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IMPLEMENTATION OF PULL-SYSTEM USING KANBAN

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Abstract

The fluctuations in demand and customer requirements have made many established companies in improving their manufacturing process by adopting advanced system. One of these systems is PULL SYSTEM, which utilizes KANBAN.

This paper deals with implementation of pull system with the use of HUB (WARE HOUSE) WITHDRAWAL KANBAN (HWK) in a leading auto-component supplier for Automobile/Automotive companies in INDIA. The objectives are of two-fold; the first one is to implement pull system and the other is to utilize material handling equipment to best of its use. This case study mainly focussed on 'A' Category items of Ball-pins and Sockets, which are major components of the company.

The result showed that customer demand is unpredictable and maintaining inventory in optimal level is difficult task. Pull system is one good tool in maintaining inventory at its optimal level.

Introduction

The basic concept of push and pull originated from marketing, but are widely used in the field of logistics and supply chain management. With a push-based supply chain, products are pushed through the channel, from the production side up to the retailer. The manufacturer sets production at a level in accordance with historical ordering patterns from retailers. It takes longer for a push-based supply chain to respond to changes in demand, which can result in overstocking or bottlenecks and delays (the bullwhip effect), unacceptable service levels and product obsolescence. In a pull-based supply chain, procurement, production and distribution are demand driven rather than to forecast. However, a pull strategy does not always require make-to-order production.

A distinction is made between push and pull production systems based on the trigger point. The pull system is based on customer orders, while a push system is based on forecasts. In short, push systems can be compared with MRP systems that utilize past information to forecast the future customer demands. In the case of a pull system, the difference between the safety stock point and the state of current inventory is similar to just-in-time, which controls the order quantities.

The block diagrams in figure 1 and 2 give a simple working of a push and a pull system.

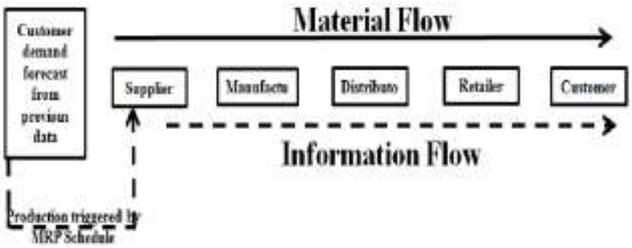

Fig 1: Information Flow, Material Flow, Production trigger process in Push System.

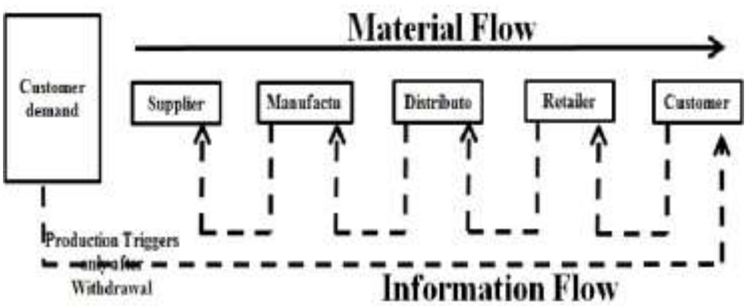

Fig 2: Information Flow, Material Flow, Production trigger process in Pull System

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The fluctuations in inventory levels in a push system are affected by forecasting errors, while the fluctuations in customer demand affect the pull system. Most of the production problems can be solved by using an appropriate pull system. Three basic types of pull production systems are:

- **Super-market pull system**: The most basic and widespread type, also known as a fill-up or replenishment pull system. In a supermarket pull system each process has a store -- a supermarket -- that holds an amount of each product it produces. Each process simply produces to replenish what is withdrawn from its supermarket. The disadvantage of a supermarket system is that a process must carry an inventory of all part numbers it produces, which may not be feasible if the number of part numbers is large.
- **Sequential pull system:** A sequential pull system may be used when there are too many part numbers to hold inventory of each in a supermarket. Products are essentially "made-to-order" while overall system inventory is minimized. In a sequential system, the scheduling department must set the right mix and quantity of products to be produced. This can be done by placing production kanban cards in a heijunka box, often at the beginning of each shift. A sequential system requires strong management to maintain, and improving it may be a challenge on the shop floor.
- **Mixed super market and sequential pull system:** Supermarket and sequential pull systems may be used together in a mixed system. A mixed system may be appropriate when an 80/20 rule applies, with a small percentage of part numbers (perhaps 20%) accounting for the majority (perhaps 80%) of daily production volume. Often an analysis is performed to segment part numbers by volume into (A) high, (B) medium, (C) low, and (D) infrequent orders. Type D may represent special order or service parts. To handle these low-running items, a special type D kanban may be created to represent not a specific part number but rather an amount of capacity. The sequence of production for the type D products is then determined by the method the scheduling department uses for sequential pull system part numbers.

Pareto's principle

Classifying inventory items according to their usage decides status of the company and best suited will directly stands for success of supply chain management and ABC classification is one of the most commonly employed inventory classification technique which is based on the 20/80 rule.

Pareto Principle employs the following rule of thumb - "vital few and trivial many". According to this rule, 20% of materials accounts for 80% of total annual consumption and 80% of materials accounts for 20% of total annual consumption.

At the end of the year, total consumption figure is multiplied by the price per item. These annual consumption figures are arranged in descending order.

- 'A' Category - Top 75% of the total annual consumption value.
- 'B' Category - Middle 15% of the total annual consumption value.
- 'C' Category - Bottom 10% of the total annual consumption value.

Kanban

Kanban (literally signboard or billboard in Japanese) is a specific type of inventory control system. The kanban system is based upon a series of coloured cards. These cards denote such factors as quantity, the type of part and the manufacturer. A card is placed in the bin or other container with each group of manufactured items as an identifier for those involved with the next phase of production or distribution.

The concept behind the lean manufacturing tool is to reduce costs in high volume production lines. One-way to do this is to smooth and balance material flows by means of controlled inventories. Translated as signal this allows an organization to reduce production lead-time, which in turn reduces the amount of inventory required.

The two most common types of Kan-bans are outlined in figure 3and are as follows:

1. **Withdrawal (Conveyance) Kan-ban: The** main function of a withdrawal Kan-ban is to pass the authorization for the movement of parts from one stage to another. Once it gets the parts from the preceding process and moves them to the next process, remains with the parts until the last part has been consumed by the next process. The withdrawal Kanban then travels back to the preceding process to get parts, thus creating the cycle.
2. **Production Kan-ban:** The primary function of the production Kan-ban is to release an order to the preceding stage to build the lot size indicated on the card.

Types of kanban are outlined in figure 3.

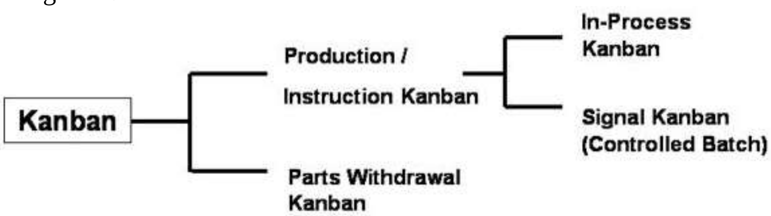

Fig 3: Out-line of types of KANBAN

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Toyota's Six Rules In Using Kanban

- Later process picks up the number of items indicated by the kanban at the earlier process.
- Earlier process produces items in the quantity and sequence indicated by the kanban.
- No items are made or transported without a kanban.
- Always attach a kanban to the goods.
- Defective products are not sent on to the subsequent process. The result is 100% defect-free goods.
- Reducing the number of kanban increases the sensitivity.

Methodology

In this section, the details of how kanban system is developed by the notables of the company for implementing the best structured method in pull system (continuous flow system) are presented. Wastes are eliminated by reducing the problems like Stock out and overstock situations.

The structured method in achieving the objective of case study is as follows:

1. Designing how the flow of kanban should be.
2. Gathering relevant documents/parameters required for kanban.
3. Designing kanban card.
4. Calculating number of kanbans to determine optimum level of inventory from past data.
5. Establishing pull mechanism and rule to assist production associate in daily operation.
6. Monthly review for the kanban status.

The flow sequence should be well designed and the documents of all the parameters that are required by the kanban are gathered and these documents are well organised, which gives all details of that kanban card. Kanban card must be designed such that all parameters should be covered/filled and from the past data, the kanban quantity to the optimum level should be determined, which adds value to the company's profit.

The mechanism is pull mechanism and the rule should be advertised to all the personnel who are literally assisted for the production that are associated in daily operation. Kanban status is reviewed by the head of Materials Management Department (MMD) on monthly basis and this review is based on marks system with four valid points.

The status of kanban can be evaluated for 100% and these 100% are divided into four major points

- Material stock at hub at right time (during in-warding) by the supplier.
- Quality of material that withdraw from the hub.
- Right mode of transportation (Use of Material Handling Equipment).
- Communication for easy flow of pull system.

The marks awarded for the first two are same (30 marks) and the last two carry 20 marks each. Sample piece in evaluating the status is as shown in Table I.

TABLE I
EVALUATION TABLE FOR PUNCH RATNA FASTENERS

Supplier - Punch Ratna Fasteners	**Oct'2015**		**Nov'2015**	
	Plan	**Actual**	**Plan**	**Actual**
Material stock in hub at right time (during in-warding) by the supplier.	30	20		
Quality of material that withdraw from the hub.	30	20		
Right mode of transportation (Use of Material Handling Equipment).	20	20		
Communication for easy flow of pull system.	20	20		
	100	80		

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Results & discussion

Hub (ware house) Withdrawal Kanban (HWK) is the kanban that are used for pull mechanism in the present case study. HWK is the kanban used in withdrawal of components from hub (ware house). The quantity for the kanban is determined by the following explanation.

Customer minimum lot size requirement is 48 numbers of parts. The processing time of one single component is 1 minute and 15 seconds. Then, the 8 hour shift (includes lunch, tea and of machine cleaning time) processes for 240 number of components. 240 is the multiple of the customer minimum lot size requirement. Therefore, the kanban quantity is ended up with 240 numbers. The material chosen for implementing pull system are ball pins and sockets which are major components of steering producing company, Mysuru.

The pull sequence is as shown in figure 4.

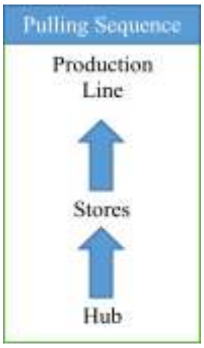

Fig 4: Pulling Sequence for the process

Initially, Production line triggers components and the materials from stores are issued to line, by detaching the HWK and placing it in HWK post. This indicates that material is required by the stores in the next trip of transportation so to fill the empty space. The hub representative will flow the information between company and hub. The ideal concept of pull system has been pictorially showed in figure 5.

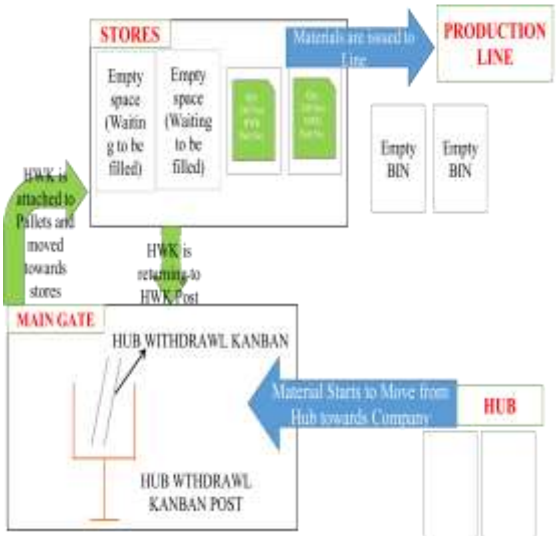

Fig 5: Pull System Concept using kanban

Safety stock/Max stock inside the plant is determined as 4 kanbans and the sum will be 960 Nos. The part numbers planned to work under this process are given in table II.

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TABLE II
'A' CATEGORY ITEMS: BALL-PIN, SOCKET USED FOR IMPLEMENTING PULL SYSTEM

Sl No	Part Number	Part Description
1	320330410-100	SOCKET-ARMADA-AXEL -
2	320330410-200X	SOCKET SEMI M/CD – AXLE
3	320337410-300	SOCKET S/MCD IFS-LOWER-1ST SIDE
4	320337410-100	SOCKET S/MCD IFS-LOWER
5	320337390-200	IFS UPPER SOCKET SEMI M/CD
6	320337310-100	SOCKET IFS UBJ
7	321036410	BALL PIN FORGING-IFS LBJ
8	321037010	BALL PIN FORGING-TELCO UPPER
9	320108410	SOCKET M14-THREADED ISHIKAWA
10	321030710	BALL PIN FORGING-ARMADA/AXLE UPPER
11	321030610	BALL PIN FORGING-ARMADA/AXLE LOWER
12	320336090-200X	TELCO UPPER SOCKET SEMI M/CD
13	310110110-100	SOCKET-EICHER SEMI M/C'D
14	320335310-100	SOCKET SEMI M/C'D-TELCO LOWER
15	310122110-100	SOCKET STEM TURNED TAFE LH
16	321007010	OBJ BALL PIN FORGING - 800CC-ISHIKAWA
17	321035310	BALPIN FORGING -T(L)
18	311010310	BALL PIN BP3X(290)
19	310160110-100	SOCKET SEMI GRES SEMI M/C'D
20	321024010	BALL PIN FORGING-NH
21	320307010	SOCKET-LCA-800CC
22	320338810	SOCKET FORGING-TAVERA LBJ
23	320108610	SOCKET FORGING -OBJ- 800CC
24	310121310-100	SOCKET PIERCED
25	311025210	BALL PIN FORGING (MF LH)
26	321026710	DANA -BALL PIN FORGING
27	320108610-300X	M 12 OBJ SOCKET FINISHED - 800CC
28	320330792	SOCKET MACHINED - SCORPIO LBJ RP
29	320311610	SOCKET-VAN LCA
30	310122310-100	MMTD M18 SOC. SEMI M/C'D
31	310121310-300	DANA SOCKET SEMI MACHINED
32	320330712	SOCKET FORGING - SCORPIO LBJ RP
33	320151010-100	SOCKET LP609

The steps involved in achieving the present objective are summarized below:

1. Flow starts at stores by issuing materials to production line and from hub to stores.
2. Documents that gathered per kanban are part number, part description, supplier name, vendor code.
3. Rectangular Card is designed and consisted of part number and description at left top of card, supplier name and code at right bottom of card and kanban name and quantity at centre of card.

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4. 960 numbers are predetermined as the maximum stock that consisted maximum of 4 HWK at stores. Two empty bins are placed at hub, which will be useful for in-warding of materials in the next trip.
5. Pull mechanism is used and is assisted for the production which will be associated with daily operation.
6. Monthly review is carried on 1st week of every month by the head of Materials management Department (MMD).

Conclusion

This paper presented a real industrial case study of kanban system implementation in a manufacturing company. The research findings showed that kanban system is essential in ensuring the success of pull system and to create smooth flow of parts/components throughout manufacturing system. Major problems like stock out and overstock situations are solved effectively by pull mechanism.

Systematic and commitment in implementing kanban system is crucial in ensuring the effectiveness in maintaining inventory at its optimal level. The ultimate goal is to meet customer satisfaction. Manufacturing pace will be well controlled and is synchronized with market demand.

Company's profit has increased by 2% to 5% by utilizing this process. Therefore, it can be concluded that implementation of kanban system has improved the efficiency of manufacturing system and this should be a part of the core task of JIT practitioner.

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