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AUTOMATE THE FLOW OF MATERIAL USING PULL SYSTEM (KANBAN SYSTEM)

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Abstract- This paper deals with Master Production Schedule to give a broad outline of the requirements for resources at different work centers in the production industry. Using a pull system in MPS for the purpose of deciding appropriate resource requirements of work stations, this system is not used to decide the production rate for each workstation. In the pull system, the information regarding material move is the same as the push system. But the information concerning processing of parts or build schedule is given by the subsequent process. Hence the material direction and build schedule information direction opposite to each other.
A kanban in a pull system is a card attached to a standard container that issues the production and withdrawal of parts between work stations. Kanban system is used to control the production of parts.
Kanban system is used to reducing waste at every workstation and improves production as well as the quality of the product. The present article briefly explains of kanban system and how to use this as a tool for managing production as well as inventory.

Keywords- Kanban system, JIT, inventory, rules, flow sequence, Scheduling.

1. Introduction-

Kanban system is designated as the Toyota Production system because it was developed by Mr. Taiichi Ohno and Eiji Toyoda to achieve objectives of company objectives.Kanban is the Japaneseword, which means that card signal. Kanban is a major component of Toyota production system. It is used to control work in process, production and inventory flow. Kanban is a card system attached to a standard container that allows the production and withdrawal of parts between work centers. The major strength of a kanban is its simplicity which means it possible for worker to make a decision at the workstation level concerning the production rate. Any change in demand is communicated to the final assembly level and thus change, in term, is communicated through kanban to every other workstation upstream exactly at the required time. Just-in-time is a manufacturing system whose goal is to optimize processes and produces by continuously pursing waste reduction. In just-in-time system, the subassemblies parts required for final assembly is pulled in small batches from the supplying work centers whenever they are needed. Kanban is the one of the most popular method used for the implementing JIT.Kanban system is used to achieve following advantages such as-

- Full control can be maintained at the workstation.
- Provides a simple and understanding process of production and inventory flow.
- Limitation of over-capacity in processes.
- Provides quick and precise information of process in the production of parts.
- Provides quick response to changes in the production process and avoids overproduction as well as minimizes waste.

Toyota developed the kanban system to meet out the global competition, in which the work in process (WIP) is managed and controlled more accurately than material requirement planning (MRP). Use a control system to convey parts between work stations in small quantities.

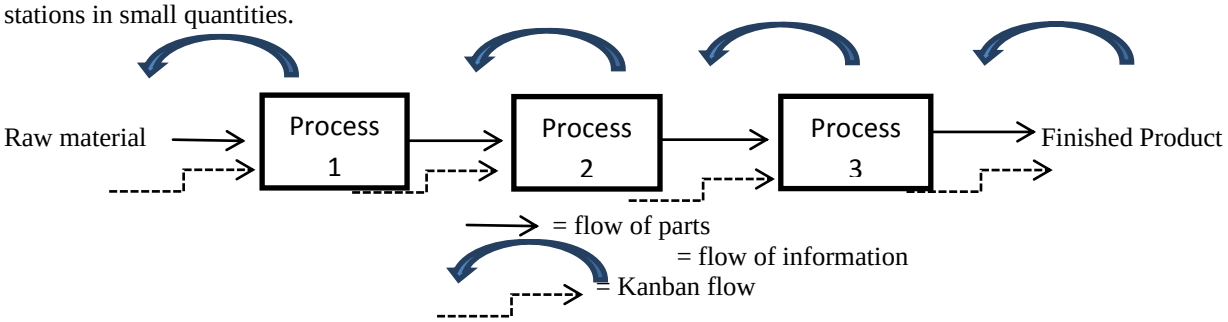

Figure 1: Pull System

2. Literature Review-

Kanban is a visual card system. Kanban is used as a trigger production at every stage. A Kanban represents the immediate requirements of the next stage. Kanban guides everyone in an industry from machine operator to trolley driver to know what the next process to be carried out.it is used to controlling inventory. Kanban applied to lean manufacturing, is a stocking technique using containers, cards and electronic signal to make production systems respond to real needs and forecasts.

A. Selection of Kanban items-

- For process change according to demand flexibility.
- For process stability.
- For tool life keep under systematic review.
- Self-certified items, that are past 6 months there is no quality issue.
- Inspected raw material report must be submitted once in 3 months.

B. Types of Kanban-

The kanban consists of a set of cards that travel between preceding and subsequent processes, communicating what parts are needed at the subsequent processes. It is used to move materials driven by the usage of parts and to control work in process, production and inventory. The most commonly used kanban are –

(i) Withdrawal Kanban
(ii) Production Kanban

(i) Withdrawal Kanban-

Withdrawal Kanbanis also known as conveyance Kanban. The primary function of a withdrawal Kanban is to pass the authorization for movements of parts from one work center to another. Once it fetches the parts from the preceding process and move them to the subsequent process, it remains with them until the last part has been consumed by the subsequent process, then the withdrawal kanban travels back to the preceding process to fetch parts and the cycle continuous.The withdrawal Kanban should have information such as the part number and part name, lot size and routing process name and location of the subsequent process, name and location of the preceding process, container capacity and number of container released. Layout of a withdrawal kanban for a hypothetical shop.

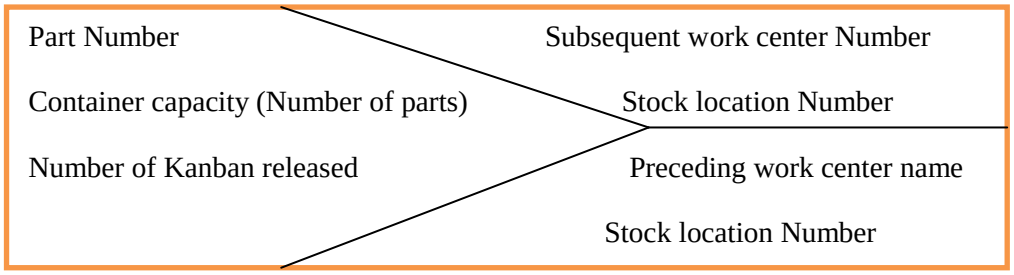

Figure 2: Withdrawal Kanban

(ii) Production Kanban-

This kanban system is used to release an order to the preceding process to build parts equal to the lot size specified on the visual card. In this system, the information regarding to the input at the preceding process should be place.

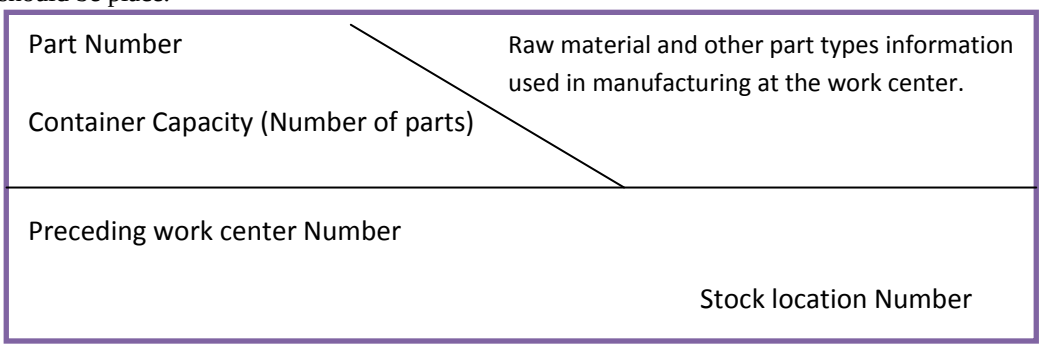

Figure 3: Production Kanban

C. Flow of withdrawal and production Kanbans and their interactions-

For understanding the flow of withdrawal and production kanbans as well as the flow path of containers consider a flow chart uses in industry.

Controlling work flow between preceding and succeeding stage PPS1 and PPS2 separated by a staging area. The sequence of movements of Kanban (withdrawal as well as production) and containers between the preceding centers and the staging area is described as follows.

i. Suppose starting point is P1 in the staging area. Move the full parts container to the subsequent processing stage SPS2.
ii. Detach the attached withdrawal card and send it to Kanban collection box at point P2. Meanwhile the parts being used by the subsequent stage.
iii. Once all the parts in a container are consumed of SPS2 attach a withdrawal Kanban form the Kanban collection box to the empty container and move it SPS 2 to location P3 in the staging area.
iv. Now at the P3 location, detach the withdrawal Kanban from the empty collection and attach it to a full parts container and also remove a production Kanban from the container to be sent to subsequent stage PSP. Send it to the proceeding stage PPS1 to trigger production of a full container. Empty container is sent from P3 to the preceding stage.
v. Put all the parts produced in the empty container and send to staging area SA with the production Kanban attached to it.

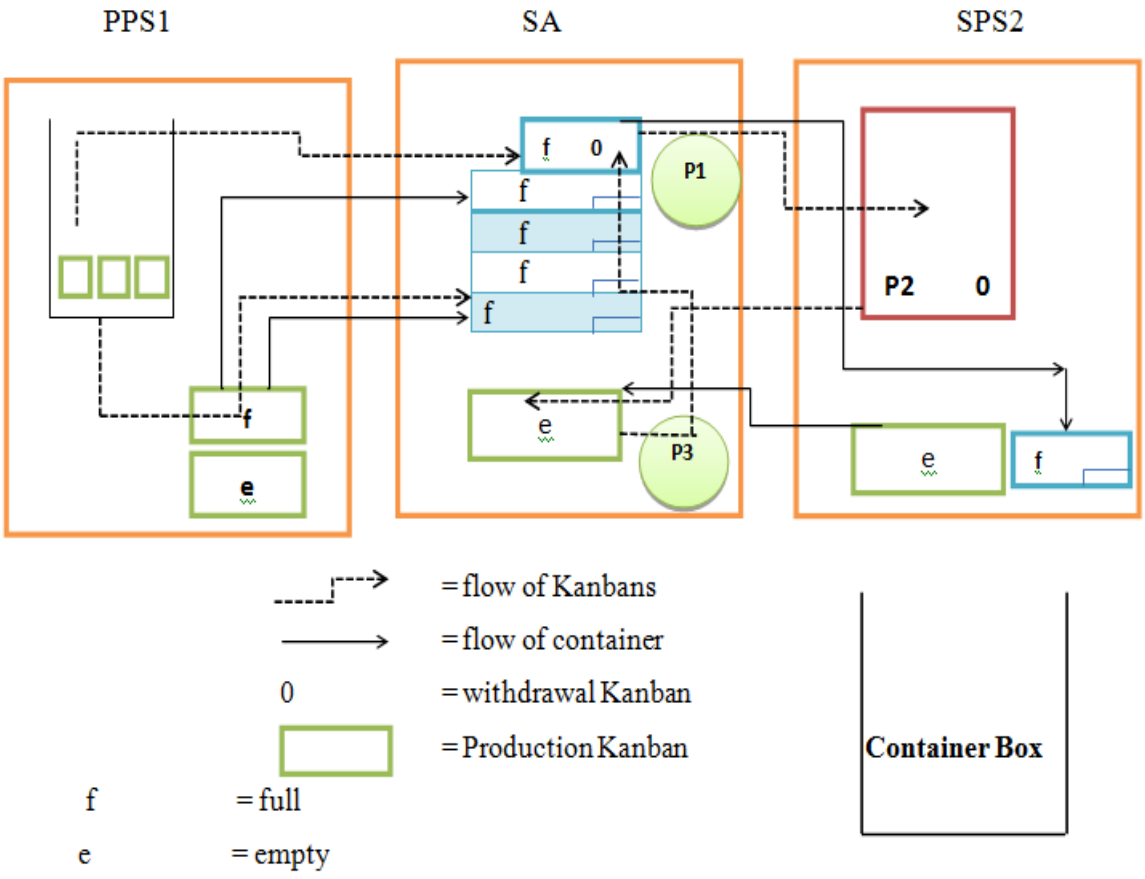

Figure 4: flow sequence in a Kanban production system

D. Rules for operating Kanban-

In order to achieve JIT production, Kanban is useful tool to manage the workplace effectively. The rules for effectively operating the Kanban are-

Table 1: Rule for operating Kanban

Rule	Description
1	No withdrawal of parts without a Kanban. Only a Kanban can authorize the flow of the parts from a preceding process to the subsequent process.
2	The subsequent process comes to withdrawal only what is needed. To ensure that the subsequent process does not arbitrarily withdrawal parts from the preceding process. The following steps are needed to implement the second rule- Step1- No withdrawal without Kanban. Step2- Number of parts issued to the subsequent process should be exactly what is specified by the Kanban. Step3- The parts in containers must be accompanied by Kanban.
3	Do not send the defective parts to the subsequent process.
4	The preceding process should produce only the exact quantity of parts withdrawn by the subsequent process.
5	Smoothing (to minimize the fluctuation) production.
6	Fine tuning of production using Kanban.

E. Kanban Planning and Control models-

Kanban is the heart of the JIT system. The number of Kanbans plays the most important part in planning, controlling and reducing the work in process inventories.

(a) A deterministic model for determine the number of Kanbans-

$$\textbf{Number of Kanban (y)} = \frac{D(T_w+T_P)(1+\alpha)}{a}$$

Where,

y = Number of Kanbans

D = Demand per unit time

T_w = Waiting time of Kanban

T_P = Processing time

a = Container Capacity (not more than 10 percent of daily requirement)

α = a policy variable

- α is a policy variable which is used as a means of managing external disturbances such as changes in demand and variability in processing and delivery times.
- When D increases the value of the lead time must be reduced accordingly.
- In order to reduce the values of a,α and lead time $(T_w + T_P)$ should be continuously pursued.

Appendix A. Table of abbreviations

S.No.	Description	Abbreviations
1	Work-in-Process	WIP
2	Just-in-Time	JIT
3	Master Production Schedule	MPS
4	Preceding Stage	PPS
5	Staging Area	SA
6	Subsequent Stage	SPS

3. Conclusion-

The traditional way of production techniques are not suitable to respond to the challenges like global economic completion, rapid social and technological changes, so it leads to development of new technologies in industries for the production. In this paper we presented the Kanban system used to achieve JIT concepts. In this system, manufacturing of defective parts should

not be tolerated and quality of the parts should be maintained. Small variations in production requirement can be adjusted. Kanban is a chain process in which orders flow from one process to another process. In Kanban system; the policy variable should be playing an important task to achieve feasible production condition in industry. Most of manufacturing industries used Kanban for in house material control.

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