection of two important parameters i.e. the lot size and the numbers of Kanban used in the process. The main objective of Kanban system is to maximise the productivity of a unit and this is done by reducing the ideal time of the process. Kanban system is a very cost efficient process if applied in proper manner.

Keywords **- Lean manufacturing, KANBAN, inventory, pull production.**

I. INTRODUCTION

In general, there are varieties of tools and techniques used in determining effective manufacturing system in a company. Kanban system is just one of the tools and techniques used in lean manufacturing besides other techniques like Quality Circle, 5S Housekeeping, and continuous improvement and many others. Lean is a set of tools that assist in the identification and elimination of waste that might improve quality as well as production time and cost. The Kanban methodology was pioneered by Toyota through the leadership of Taiichi Ohno, who is known as the father of the Toyota Production System. Ohno recognized the inefficiencies in their production line and sought ways to better their processes. A car is definitely a complex product to build; with around 30,000 parts and components moving through the assembly line things can get inefficient. In order to remain competitive in global competition and to be able to meet unprecedented market changes, organizations must not only design and offer better products and services; but need to improve their manufacturing operations.

One of the strategies is by deploying lean manufacturing practices that can be used to improve the operational performances. Lean manufacturing basically refers to manufacturing processes without waste. Waste is anything other than the minimum amount of equipment, materials, parts, and working time, which absolutely are vital to production. Despite the availability of extensive operations management knowledge and resources, many organizations are still struggling to become lean. Hence, organizations need to evaluate and assess the current state of operations in their manufacturing facilities. Therefore, one of the key thrust in good manufacturing practices is setting up lean manufacturing with an effective Kanban system.

II. LITERATURE REVIEW

"**Lean Manufacturing Case Study with Kanban System Implementation**" paper is published by nor Azian Abdul Rahmana, Sariwati Mohd Sharifb, Mashitah Mohamed Esa.

Lean manufacturing has been the buzzword in the area of manufacturing for past few years especially in Japan. The Kanban system is one of the manufacturing strategies for lean production with minimal inventory and reduced costs.

However, the Kanban system is not being implemented widely by manufacturing companies in Malaysia. Thus, the objectives of this case study are 1) to determine how does the Kanban system works effectively in multinational organization; and 2) to identify factors hindering Malaysian small and medium enterprises (SME) from implementing Kanban. Findings of the study suggest that top management commitment, vendor participation, inventory management and quality improvement are important for Kanban deployment and towards lean manufacturing [1]

"Implementation of Kanban system for inventory Tracking and establishing pull production (a case study)" paper is published by Vignesh Ravichandran, N.Ganesh Kumar.

The purpose of this paper is to analyze and implement Kanban system to pressure vessel manufacturing facility in order to manage its subcontract inventory. The facility manufactures air receivers and air-oil separators for compressors. The plant is not able to meet the demand of its customer due to production line stoppages. The facility experiences production line stoppages due to non-availability of the raw material (subcontract) inventory. This was primarily due to the absence of a proper model of inventory management and a system to track the status of on hand inventory. Tracking of raw material was difficult, as the variety of models manufactured in the facility was high. The problem of raw material non-availability was addressed by setting up a model of inventory to determine the required inventory levels for all the models. The issue of tracking the status of on hand inventory was addressed by implementing the Kanban system, which ensured raw material availability and also helped in establishing pull system. [2]

"Application of Kanban system for implementing lean manufacturing (a case study)"paper is published by B.Vijaya Ramnath, C. Elanchezhian and R. Kesavan.

This paper deals with implementation of lean manufacturing in Engine valve machining cell in a leading auto components manufacturing industry in the South India. The main objective of this paper is to provide a background on lean manufacturing, present an overview of manufacturing wastes and introduce the tools and techniques that are used to transform a company into a high performing lean enterprise. Value stream mapping is a main tool used to identify the opportunities for various lean techniques. The focus of the lean manufacturing approach is on cost reduction by eliminating Non- Value added activities.

Applications have spanned many sectors including automotive, electronics and consumer products manufacturing. In this paper, Value Stream Mapping (VSM) is used to map the current operating state for production line. This map is used to identify sources of waste and to identify lean tools for reducing the waste. To eliminate the wastes found from the current state map Kanban system is suggested for pre machining section and single piece flow concept is suggested for machining section. Then a future state map has been developed for the system with lean tools applied to it [3]

"**Electronic Kanban System"** paper is published by M.Raju Naik, E.Vijaya Kumar, B.Upender Goud

The project's objective is to study the role of Kanban in Production system. With the present rate at which the technology is evolving and the competition among the company there is a must among the manufacturer to produce their product at cost efficiency. The theory below hence describes about the impacts of KANBAN in an industry and its basic framework. In this paper we have talked about the Kanban efforts on a multi stage in order to improve planning and production and role of Kanban size in Just in Time Manufacturing are discussed. The problem faced by a manufacturing company (Oral B) and how they overcame it by implementing Kanban with a great margin of profit is discussed briefly. Future trends in implementing Kanban such as digital and E-Kanban and also the scope of their effects is explained as a part of study. The scope of the project is limited to discussion of current and future Kanban strategy.

This paper presents a case study of the use of an e-Kanban system to minimize operational and logistics issues for a parts supplier within the automotive industry. Measures of operations and logistics performance are examined both before and after the implementation of the e-Kanban system through a series of observations, in-depth interviews, and documentation reviews. The results indicated improvements in production lead times, financial costs, effective and efficient work processes, and reductions in waste [4]

"**Kanban implementation from a change management perspective"** paper is published by Mahgol Amin Tomomi Kubo

The purpose of this thesis is to investigate and analyze the implementation process of KANBAN, a lean technique, into a section of Volvo IT (i.e. BEAT). The KANBAN implementation into BEAT when 'resistance for change' and 'forces for change' arise is also analyzed. This implementation of KANBAN is equivalent to change taking place in the Volvo IT's operational process. The thesis follows theories and literature on change management and lean principles in order to support the research investigation [5]

III. PROBLEM STATEMENT

In any manufacturing industry, there are several problems are related to manufacturing waste, inventory, etc. these problems are generalize in all industries. Similarly some problems are found in molding section for our product JF& H/L LENS.

1. **Non continuous Streamlines in the company's processes** – In any manufacturing industry to streamline their processes throughout the entire organization, from the front office all the way to distribution is important. Efficiencies are witnessed and the manufacturer is able to work at its full potential. If these processes are not continuous then this results in a reduced manufacturing cost and increased speed to market.
2. **Different waste** – Lean addresses the Nine Areas of Waste: motion, inventory, waiting time, transportation, information, quality, overproduction, processing and creativity. By eliminating waste, a company has the opportunity to abolish time spent on unnecessary tasks.
3. **The job is never done** – A key element of Kanban is "continuous improvement." This means that there are continuous opportunities to become more KANBAN.

IV. INVENTORY MODEL

The flow of product JF H/L LENS after manufacturing. This flow shows how product was passed from every station, and how many times part was remain at one station.

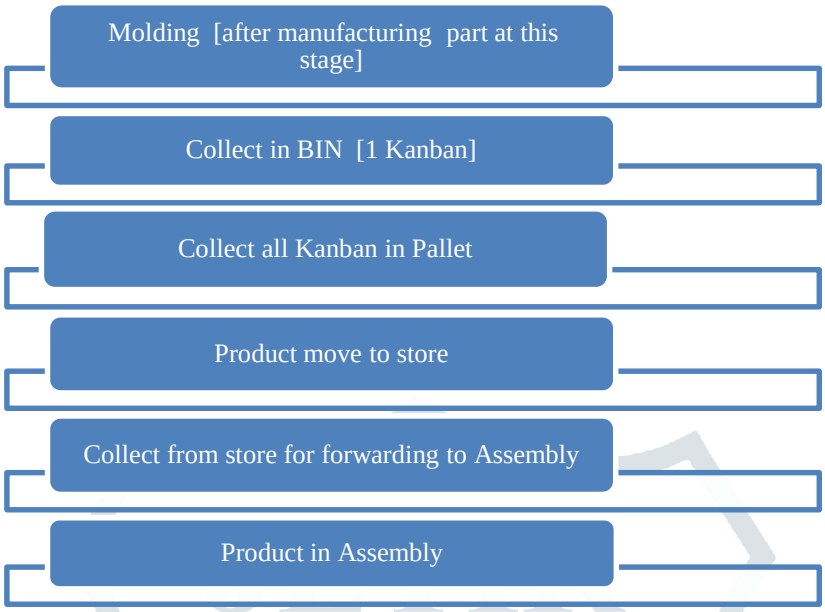

Fig. 1 Flow Chart of Inventory

V. KANBAN SYSTEM FOR INVENTORY TRACKING

One of the major problems in inventory is the tracking of the status of inventory. There was not any fixed batch quantity for the models and was dealt in arbitrary quantities. The major constraint is that the raw material occupies significantly more volume when compared to the actual JF H/F LENS. As the withdrawal was in arbitrary batch sizes, the materials department could not precisely track the raw material inventory. To enable the tracking and to curtail overproduction, kanban system has been implemented.

A *Kanban cards*

Kanban cards are a key component of kanban and they signal the need to move materials within a production facility or to move materials from an outside supplier into the production facility. The kanban card is, in effect, a message that signals a depletion of product, parts, or inventory. When received, the kanban triggers replenishment of that product, part, or inventory. Following image shows the Kanban Card for K-3H/L LENS product.

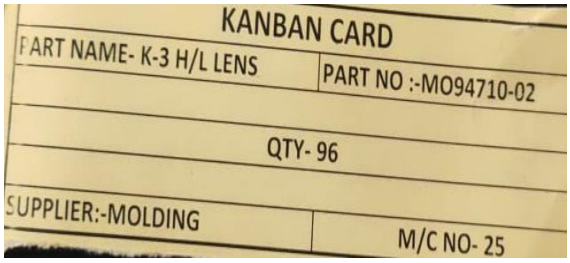

Fig.2 KANBAN Card

B *Kanban table*

A Kanban table is one of the tools that can be used to implement Kanban to manage work at a personal or organizational level. KANBAN table visually depict work at various stages of a process using cards to represent work items and columns to represent each stage of the process. Cards are moved from left to right to show progress and to help coordinate teams performing the work. A Kanban table may be divided into horizontal "swim lanes" representing different kinds of work or different teams performing the work. Kanban table can be used in knowledge work or for manufacturing processes.

Simple tables have columns for "waiting", "in progress" and "completed" or "to-do", "doing", and "done". Complex Kanban boards can be created that subdivide "in progress" work into multiple columns to visualize the flow of work across a whole value stream map.

Fig. 3 KANBAN Table

This icon indicates a location for collecting Kanban signals, typically located near a supermarket. In a two-card system it can be used to exchange withdrawal and production Kanban. In Minda Company same type of system are used under the KANBAN post.

C *KANBAN Post*

In Kanban post there are two color sections are their Red, and Green colors are used in Kanban post. The meaning of all that colors is differently. Kanban post having several rectangular boxes or slots in one big column.

Red color always indicate high priority, it means if any kanban card is obtained in red zone then it is having risk for late supply to the customer. Hence red zone work first completed and then go for next priority. Hence red zone always remain blank.

And after red zone employee focuses on green zone and take the action for completing next task. That means completed the all Work which is shown in green zone. The photo of actual KANBAN post in Company are as shown below

Fig.4 KANBAN Post

Fig.5 KANBAN Post At Shop Floor

VI. HOW KANBAN WORKS

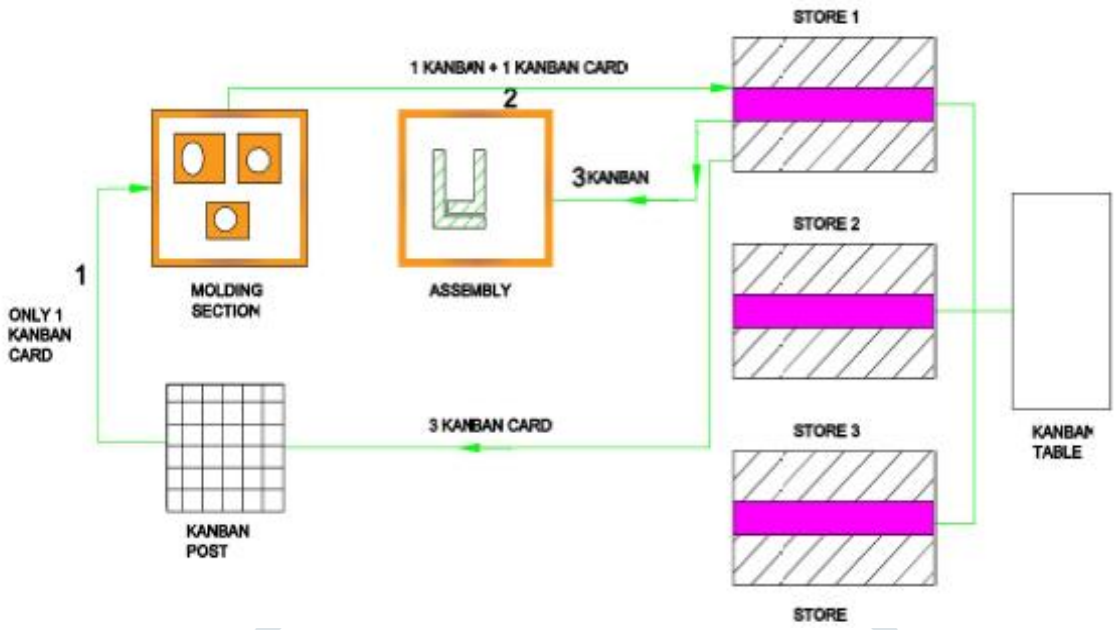

FIG. 6 WORKING OF KANBAN

A. PRODUCT PROCEDURE AND ACTIVITY

Steps	When	Who	Activity
I	Receive Material	Store	*Take Kanban from "Under request / delay of kanban box" * Attach kanban card to container ; one kanban to one container.
II	Supply to molding line	KANBAN post	*Take out Kanban card from container. *Put Kanban card into "collection" of kanban post.
III	Make delivery to Assembly line	Supplier	*Sent mail of Delivery request to supplier. *Send kanban for assembly.

B. NUMBER OF KANBAN IS CALCULATED BY

$$\text{Number of Kanban} = \frac{\text{Demand} * \text{Lead time } (1 + \text{safety stock\%})}{\text{container quantity}}$$

$$\text{Kanban} = \frac{d \times L \times s}{c}$$

$$= \frac{592 \times \frac{1}{2} + \frac{0.50}{100} \times 592}{112}$$

$$= 2.66 \approx 3$$

Where, d= Demand of product on time basis
L= Lead time
S= Stock of safety

C= Bin Capacity

KANBAN =3/day

$$= \frac{\times 6}{18\ kanban\ /week} \qquad \frac{\times 4}{72\ kanban/\ month}.$$

Product Name = K-3 H/L Leans.
Product Required = 12000/ month.
Lead time = 2 days.
Cycle time = 55 sec.
Cavity = 1.

Solution:-

1] Daily demand = $\frac{Product\ required}{days\ in\ month}$

$= \frac{462 \times 55 \times 2}{\frac{1}{3600}}$

= 14.1 hr.

2] Product per hour = $\frac{per\ day\ required \times cycle \times Lead\ time}{\frac{Cavity}{3600}}$

$= \frac{12000}{26}$ = 461.53

= 461.53 ≈ 462 =462 / day.

3] Lot size = Required per day × Lead time

= 461.53 × 2

= 923

4] Shot lot = $\frac{Lot\ size}{Cavity}$

$= \frac{923}{1}$ = 923

5] KANBAN Hour = $\frac{Lot\ size}{\frac{Quantity\ in\ Bin}{Product\ per\ hour}}$

$= \frac{923}{\frac{96}{14.1}}$

= 0.61

= 0.61 ≈ 1

= 1 hr.

6] Pattern no. of KANBAN = $\frac{Lot\ size}{Qusntity\ of\ bin}$

$= \frac{923}{96}$

= 9.61

= 9.61 ≈ 10

= 10

7] Safety no. of KANBAN = $\frac{Required\ /day \times Safety\ stock}{Quantity\ of\ Bin}$

$= \frac{462 \times 0.50}{96}$

= 2.40

8] Total no of KANBAN = Patterns of KANBAN + Safety of KANBAN

= 10+3

= 13.

Hence we got no. of KANBAN is 13

VII. RESULT

With the help of applying KANBAN system in molding to assembly section we have following results

1. Shipping raw material according to the KANBAN quantity.
2. Withdrawal of inventory in fixed batch sizes.
3. Pull production process
4. Visual control by means of the kanban board
5. Production only made to the required inventory specified in the kanban card.
6. Waiting time has been reduced as only required amount of inventory is processed.
7 Supermarket systems are implemented where inventory is replenished only if it falls below a certain level.
8. Kanban cards are used to track inventory at the molding end.
9 No production line stoppages due to material non-availability.

VIII. CONCLUSION

The major differences prior to and after implementing the KANBAN system. The implementation of KANBAN system has ensured raw material availability and hence prevents production line stoppages. The kanban system has also helped in preventing over production and dumping of inventory.

This case study demonstrates how KANBAN can effectively use to exert control on inventory, which contributes substantially to costs.

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