POTENTIAL OF KANBAN IN THE MANUFACTURING PROCESSES OF CUSTOMIZED PRODUCTS

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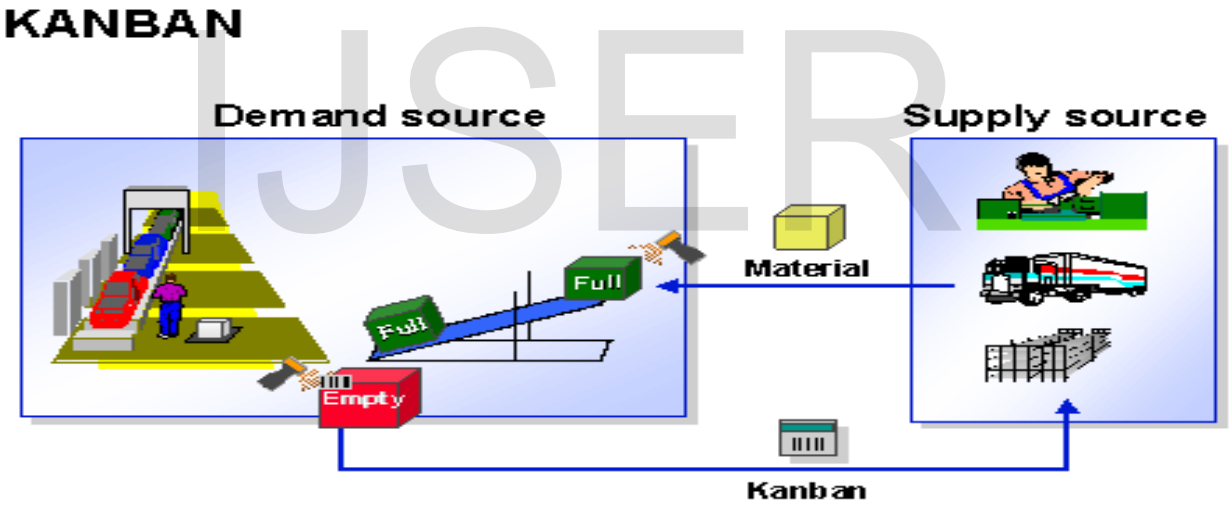
Abstract

A Japanese word meaning "card signal." It represents any visual method used to show the need for parts or products to be moved or produced. In Kanban the material flow is organized by the cards that are fitted in each container. Each container contains one material with fixed quantity.

As soon as the container is emptied at the demand source the replenishment is initiated. The supply sources can be in another place and it can be an In house Production, An external supplier or a warehouse. The demand source will use another full container until the previously emptied container is re filled.



KANBAN is implemented with the modules MM (Materials Management) and PP (Production Planning) in automobile client. It helps to the business to achieve lean inventory management by pulling only the stock which actually business need. For this configure storage locations, supply areas, statuses and alerts and then then setup KANBAN specific master data.

Keywords— *Kanban, Manufacturing, RFID, Lean, In-house Logistics*

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1. INTRODUCTION

The Kanban system is one of the Japanese manufacturing methods created by Toyota (Olsson 2012) Motor Corporation. It is part of the Lean concept that aims to optimize production processes. These methods create most advantages, when they are applied to a manufacturing facility that operates according to a pull control. Thus, the production is phased according to the actual demand in the right time (Slack, Chambers, Johnston & Betts 2009: 362).

The motivation for the research was created within the employment organization that had demand for a Kanban implementation project. An additional benefit for the author was being able to deepen the knowledge of Lean manufacturing concept and different kinds of Kanban systems both in theory and in practice.

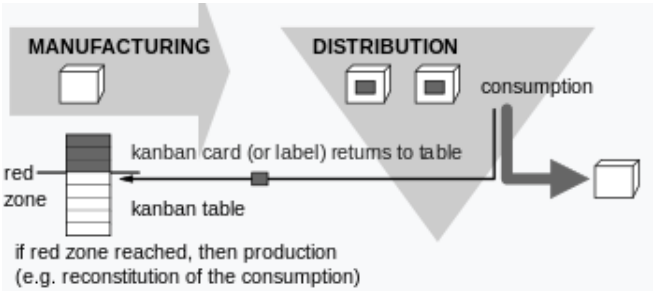
2. RESEARCH OBJECTIVE

The report researches the actual potential of Kanban system in the inventory management and the manufacturing processes of customized products based on the theory and real business life case studies. The aim is to objectively outline the advantages and disadvantages of implementing the Kanban system and define the theoretical and/or practical reasons behind these results. The research area includes, but is not limited to, Industrial Management, Operations Management, Logistics and Kanban. The literature review consists of academic articles retrieved via EBSCOhost and Science Direct, publications available at academic library of Tritonia, eBooks and case studies from various Internet sources and additional classified business materials of the employer company involved.

3. BACKGROUND

3.1 KANBAN Processing

Kanban maintains inventory levels; a signal is sent to produce and deliver a new shipment as material is consumed. These signals are tracked through the replenishment cycle and bring extraordinary visibility to suppliers and buyers.



One key indicator of the success of production scheduling based on demand, pushing, is the ability of the demand-forecast to create such a push. Kanban, by contrast, is part of an approach where the "pull" comes from demand. Re-supply or production is determined according to the actual demand of the customer. In contexts where supply time is lengthy and demand is difficult to forecast, often, the best one can do is to respond quickly to observed demand. This situation is exactly what a Kanban system accomplishes, in that it is used as a demand signal that immediately travels through the supply chain. This ensures that intermediate stock held in the supply chain are better managed and/ are usually smaller. Where the supply response is not quick enough to meet actual demand fluctuations, thereby causing potential lost sales, stock building may be deemed more appropriate, and is achieved by placing more Kanban in the system.

3.2 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 depletion of product, parts, or inventory. When received, the Kanban triggers replenishment of that product, part, or inventory. Consumption, therefore, drives demand for more production, and the kanban card signals d

product—so kanban cards help create a demand-driven system.

It is widely held[citation needed] by proponents of lean production and manufacturing that demand-driven systems lead to faster turnarounds in production and lower inventory levels, helping companies implementing such systems be more competitive.

In the last few years, systems sending kanban signals electronically have become more widespread. While this trend is leading to a reduction in the use of kanban cards in aggregate, it is still common in modern lean production facilities to find use of kanban cards. In various software systems, kanban is used for signaling demand to suppliers through email notifications. When stock of a component is depleted by the quantity assigned on kanban

Card, a "kanban trigger" is created (which may be manual or automatic), a purchase order is released with predefined quantity for the supplier defined on the card, and the supplier is expected to dispatch material within a specified lead-time.

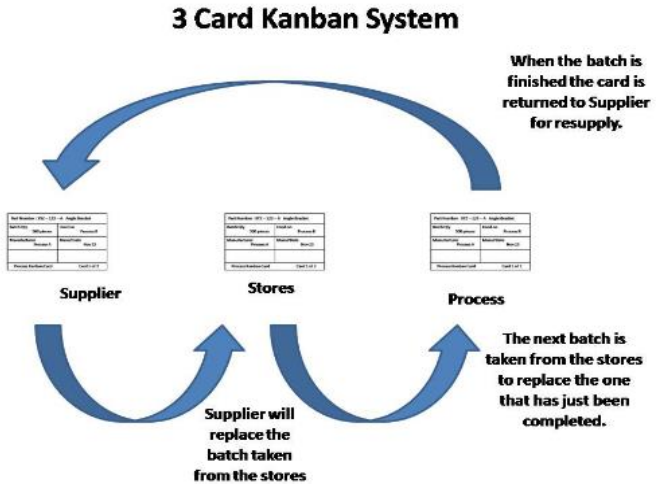
Kanban cards, in keeping with the principles of kanban, simply convey the need for more materials. A red card

lying in an empty parts cart conveys that more parts are needed.

3.3 KANBAN: Three Bin System

An example of a simple kanban system implementation is a "three-bin system" for the supplied parts, where there is no in-house manufacturing. One bin is on the factory floor (the initial demand point), one bin is in the factory store (the inventory control point), and one bin is at the supplier. The bins usually have a removable card containing the product details and other relevant information—the classic kanban card.

When the bin on the factory floor is empty (because the parts in it were used up in a manufacturing process), the empty bin and its kanban card are returned to the factory store (the inventory control point). The factory store replaces the empty bin on the factory floor with the full bin from the factory store, which also contains a kanban card. The factory store sends the empty bin with its kanban card to the supplier. The supplier's full product bin, with its kanban card, is delivered to the factory store; the supplier keeps the empty bin. This is the final step in the process. Thus, the process never runs out of product—and could be described as a closed loop, in that it provides the exact amount required, with only one spare bin so there is never oversupply. This 'spare' bin allows for uncertainties in supply, use, and transport in the inventory system. A good kanban system calculates just enough kanban cards for each product. Most factories that use kanban use the colored board system.



Case Study

The first case study is chosen because the company involved has a similar field of business than the company for which the master's thesis is currently being conducted. Both manufacture a wide variation of electric motors. In the first case study Kanban is being implemented mainly for stamped metal castings that are one of the main components in motor production. These parts require special attention because the supplier's plant is situated in Mexico and the motor manufacturing plant is in the central United States. Therefore, the shipping time is long, and the deliveries are weekly truckload quantities. The main problems are related to inventory management because forecasting the correct customer demand beforehand is extremely difficult. It has resulted in high inventory levels of castings, since the company tries to avoid frequent stock-outs that lead to missed delivery dates and line downtime in production. (Gross et al. 2003: 223–224.)

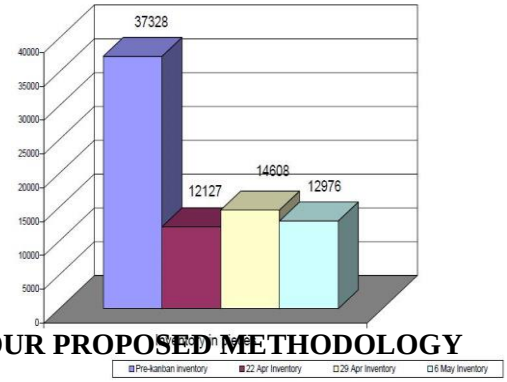
The situation before Kanban implementation was alarming. The total number of castings for motor production was fifty-two of which thirty-eight were entitled to a volume that required a stock. Castings were ordered on a three-week lead-time and the demand was forecast based on an

MRP system. Since the demand had high variation and the lead time was long, the company ended up having an average inventory level of over eighteen days of production and significant variations in quantities ordered. Because of large inventory levels the company had to rent

warehouse space adding an unnecessary cost in order to assist its production. (Gross et al. 2003: 224.)

The solution in the first case study was to implement a pull system and streamline the supply chain. Kanban was the main tool during this process. Since the products were customized, it was impossible to reduce the variation of customer demand. In addition, creating a buffer with finished products would not have helped to decrease the inventory levels. The supply chain

was modified to meet the actual demand and react faster to the variation. (Gross et al. 2003: 224.)



4. OUR PROPOSED METHODOLOGY

We proposed implementing 'KANBAN processing with In house manufacturing' and with one year of project work, all outlined issues were addressed. Depiction of flow which was implemented in automobile client is below

4.1 Steps Involved in 'KANBAN Processing In house manufacturing

The below steps will help to setup by a Kanban cycle for the In- house production with a REM cycle.

4.1.1 Master Data

4.1.1.1 Production Supply Area Setup

All the Kanban control cycle are created with specific to material plus supply area combination. So, production supply area is one of the important master data. It is an interim storage location on the shop floor which is used to provide material directly to the production line or the work center. It is customized with Plant S. Location / Person responsible. Goods movements are posted to the storage location assigned to the supply area. One Storage location can be assigned to several supply areas; however, one supply area cannot be assigned to several storage locations.

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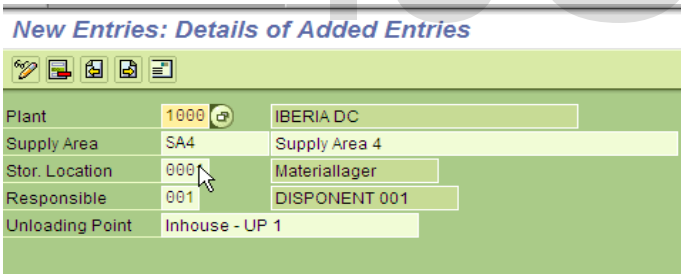
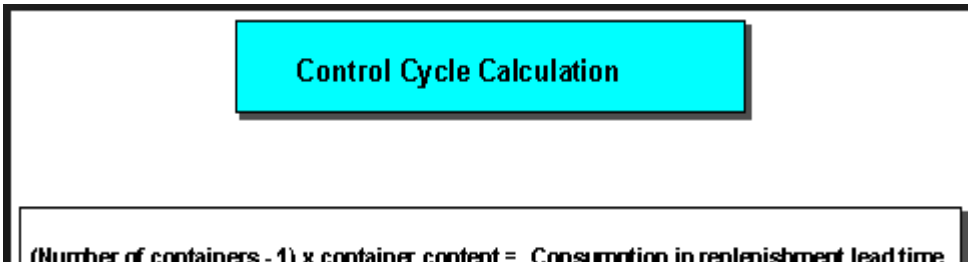
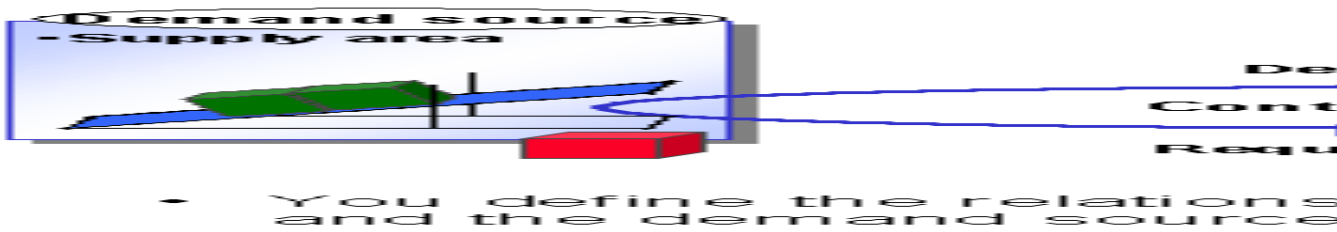


4.1.1.2 Kanban – Control Cycle Creation

The control cycle defines the relationship between the demand source and the supply source. The control cycle contains the following control data for KANBAN production: Kanban circulation, that is, the number of Kanban and the Kanban quantity. The basic data required for automatic Kanban calculation, if necessary. Replenishment strategy Printing Kanban, if necessary, The delivery address, if necessary The process control (for example, indicator for separate goods receipt, status sequence key, indicator for the logic for triggering replenishment for 'one-card' KANBAN), if necessary.





4.1.1.2 Kanban – Replenishment Strategy

The replenishment strategies define in the control cycle how replenishment is to take place:

- Using in-house production
- Using external procurement
- Using stock transfer

The replenishment strategies also determine whether and which replenishment elements (run schedule quantities, production orders, and so on) are created by the kanban signal.

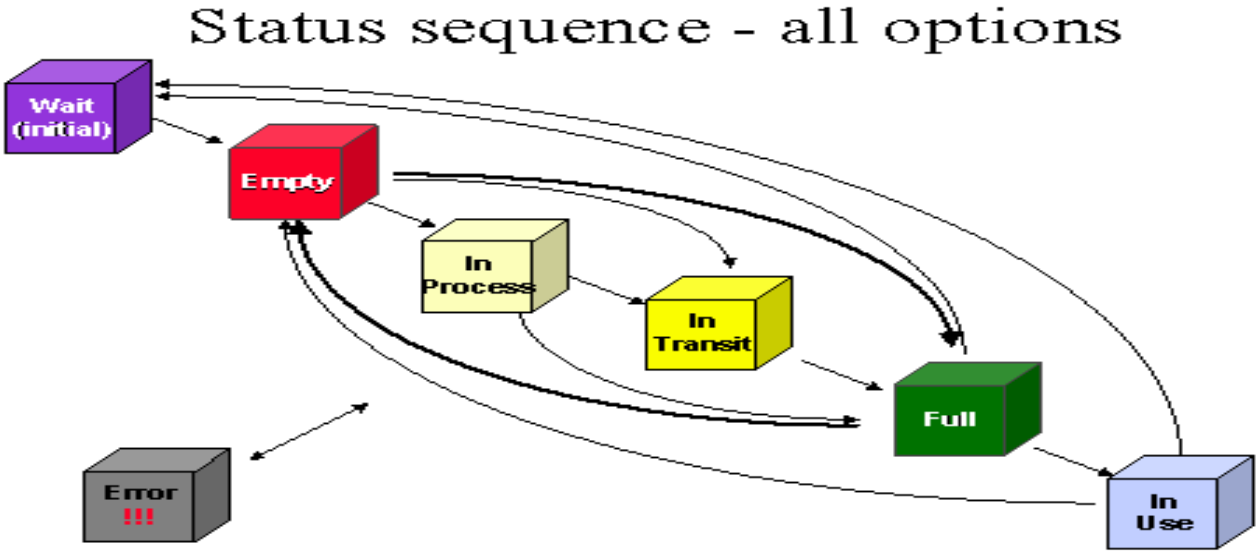
The replenishment strategy is assigned to the material in the control cycle.

4.1.2 KANBAN Control

This component describes the functions of KANBAN control. It explains, amongst other things, how the signal is triggered to replenish a material and which replenishment strategies are available.

4.1.2.1 KANBAN Signal

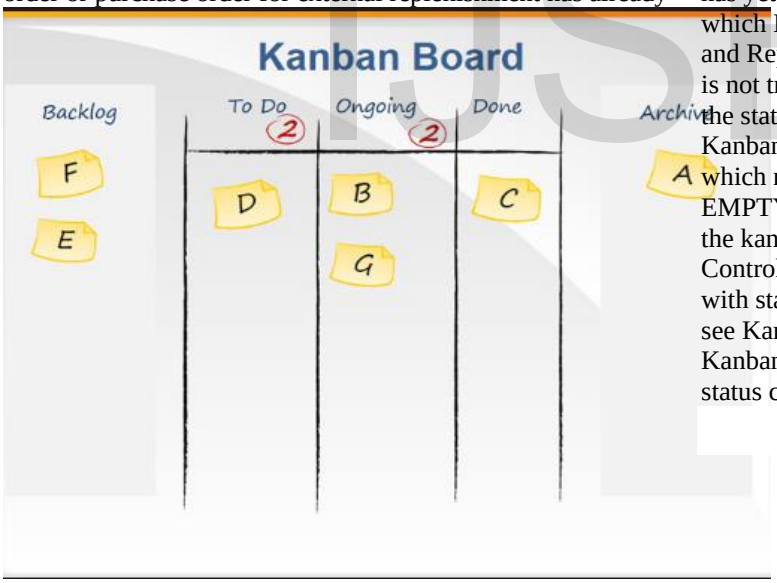
The KANBAN signal, usually in the form of a bar code, triggers a status change. In general, it is sufficient to work with the two statuses EMPTY and FULL. The KANBAN signal occurs, in general, after using the bar code. When a kanban is empty, the system receives the necessary information on the control cycle and replenishment, and automatically makes the postings required to trigger replenishment. When a kanban is full, the system automatically posts the goods receipt for the replenishment (depending on the settings).



4.1.2.2 KANBAN Board

To provide the demand source as well as the supply source with a detailed overview circulation, you have the option of using the kanban board. The kanban board can also be used to trigger the kanban signal.

The following information is available with the kanban board: Kanban's with the status EMPTY. Replenishment has been triggered for these Kanban. That is, a planned order, production order or purchase order for external replenishment has already been created in the background. Kanban's with status FULL, from which you can withdraw material. In control cycles where the status change and goods receipt are separated, the system also displays whether the separate goods receipt for the full kanban has already been made or not ('+' means goods receipt has taken place; '-' means that it has not taken place). Kanban with status WAIT. These are Kanban that have been newly introduced to the control cycle and for which no procurement has yet been triggered. Kanban in control cycles, for which Independent Supply Source/Separation of Status Change and Replenishment has been defined. In this case, replenishment is not triggered automatically when the demand source changes the status. Instead, the supply source triggers replenishment. Kanban that have been assigned the locking indicator and for which no replenishment has been triggered since they were set to EMPTY. Kanban can only be locked in the control cycle or by the kanban calculation. Please also read Creating/Changing a Control Cycle for Classic KANBAN and Calculation. Kanban with status IN PROCESS or IN TRANSIT. Please also see Kanban Board from the Supply Source View .
Kanban with the status ERROR. If an error occurs during the status change, the kanban is considered faulty.



5. PROCESS FLOW OF KANBAN IMPLEMENTED IN AUTOMOBILE INDUSTRY

The Kanban System is considered a formalization of the JIT (just-in-time) method. Kanban's greatest contribution is the "PULL" method, meaning that inventory is requested based on demand as ordered, as opposed to the "PUSH" system, in which inventory is sent to the assembly plant based on forecasted need, not considering the actual need. The KANBAN system is organized using a series of card in order to execute each phase. These cards labels state what phase of the vehicle manufacturing process the goods are currently in. There are three main labels:

- Withdrawal Kanban (K1): This is the order made to the provider based on production needs.
- Production Kanban (K2): This is the order for the provider to manufacture pieces, based on the withdrawal Kanban issued by the assembly plant.
- Transport Kanban (K3): This is the order to transport these pieces to the assembly plant.
- K1, K2, and K3 are names used to illustrate this procedure based on the following system:

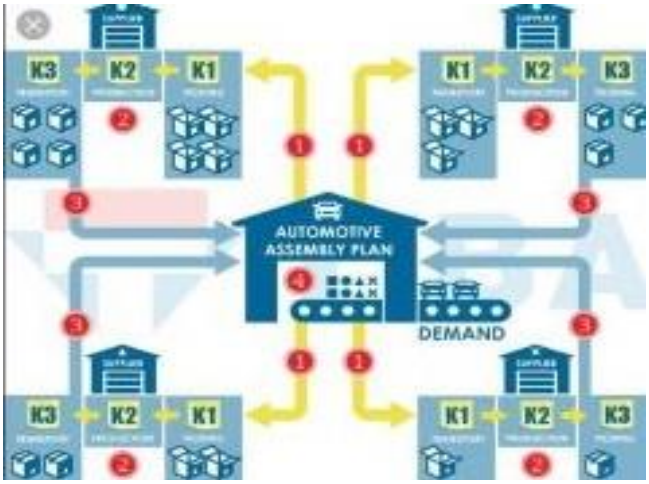


Fig 9: Process flow implemented in automobile industry

The assembly plant has a specific need for parts. Before they run out, the plant issues an order to each provider with the exact demand quantity (withdrawal Kanban).

2. Each provider (in this case, the tier 1 and 2 suppliers) manufactures the goods based on the request received. It does so through a production order (production Kanban).

3. The automotive parts are sent to the assembly plant based on said demand (transport Kanban).

4. The assembly plant receives these parts without interrupting its production.

The main advantage of the Kanban System is that it can absorb variations in the flow of demand as a function of highs and lows in production. In addition, the Kanban System sees the entire production line as a single process, assembling one piece (a vehicle) across the entire cycle without any interruptions or waste fulness.To summarize, there are five rules in the Kanban System:

- When the assembly plant is about to run out of a part, a withdrawal Kanban is issued.
- The parts are only produced in the quantities requested in the Kanban.
- Nothing is produced or transported without a Kanban order.
- All batches of parts are associated with a Kanban.
- The more productive this process, the fewer Kanban cards in circulation.

6. RESULT

Our research was well appreciated by both the users as well as the management of the company who felt that the models were easy to understand and reflected the company's business objective. However biggest concern was to reduce the idle time in a production process. The main idea behind the Kanban system is to deliver what the process needs exactly when it needs Modern manufacturing firms use sophisticated production scheduling software to plan production for each period, which includes ordering the correct stock. Information is exchanged with suppliers and customers through an Electronic Data Interchange (EDI) to help ensure that every detail is correct.

7. TECHNICAL CHANGES REQUIRED FOR ACTIVATION OF KANBAN

Depending on business practice we must implement Below technical changes in company to activate KANBAN process

'Define No range for Control cycle. A control cycle is the critical Kanban master data that maintains information about how the system will create replenishment elements when a demand source sets a Kanban to EMPTY.

Define No range for KANBAN Id No. The system assigns a unique internal identification (ID) number to every Kanban that it creates. To define the internal number range for the Kanban ID number.

Define MRP Controller. A MRP controller is a person responsible for the supply area.

Define replenishment strategy. The replenishment strategy, which is defined in Customizing for KANBAN and which is assigned to a material in the control cycle, controls whether procurement is to take place using in-house production or external procurement or whether stock is to be transferred between storage locations.

8. CONCLUSION

In this paper we have provided a process to implement KANBAN Process. To overcome the challenges of having to much work and not enough time to take a step back, many teams have found Kanban to be a good starting point. Kanban offers a systematic approach to identifying opportunities for improving efficiency. Plus, Kanban is a practice, so teams can leverage its principles in their everyday work instead of having to stop what they are doing to focus on a new improvement initiative. When a team practices Kanban to identify opportunities, they can use its proven methods to invent and implement their own unique solutions.

There are many advantages to using the kanban system to manage work, including:

- Flexibility
- Focus on continuous delivery
- Reduction of wasted work / wasted time
- Increased productivity
- Increased efficiency
- Team members' ability to focus

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