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A PATH FOR HORIZING YOUR INNOVATIVE WORK

APPLICATION OF KANBAN TOOL IN INVENTORY MANAGEMENT

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Abstract: Lean manufacturing it is a comprehensive set of techniques that, when combined and matured, will allow you to reduce and then eliminate the waste from a company. Lean manufacturing is more than a set of tools and techniques and has been widely adopted by many production companies. Lean manufacturing is a culture in which all employees continuously look for ways to improve processes. The present article intend to make a briefly presentation of Kanban system and how a company can use this tool for managing the inventory. This method is one of the most used methods to reduce the waste and continuous business improvement.

Keywords: Kanban, lean manufacturing, inventory

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INTRODUCTION

The challenge to organizations utilizing lean manufacturing is to create a culture that Lean manufacturing is a performance based process used in manufacturing organizations will create and sustain long-term commitment to increase competitive advantage. The basics from top management through the entire of lean manufacturing employ continuous workforce. This principles have been applied improvement processes to focus on the successfully worldwide in the auto industry elimination of waste or non value added and are being increasingly employed in many others industrial sectors [1]. steps within an organization. In the 1970s, it became clear to a select Lean Manufacturing is a term popularized few that the Japanese, most notably by Womack, Jones and Roos to describe a Toyota, had found a better way to method for production based on the Toyota manufacture cars, which caused a number of Toyota Production System (TPS). Within very interesting things to happen. First, organization, four prominent gentlemen and most notably, the majority are credited with developing the system: manufacturing world went into a huge case Sakichi Toyoda, who founded the Toyoda Group in 1902, Kiichiro Toyoda, son of of denial. This was heard as "that will Sakichi Toyoda, who headed the automobile work in Japan, but not here" and a variety manufacturing operation between 1936 and of other statements that could politely be said to have lacked insight. From that 1950, Eiji Toyoda and Taiichi Ohno, small group came a series of efforts to try errors. The way it should be fix the errors to capture parts of the Toyota Production is to use things like cycle counts which System that were serving Toyota so well. Then take more people, more time, more the piece that seemed the most appealing computers, and worst of all more reports was the JIT concept. It was rapidly and more meetings. In addition, we must popularized as an inventory reduction care for this inventory to make sure it does effort, which in fact is only a part of what not get damaged. And finally, we must ship it really is. JIT practitioners came out of it before it becomes obsolete. All of these the woodwork and many companies went liabilities of inventory are obvious bottom-about implementing kanban and slashing line opportunities, and yet the greatest inventories to reduce the high cost of advantage of reduced inventory is not even producing and managing the inventory. mentioned here. In fact, it is often not even Some of the companies start to use the recognized. In just a minute, the company "zero inventory" slogan and slashed will get to that crucial advantage which so inventory with such fervor it was as if they few see and even fewer appreciate. Kanban were pursuing the Holy Grail of means sign board. A kanban can be a manufacturing. Many early efforts at variety of things, most commonly it is a imitating Lean production focused on the card, but sometimes it is a cart, while other Just in Time (JIT) concept of inventory times it is just a marked space. In all cases, reduction [2]. its purpose is to facilitate

flow, bring about In this article, we presented why many of pull, and limit inventory. It is one of the these efforts failed, why a company have key tools in the battle to reduce inventory, why they need inventory, and overproduction. Kanban provides two the reasons why a company strive to major services to the Lean facility. Kanban reduce inventory. Moreover, we presented provides two types of communication. In the kanban concept and the six rules of both cases, it gives the source, destination, kanban management. part number, and quantity needed. The kanban system is very flexible, and many types of kanban can be used.

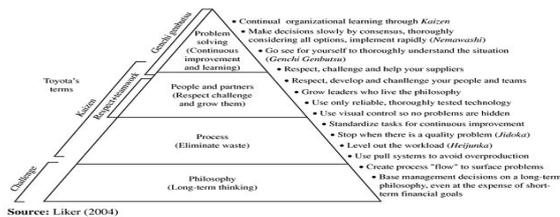


Figure 1: 14 Principles of the Toyota Way (Liker, 2004)

2. Description of the Kanban System

Kanban: A tool to achieve just-in-time which consists of a card containing all the information required to be done on a product at each stage along its path to completion and which parts are needed at subsequent processes (Monden, 1993). Likewise, as long as they follow the basic rules of Kanban, they can be used in a large variety of ways

2.1. Basics

2.1.1) 5S

5S is another lean tool that Toyota uses to eliminate waste. The principle behind this method is visual control, which helps surface problems and improving the work environment. The idea was to clean and organize the work place to the point where problems would be visually obvious. Instead of a mess in a factory that could easily hide waste, 5S would clean out and organize that same factory to make problems stand out. The 5 Sís as stated in The Toyota Way by Liker are as follows:

1. Sort ñ Sort through items and keep only what is needed while disposing of what is not.
2. Straighten ñ iA place for everything and everything in its place.
3. Shine ñ The cleaning process often acts as a form of inspection that exposes abnormal 1. and pre-failure conditions that could hurt quality or cause machine failure.
4. Standardize ñ Develop systems and procedures to maintain and monitor the first three Sís.

5. Sustain ñ Maintaining a stabilized workplace is an ongoing process of continuous improvement.

Besides making problems more visible, 5S also helps sustain Toyota's strive for continuous improvement, as the last of the 5 S's indicates. Kanban tickets serve as a visual signal to control abnormalities in production (Monden, 1993). The absence of a Kanban ticket on a container can work as a signal that a problem exists. Also, a Kanban ticket can determine whether working overtime is necessary or not. Digital display panels show the pace of production, the day of production, and the number of units that has been produced during the day (Monden, 1993). Inventory costs a lot of money and majority of kanban follow a standard companies try to solve this problem. First, pattern. Process improvement in a Kanban there are the raw materials and operating system is accomplished by the reduction of expense it costs to produce it. Next, a inventory, witch can be achieved by: company must handle it, which means that - reducing any of the four replenishment they need more people and machines like times or reducing the pickup volume by forklifts. Usually moving the material the customer, this is usually achieved by around, more than once before it gets to it increasing the pickup frequency; desired location. - reductions in any of these items will This in turn requires space and reduce cycle stock inventory; transportation and neither are free. Next, - reducing the variation in the production we must keep track of it, which means rate, which allows safety stock reductions; people, computer programs, and reports - reducing the variation in the customer galore, almost all of which are filled with demand, which allows buffer stock errors. The company should try to fix these reductions. Apreutesei, M., et al.: Application of Kanban System for Managing Inventory 163 The kanban system it is a powerfull tool easily bypasses all the accounting and for reducing the waste during production planning systems that tend to not only because first it is direct communications to delay this signal but also add variability produce material, in other words, to supply along the way. The kanban system is and the customer [3]. dealing real time with the realities of what is happening on the line. Second, kanban It is the pull signal to produce. Once the product is withdrawn by the customer, at creates an absolute limit on total inventory. that moment the kanban tells us exactly Since each kanban represents a certain what the customer is using, and hence what amount of stock, and the number of kanban the customer will need later. This kanban are strictly controlled and limited, this is sent as fast as possible to the production creates an upper limit on the inventory. line. In essence, the kanban system is Below is presented a formula witch is doing the "talking" to the production using in production to show how kanbans system, telling it to produce because some could flow between a customer cell and a product has been removed.

2.1.2 Withdrawal Kanban:

The main function of a withdrawal Kanban is to pass the authorization for the movement of parts from one stage to another (Monden, 1993). The Kanban in Figure 1 shows that the subsequent process (machining) requests the parts from the preceding process (forging). The part, which is a drive pinion, must be made at the forging process and picked up for the subsequent process at the position B-2 of the forging department. The box has shape type B and each of them contain 20 units of the part needed. This Kanban is the fourth of eight sheets issued.

Store Shelf No. <u>5E215</u> Item Back No. <u>A2-15</u>		Preceding Process
Item No. <u>35670S07</u>		<u>FORGING</u>
Item Name <u>DRIVE PINION</u>		<u>B-2</u>
Car Type <u>SX50BC</u>		Subsequent Process
		<u>MACHINING</u>
Box Capacity	Box Type	Issued No.
<u>20</u>	<u>B</u>	<u>4/8</u>

Figure 1. Withdrawal Kanban.

2.1.3 Production ordering Kanban. :

The primary function of the production Kanban or in-produce (Monden, 1993). The Kanban in Figure 2 shows that the preceding machining process SB-8 must produce an item called craft shaft for a car type SX50BC-150 and the part must be placed at store F26-18.

Store Shelf No. <u>F26-18</u> Item Back No. <u>A5-34</u>	Process
Item No. <u>56790-321</u>	<u>MACHINING</u>
Item Name <u>CRANK SHAFT</u>	<u>SB-8</u>
Car Type <u>SX50BC-150</u>	

Figure 2. Production ordering Kanban.

2.2 Signal Kanban :

A signal Kanban is tagged into a box within the production lot (or batch) and is used to specify lot production in the stamping processes. Two types of signal Kanbans are used (Monden, 1993):

2.2.1 Triangular Kanban:

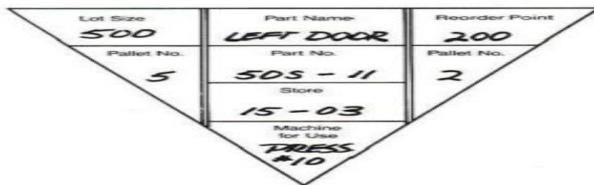


Figure 3. Triangular Kanban.

The triangular shaped Kanban in Figure 3 shows that an order from punch press process # 10 is required when the lot size is down to 200. It is placed on pallet 2 of 5.

2.2.2 Material requisition Kanban :

The rectangular shaped Kanban in Figure 4 shows that the press process # 10 must go to the store 25 to withdraw 500 units of steel board, when the left doors are withdrawn down by two boxes.

Preceding Process	STORE 25 → PRESS #10		Subsequent Process
Back No.	MA 36	Item Name	STEEL BOARD
Material Size	40x3'x.5'	Container Capacity	100
Lot Size	500	No. of Container	5

Figure 4. Material requisition Kanban.

2.3 Production Smoothing Method

“Heijunka” is the Japanese word for production smoothing (Tapping, 2002). It is a method for planning and leveling customer demand by volume and variety, while keeping the level of production as constant as possible over a specific time period. Production smoothing is very important state when implementing a Kanban system and reducing idle time regarding labor, equipment, and work-in-process inventory (Monden, 1993). It is the basis of the Toyota production system.

Standardization of Operations

Standardization of worker actions is an important principle in eliminating wastes (Ohno, 1988). It refers to organizing the job and performing it in the most effective way. In a standardized workplace every worker follows the same steps within the production process. The Toyota production system includes in its standard operations three elements:

1. Cycle time: The time necessary to produce one piece or unit.

2. Standard operation routine: The order of operations in which workers process a product.
3. Standard inventory: The minimum amount of work-in-process inventory necessary to process a product. This system supplier cell.

Step 1

$$\frac{\text{Designed daily production rate} \times \text{replenishment time}}{\text{available time}} = \text{Kanban quantity}$$

Step 2:

Replenishment time that is less than one quantity Kanban shift would result in a two-bin system.

Step 1

$$\frac{\text{Kanban quantity}}{\text{lot size}} = \text{number of cards. (2)}$$

Lot size may be required due to weight, size, A, B, C categorization, setup times,

$$\text{Step 1: } \frac{90 \text{ pieces} \times 15 \text{ hours}}{7.5 \text{ hours}} = 180 \text{ piece}$$

"A" parts = 1/2 day demand, or

$$\text{Step 2: } 180 \text{ pieces} \div 45 \text{ pieces} = 4 \text{ cards}$$

(2) cards. of number = size lot

Replenishment time that is greater than one shift would result in a card system.

Lot size may be required due to weight,

For example:

size, A, B, C categorization, setup times, hours 15 pieces \times 90pieces, =180

Step 1: (3) hours 7.5pieces. 45 or demand, day 1/2 parts A"" =

Step 2: cards 4 pieces 45 pieces = \div 180. (4)

Every Kanban system should have the (inventory and lead-time) have a major minimum identification requirements, influence on continuous improvement within a cellular operation. In Figure 1 is witch are: part number, part description, presented an example of a Kanban card. part quantity, point of supply, point of consumption, "one of... cards" (e.g., 1 of 3; 2 of 3; 3 of

3). The determination of Kanbans is an important step in the cell design process because Kanbans are the limiting factor for inventory levels (raw material, WIP, finished goods) and are the control element Fig. 1. Example of a Kanban card on lead-times. These operational aspects kanban card Bulletin of the Transilvania University of Brasov • Vol. 3 (52) - 2010 • Series function is to move with the actual material.



2.4 . Kanban Circulation

If the actual material and kanban can The kanban contains information that consistently move together, the following serves as a work order. It is an automatic become possible: no overproduction will directional device which gives information occur, priority in production becomes concerning what to produce, when to obvious (when the kanban for one item produce, in what quantity, by what means piles up, that is the item that must be and how to transport it. The kanban system produced first), and control of actual was created to do the following: engage in material becomes easier. The shape of the standard operation at any time, give kanban is not fixed. Depending on the directions based on the actual conditions processes they are made of iron, they can be existing in the workplace and prevent a in size or triangular in shape. The important deluge of paper which cannot serve as consideration is how it's best to transmit the future source materials. Another kanban requisite information accurately [4].

The six rules of the Kanban

Table 1

Rule no.	Rule	Function
1	Later process goes to earlier process and picks up the number of items indicated by the <i>kanban</i> .	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 <i>kanban</i> .	Provides production information and prevents overproduction.
3	No items are made or transported without a <i>kanban</i> .	Prevents overproduction and excessive transportation.
4	Always attach a <i>kanban</i> 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 <i>kanban</i> increases their sensitivity.	Inventory reduction reduces waste and makes the system more sensitive.

Later process goes to earlier process and Creates pull, provide pick up or transportation :

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5 Defective products are not sent to the Prevents defective parts from advancing: subsequent process. identifies defective process.

6 Reducing the number of kanban increases Inventory reduction reduces waste and makes their sensitivity. The system more sensitive.

The kanban system is very flexible, and production line. If they go to planning, they many types of kanban can be used. generally do little with the Kanban, but they Likewise, as long as they follow the basic like to stay in the loop. From planning, the rules of Kanban, they can be used in a large kanban are sent to the front of the variety of ways. However, the majority of production line per the information on the kanban follow a standard pattern. Let's kanban. The kanban are then placed in the follow a kanban as it is circulated. Since heijunka box, a load leveling tool. From Lean thinking usually works best if we here, the production workers withdraw the start at the customer and work backwards, kanban from the box in sequential order, let's do just that. Since Rule 3 says that the and the process then produces the product has kanban attached. When the in the quantity listed on the kanban. customer comes for his pickup, the kanban The kanban has just served to be a are removed and placed in a kanban post. production work order and is infinitely From here, the kanban are picked up, superior to any MRP type system to trigger normally by a materials handler, and production. The worker then attaches the transported to Planning, or ideally they go kanban to the products made and they are directly to the heijunka box in front of the placed in the designated spot, ready for Apreutesei, M., et al.: Application of Kanban System for Managing Inventory 165 pickup. On his normal circulation, the synchronization all stations would spring materials handler picks up the products, with into action and another would be produced, kanban attached. The kanban tell him exactly almost instantaneously. Once a customer where to deliver the products, normally this arrived, product was ready; however, if the is the storehouse, which completes the cycle. customer did not withdraw a product, no The Kanban have moved a distance and production

would occur. One hundred percent have consumed time by: n-time delivery and no overproduction - Transportation to, and time in, planning; mean a near perfect Lean system [5]. - Transportation time to and time spent This, of course, would only occur in a waiting in the queue, the heijunka box; perfect therefore, non-real system. - Time spent in the production line; Unfortunately, we mortals need to deal with - Time used to deliver the finished goods. the realities of life. These realities of life Process improvement in a kanban system include several issues. First and foremost is accomplished by the reduction of inventory. is the issue of variability. Since perfect The reduction of inventory and hence the synchronization is not possible, 100 percent reduction of kanban can be achieved by: on time delivery and zero overproduction - reducing any of the four replenishment are also not possible. Through these ideals times or reducing the pickup volume by might be ones to shoot for, they are the customer, this is usually achieved by typically impossible and many times increasing the pickup frequency; impractical. Variations always exist in rate, - reductions in any of these items will quality, people, machine and environments. reduce cycle stock inventory; They are inevitable and omnipresent. All - reducing the variation in the production this variation creates inventory. So, to rate, which allows safety stock reductions; compensate for the variation, we need some - reducing the variation in the customer buffers. This causes our total inventory to demand, which allows buffer stock rise and Little's Law tells us our lead time reductions. will increase, which likely will cause us to hold even more inventory as finished goods. So how do we reduce the inventory,

3. How Can the Kanban System Help

Avoid overproduction of both the local the Company? (WIP) and finished goods, bringing .Think for a moment about a perfect inventory to its minimum. Either task can be stockless (almost) manufacturing system. done simply, by doing both simultaneously It would have a cell where all the and well is the trick of a good business necessary processing steps are connected system. And that trick is kanban. with zero inventory between stations, one-The essence of kanban is two fold. First, piece flow, operating with 100 percent it is direct communications to produce availability and 100 percent yield, and material, in other words, to supply the hence the steps would operate in total customer. It is the pull signal to produce. synchronization. We would simply tell the Once the product is withdrawn by the operators to keep one unit of production in customer, at that moment the kanban tells the finished goods inventory and if the us exactly what the customer is using, and customer came and removed a unit, then hence what the customer will need later. and only then would we replace it. In this ,This kanban is sent as fast as possible to system, with 100 percent on-time delivery, the production line. In essence, the

kanban once the customer withdrew an item, it system is doing the "talking" to the would signal replenishment, and in total production system, telling it to produce because some product has been removed. tools exist, Kanban is one of the most This system easily bypasses all the powerful in the House of Lean and must be accounting and planning systems that tend applied totally, following all six rules of to not only delay this signal but also add the kanban management in order to be variability along the way. The kanban really effective.

CONCLUSIONS:

In this article we presented the Kanban system as the lean manufacturing tool used for reducing the inventory. Moreover, we have showed the 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. 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. The Kanban system it is direct communications to produce material. It is the pull signal to produce. In essence, the kanban system is doing the "talking" to the production system, telling it to produce because some product has been removed by their customers. Though a number of inventory reduction tools.

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