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Design and Implementation of Kanban System to Reduce Finished Goods Inventory

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Abstract: ***Lean manufacturing system principles that emphasize waste elimination and Just-In-Time have created new strategies to optimize operational costs and improve manufacturing efficiency. The push system aimed at making large inventories for customers is no longer done by Japanese companies. Most of them like Toyota use a pull system by using kanban to manage manufacturing control processes based on actual market demand. As a result, they are able to reduce their inventory and shorten lead time. Large inventories can be attributed to the amount of production that is not in accordance with consumer demand and excessive production will impact on overtime production costs. This study covers pre-requisite activities in building Kanban systems, starting from designing kanban flow (value stream mapping), making heijunka, and calculating kanban population. This paper studied the design and implementation of kanban system in local auto component company in Indonesia. The scope of the implementation was focused on the rear axle assembly process or known as rear-wheel drive. This paper concludes that implementation of the kanban system minimized inventory, reduced lead time, and minimized unnecessary overtime production cost. The purpose of this study is to show that Kanban system can reduce finished goods inventory, inventory cost, and production overtime costs.***

Keywords: inventory reduction, just in time, kanban system, lead time reduction.

1. Introduction

Over production is producing something earlier or in greater quantities than customer needs. Producing earlier or more than is required creates other wastes such as excess labor, storage, and transportation costs because of excess inventory [1]. There are several prerequisites for applying just in time / pull system, among others: following takt time, making stream flow of information and materials (Value Stream Mapping), making heijunka, and calculating kanban population. Takt time is the speed of making the product in accordance with the speed of sales. Mapping the flow of information and materials serves to map the problems that occur and target improvements to be made. Heijunka is a JIT tool to produce goods evenly against the amount and time. kanban is a card that can be used to perform production command functions, prevent excessive production, visual control, manual process improvement, and reduced management costs [2].

In order to provide the right solution then need to formulated the existing problems, as follows:

1) How to manufacture or design a kanban system consisting of takt time, value stream mapping, heijunka, and kanban?
2) Whether the implementation of kanban system can reduce inventory and finished goods inventory cost?
3) Will the results of the implementation of kanban system can reduce production overtime cost?

Based on the background and formulation of problems that have been in the analysis will be formulated the purpose of this study as follows:

1) Designing kanban system consisting of takt time, value stream mapping, heijunka, and kanban.
2) Implementing kanban system to decrease inventory and finished goods inventory cost.
3) Implement a kanban system to lower overtime production cost.

1.1 Just In Time

Just in time is an internal driver for production and operation management. In addition just-in-time is useful to reduce costs, improve quality, and shorten the lead time of manufacture. The new Toyota production system considers how to adjust production schedules to market demand changes at low cost, high quality, and delivery on time.[2]

Here are some steps of applying Just-In-Time [2]:

1. Implementing 5S as the basis for improvement
   The basis for improvement in the workplace is the concept of 5S: seiri (sorting), seiton (structuring), seiso (cleaning), seiketsu (stabilization), and shitsuke (habituation). If 5S has not been achieved it will often occur slowdown and defective items. In such work areas, in general the spirit of the workers is low.
2. Implementation of production evenly (heijunka)
   Here are the basic prerequisites for JIT:
   a. Make the layout of equipment and machinery in the order process.
   b. Connect adjacent processes.
   c. Create U-shaped production line.
   d. Align process to every worker in production line.
   e. Change the seated workers into standing workers.
   f. Produce with small lot size and fix setup time method.
   g. Work according to cycle time.
   h. Make the product according to the speed of sale (takt time).
   i. Autonomation (jidoka)
   j. Use kanban cards

1.2 Value Stream Mapping

To create a JIT concept required a tool that visually presents the flow of material and information to find out the time required to make the goods from the information received until sent to the customer. It became the beginning of Value Stream Mapping (VSM) and Toyota called it Material and Information Flow Chart (MIFC) [2]. There are several important points in making VSM , among others:

1) Use the current state map only as a basis for future state maps and to eliminate waste in all processes.
2) A future state map presents the concept of what it wants to achieve. The map does not show specific details of how the situation will be built.
3) Future mapping needs to be facilitated by someone with deep lean expertise. A person with a deep lean expertise within the group needs to have real experience with Lean and fully understand what is portrayed on the map.
4) Implement a Wallpaper of Value Stream Mapping.
5) Start with a map and implement it, then work on the next map and start implementing again until kaizen is done more deeply at all points inside the VSM.
6) Someone with the influence of management must lead corrective actions because the making of VSM aims to perform Kaizen in every process.
7) Do not just plan and do, but also check and act.

1.3 Kanban

Kanban is a pulling system tool in the form of a card or other signaling method for customers indicating that the customer is ready to get supplies. In addition there are other elements of visual control systems and standardized work. If the three elements of the pulling system are properly installed then a relationship between supplier and customer processes will occur [1].

The kanban system serves to reduce management costs by eliminating scheduling staff. Planners are not needed because the kanban system is a flow of information for sales and production. For kanban suppliers serves as a hint of when and how much material is needed. Here are some rules for implementing a kanban system [2], as follows:

1) The next process must take the required product, the required amount, and at the time required from the previous process.
2) The process before having to produce the appropriate amount taken by the next process of the previous process.
3) Defective products should not be forwarded to the next process.
4) The number of kanban must be calculated according to the lead time or to a minimum.
5) Kanban system can absorb the fluctuation order from customers.
6) The amount listed on the kanban shall be equal to the amount contained in the container.

In implementing kanban systems in the manufacturing area should be equipped with relevant equipment. Many tools are used to support the kanban system that serves to visualize the operation and ensure the producer line works in accordance with takt time, such as: heijunka board, lot formation post, kanban post, and kanban card that is tools used to run kanban system [3].

The kanban system uses two types of kanban namely Part Withdrawal Kanban (PWK) and Kanban Production Instruction (PIK). Production Instruction Kanban (PIK) serves as a production command in accordance with the pull of consumers. Part Withdrawal Kanban (PWK) is kanban withdrawal of goods. PWK is a kanban withdrawal of goods called Part Withdrawal Kanban. The PWK card is used to pull the required items from the previous process inventory and the PIK card is used to provide instructions for the previous process to produce what is needed to replenish inventory [4].

1.4 Heijunka

Heijunka means flattening the product mix for a certain period of time in order to produce all kinds of components every day or even every few hours. Customers generally do not order products of a certain batch size, but they are often produced in large lots. The concept is to produce goods in smaller quantities and according to customer demand [1].

The purpose of heijunka is to reduce the variability of customer orders by performing demand analysis over a period of time and producing patterns that fit into smaller time schemes. Heijunka can also create a constant flow in the production process. There are two stages of the leveling process that is the stage of leveling the volume and leveling the model variation [5]. The initial step to leveling the production process can be done by producing in large quantities the amount at which the production process follows the average demand given in the time interval or is called Every-Part-Every-Interval (EPEI) [6].

3. Method

Kanban system design process is divided into 3 three steps, the first is to create Value Stream Mapping or MIFC (Material & Information Flow Chart). The second step makes heijunka is to level the consumer withdrawal with the form of Withdrawal Kanban Part using Toyota Chased method method. The third step counts the number of Kanban Production Instruction population using Monden's formula, following explanation of each step of the kanban system design:

1. The first step is to create VSM (Value Stream Mapping). Value Stream Mapping is a troubleshooting method that can define current problems, identify goals, and recognize the gap between the current condition and the target condition. The following are some characteristics of a Value Stream Mapping / MIFC, as follows:
   a. Creating a MIFC / VSM that describes the current state and target conditions in which the process is interconnected forms a flow of processes and information using a kanban system for production orders and the taking of goods
   b. Producing in accordance with the speed of sale (takt time) and produce evenly (heijunka).

$$Takt\ Time\ Line\,(TTL) = \frac{Effective\ Working\ Hour}{Total\ Daily\ Order}$$

c. Every round of flow within VSM is influenced by takt time and cycle time. If CT is bigger than TTL then CT = ATTL (Actual Takt Time Line) means to meet the demand required extra hours overtime, here is the ATTL formula:

$$ATTL = \frac{Effective\ Working\ Hour\ + Overtime}{Total\ Daily\ Order}$$

d. Calculates lead time from when customer ordering, manufacture until product delivery.

2. The second step is to level orders by using heijunka. Heijunka is needed for equalization of workloads at each work post within the production line, keeping the operating time constant, and leveling the customer's tug at certain time intervals so that the order of production is in line with the consumer's demand. Here are the key points for making heijunka:
 1) Create customer part list
 2) Specify working hour
 3) Delivery cycle issue per destination
 4) Quantity per PWK
 5) Determine the average PWK per cycle
 6) Determine the maximum number of PWK per cycle
 7) Specify the number of heijunka columns
 8) Create a kanban pattern

3. The third step is to calculate the number of Kanban Production Instruction (PIK) by using Monden's formula:

$$y = \frac{LT \times (1+\alpha)}{TT}$$

Where,
y = *Number Of PIK* (*Production Instruction Kanban*)
LT = *Lead time*
TT = *Takt Time*
α = *Buffer, or safety factor*

Production Instruction Kanban is divided into two methods namely kanban by kanban and lot production. The difference between the two methods is in the dandori time (setup time) that affects the Lead time (LT) calculation. Here is an explanation of use for both methods:

1) Kanban Method By Kanban

This method is applied to a flexible production line or no setup time. Kanban by kanban method is usually applied to the assembly line. Here's the VSM production area with kanban by kanban method:

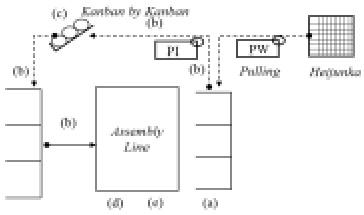


Figure 1: VSM Production Area with Kanban Method by Kanban

From figure 1 obtained points of movement of material and information. At the points it is taken the waiting time and the process and then enter the value of these points into calculation of table 1 to calculate lead time process and number of PIK.

Table 11: Calculation of Kanban PI with Kanban Method by Kanban

No.	Part Number / Model	(D) Order/ Day	(WH) Working Hour	(TT) Takt Time	(a) 1 × Pulling	(b) Conveyance	(c) 1 × Pulling	(d) Process Time	(e) 100% - Eff × d	(LT) Total Lead Time : a+b+c+d+e	(1+α) Safety Factor	(y) Total Kanban : $\frac{LT \times (1+\alpha)}{TT}$
1												
2												
3												
4												
5												

2) Lot Production Method

This method is applied to an existing setup time line, where setup time refers to the SMED (The Single Minute Exchange of DIE) which is a conceptual setup time of not more than 10 minutes [7]. If the concept of SMED has not been met then the lot production method can still be used, but the setup time should still be reduced to minimize lot size. The lot lot method is usually applied to machining line. Here's VSM production area with lot production method:

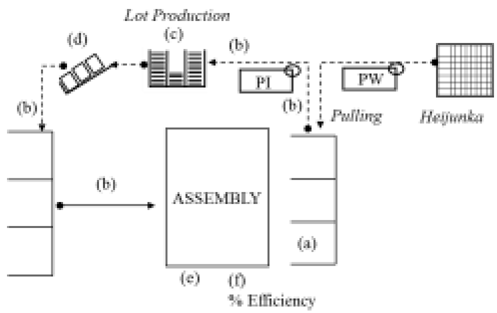


Figure 2: VSM Production Area With Lot Production Method

From Figure 2 enter the values of material movement points and information into table 2 to calculate lead time process and number of PIK.

Table 2: Calculation of PI Kanban with Lot Production Method

No.	Part Number	(D) Order/ Day	(WH) Working Hour	(TT) Takt Time	(CT) Cycle Time	(a) 1×Pulling	(b) Convey	(c) n = lot size (n-1)×C×TT	(d) n = lot size (n-1)×C×CT	(e) Process Time	(f) 100%-Eff×e	(LT) Total Lead Time : a+b+c+d+e+f	(1+α) Safety Factor	(y) Total Kanban : $\frac{LT\times(1+\alpha)}{TT}$
1														
2														
3														
4														
5														

In the table 2 value of "n" (lot size) can be searched with some calculation steps, following the calculation steps to find the value of lot size:

a. Setup time frequency (f)

$$f = \frac{Setup\ Time\ Allocation}{Setup\ Time}$$

Setup Time Allocation = % Company Policy× Loading Time
Loading Time = D × CT
where, D = Order / Day
CT = Cycle Time

b. Lot size (n)

$$n = \frac{D}{f}$$

Where, n = Lot size
D = Order/day
f = setup time frequency

4. Results

4.1 Value Stream Mapping Design

The first stage of making the kanban system is to create VSM or Value Stream Mapping for the current condition and target repair conditions. Figure 3 is the depiction of the Value Stream Mapping current state. At point C there is a buildup of uncontrolled goods that causes the goods to wait for 1800 minutes before being sent to customer. Uncontrolled accumulation of goods is caused by the production planner that makes the production schedule not in accordance with customer demand is the exact amount, goods, and time. At points D assembly line using cycle time 50 seconds and takes production time 1020 minutes to 1080 minutes. Figure 3 shows the total lead time needed to make one item for 2.4 days.

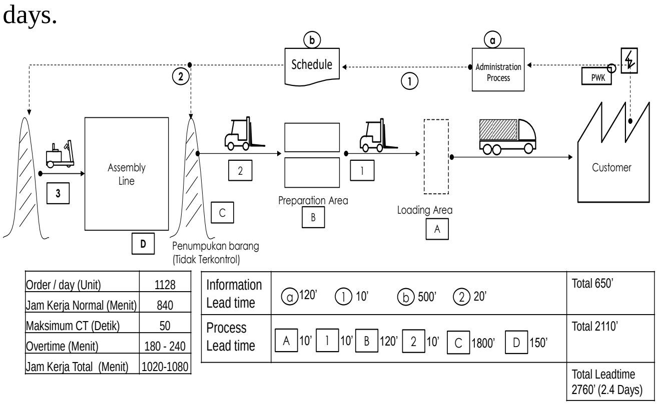


Figure 3: VSM Current Condition

After the creation of VSM current condition is continued the making of VSM target condition that is making mapping for improvement target which will be done forward to shorten the lead time of movement of material and information.

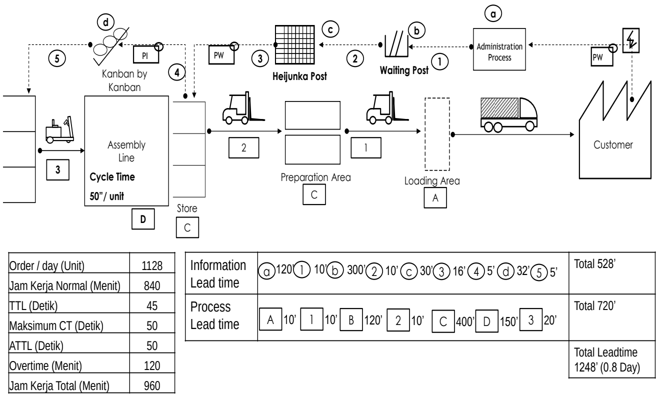


Figure 4: VSM Target Condition

Target reduction of point C in the VSM target to 400 minutes is by changing the mound of uncontrolled goods into a controlled store to a predetermined level of inventory. In figure 4 total lead time decreased to 0.8 days previous 2.4 days.

4.2 Heijunka Design

The second stage is the manufacture of heijunka which serves to smooth the amount of production and time of withdrawal of finished goods goods. Heijunka made according to production working hours, in figure 4 normal working hours of production in one day 840 minutes plus overtime 120 minutes become 960 minutes / day.

Table 3: Heijunka Rear Axle Assembly B Line

KOLOM A	KOLOM B	KOLOM C	KOLOM D	KOLOM E																					KOLOM F
Destination	Model	Part Number	Qty Kanban / Cycle	Pulling Time (Every 16 Minutes)	0:16:00	0:16:00	0:16:00	0:16:00	0:16:00	0:16:00	0:16:00	0:16:00	**0:26:00**	0:16:00	0:16:00	0:16:00	0:16:00	0:16:00	0:16:00	0:16:00	0:16:00	0:16:00	0:16:00	0:16:00	
				Number of heijunka column	1	2	3	4	5	6	7	8	9	10	11	12	53	54	55	56	57	58	59	60	
				WH-->	7:40	7:56	8:12	8:28	8:44	9:00	9:16	9:32	9:48	10:14	10:30	10:46	5:26	5:42	5:58	6:14	6:30	6:46	7:02	7:18	Kanban Surplus
ADM	D17D	BZ G30	Ave : 2	Cycle			CYCLE 5					CYCLE 6					CYCLE 3					CYCLE 4			
MRJK 2-2	Avanza			Pattern	5	1	3	2	4	5	1	3	2	4	5	1	3	2	4	5	1	3	2	4	
1 - 12 - X				Qty KBN		1		1			1		1			1		1			1		1		
				Fluctuation																					
				Act KBN																					
ADM	D17D	BZ D50	Ave : 1	Cycle			CYCLE 5					CYCLE 6					CYCLE 3					CYCLE 4			
MRJK 2-2	Avanza			Pattern	4	2	5	1	3	4	2	5	1	3	4	2	5	1	3	4	2	5	1	3	
1 - 12 - X				Qty KBN				1					1					1					1		
				Fluctuation																					
				Act KBN																					
ADM	D17D	BZ D20	Ave : 1	Cycle			CYCLE 5					CYCLE 6					CYCLE 3					CYCLE 4			
MRJK 2-2	Avanza	BZ D60		Pattern	3	5	1	4	2	3	5	1	4	2	3	5	1	4	2	3	5	1	4	2	
1 - 12 - X				Qty KBN			1					1					1					1			
				Fluctuation																					
				Act KBN																					
ADM	D17D	BZ G10	Ave : 1	Cycle			CYCLE 5					CYCLE 6					CYCLE 3					CYCLE 4			
MRJK 2-2	Avanza	BZ G20		Pattern	2	4	3	5	1	2	4	3	5	1	2	4	3	5	1	2	4	3	5	1	
1 - 12 - X				Qty KBN					1					1					1					1	
				Fluctuation																					
				Act KBN																					
ADM	D17D	BZF90	Ave : 1	Cycle			CYCLE 5					CYCLE 6					CYCLE 3					CYCLE 4			
MRJK 2-2	Avanza	BZG50		Pattern	1	4	2	3	5	1	4	2	3	5	1	4	2	3	5	1	4	2	3	5	
1 - 12 - X		BZG40		Qty KBN	1					1					1					1					
				Fluctuation																					
				Act KBN																					
ADM	D40D	BZ 590	Ave : 1	Cycle	CYCLE 4						CYCLE 5								CYCLE 3						
MRJK 2-3	Grand Max			Pattern	4	1	5	2	6	3	4	1	5	2	6	3	6	3	4	1	5	2	6	3	
1 - 10 - X				Qty KBN		1						1								1					
				Fluctuation																					
				Act KBN																					
ADM	D40D	BZ 760	Ave : 1	Cycle	CYCLE 4						CYCLE 5								CYCLE 3						
MRJK 2-3	Grand Max	BZ 770		Pattern	2	4	1	5	3	6	2	4	1	5	3	6	3	6	2	4	1	5	3	6	
1 - 10 - X				Qty KBN			1				1										1				
				Fluctuation																					
				Act KBN																					
ADM	D40D	BZ620, BZB30	Ave : 1	Cycle	CYCLE 4						CYCLE 5								CYCLE 3						
MRJK 2-3	Grand Max	BZB20, BZ650		Pattern	3	5	4	6	1	2	3	5	4	6	1	2	4	2	3	5	1	6	4	2	
1 - 10 - X		BZ640, BZ630		Qty KBN					1						1		1							1	
		BZB00, BZA90		Fluctuation																					
		BZB10		Act KBN																					
		Total Jumlah Kanban / Interval			1	2	2	2	2	1	2	2	2	1	2	1	2	2	1	2	2	1	2	2	

In table 3 column A indicates the destination of each customer, there are two destinations or delivery destination namely ADM MRJK 2-2 MRJK to carry D17D / Avanza and ADM MRJK 2-3 models to carry D40D / Grandmax model. In column A of delivery for MRJK ADM 2-2 is done 12 times every day while for MRJK 2-3 the delivery is 10 times every day. In columns B and C denote the model and part number, where the part number is grouped into one model with a minimum number of kanban / cycle a number of kanban. In table 3 column D the average withdrawal of PWK / cycle (Part Withdrawal Kanban) minimum of 1 kanban, if the merger of some part number does not reach one kanban then must be combined with other part number until amount of one kanban. In column E are some important points in making heijunka include determining the number of heijunka columns, pulling time and kanban pattern. Can be seen in column E Determination of the number of heijunka columns from the calculation obtained 60 columns, where the number of columns must be based on the smallest multiples of alliance. Then after getting the number of heijunka columns then the pulling time can be determined from the division total working hours of production with the number of heijunka columns so that there is a pulling time of 16 minutes for each withdrawal of goods to finished goods. Next, make kanban pattern, pattern made for each delivery cycle obtained from random number. Kanban pattern was made for each delivery cycle obtained from the random number. Kanban pattern function is to flatten the PWK for each pulling time interval, as in table 3 total kanban per column or total PWK per 16 minutes (pulling time) is 1 to 2 kanban.

4.3 Calculation of Production Instruction Kanban Population

The third stage is calculation of population Production Instruction Kanban (PIK). Calculation of PI kanban population can use kanban by kanban method because in assembly line there is no setup time.

Table 4: Calculation of PIK Population Assembly Line With Kanban Method by Kanban

No.	Part Number	(D) Order/ Day	(WH) Effective Working Hour + overtime (Minutes)	(TT) Takt Time WH / D (Minutes)	(a) 1 × Pulling (Minutes)	(b) Conveyance (Minutes)	(c) 1 × Pulling (Minutes)	(d) Process Time (Minute	(e) 100%-Eff×(d) (Minutes)	(LT) Total Lead Time : a+b+c+d+e	(1+α) Safety Factor	(y) Total Kanban : LT × (1+α) / TT	(FG) Finished Goods c + α
1	BZG30	302	960	3	16	30	32	150	15	243	2	156	84
2	BZD50	153	960	6	16	30	32	150	15	243	2	84	48
3	BZG10	94	960	10	16	30	32	150	15	243	2	48	24
4	BZD60	89	960	11	16	30	32	150	15	243	2	48	24
5	BZF90	54	960	18	16	30	32	150	15	243	2	36	24
6	BZD20	46	960	21	16	30	32	150	15	243	2	24	12
7	BZG50	25	960	38	16	30	32	150	15	243	2	24	12
8	BZG20	23	960	42	16	30	32	150	15	243	2	12	12
9	BZG40	17	960	56	16	30	32	150	15	243	2	12	12
10	BZ 590	124	960	8	16	30	32	150	15	243	2	70	40
11	BZ760	72	960	13	16	30	32	150	15	243	2	40	20
12	BZ770	47	960	20	16	30	32	150	15	243	2	30	20
13	BZ620	31	960	31	16	30	32	150	15	243	2	20	10
14	BZB30	18	960	53	16	30	32	150	15	243	2	10	10
15	BZB20	16	960	60	16	30	32	150	15	243	2	10	10
16	BZ650	9	960	107	16	30	32	150	15	243	2	10	10
17	BZ640	4	960	240	16	30	32	150	15	243	2	5	5
18	BZ630	3	960	320	16	30	32	150	15	243	2	5	5
19	BZB00	3	960	320	16	30	32	150	15	243	2	5	5
20	BZA90	2	960	480	16	30	32	150	15	243	2	5	5
21	BZB10	2	960	480	16	30	32	150	15	243	2	5	5
											TOTAL	659	397

In table 4 of the calculation of PI kanban population obtained number of outstanding PI kanban for each part number. Total finished good is needed only 397 kanban where 1 kanban PI equal to 1 unit so total finished finished goods assembly line rear axle B only need 397 unit. The finished goods inventory will continue to be maintained during the outstanding PI kanban population in accordance with the calculation of PI kanban and line efficiency 90%. If the line efficiency is below 90% then inventory will decrease and if the outstanding PI kanban exceeds the calculation of kanban then the inventory will be excess. To control the number of kanban PI to remain in accordance with the kanban population by adding a unique bar code-shaped number to the PI kanban. From table 4 total of PI kanban cards made as many as 659 cards.

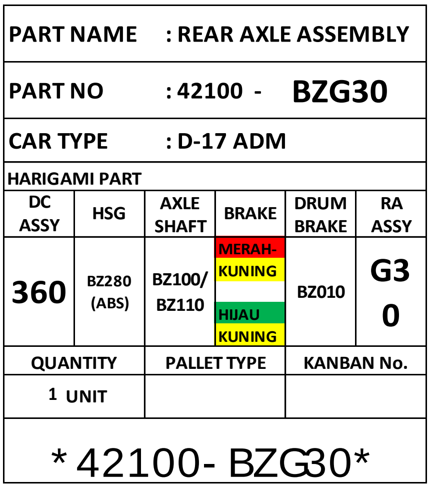
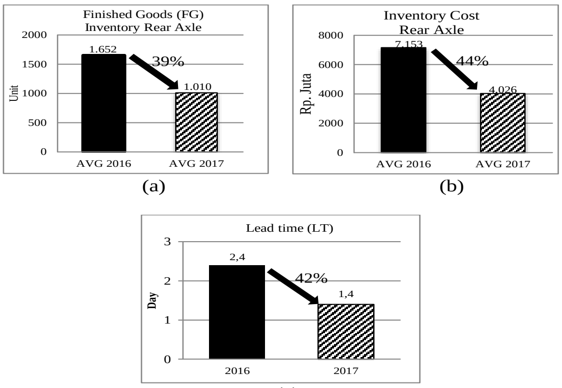


Figure 5: PIK Design

4.4 Implementation of Kanban System

In Figure 6 there are three graphs showing a significant decrease after the implementation of kanban system in the assembly line of rear axle production that is the decrease of finished goods inventory, inventory cost, and lead time. Figure 6 (a) shows FG inventory decreased by 39% from 2016 to 2017. This decrease is significant from the average FG inventory of 2016 by 1652 units to 1010 units in 2017. The author performs the first production system improvement activity in assembly line B then applied also to line A, so the value of FG inventory of 1010 units is the addition of total FG inventory from two assembly lines namely rear axle assembly A and B.

In addition, cost of FG inventory for rear axle in figure 6 (b) also decreased significantly from the average monthly inventory cost from 7.15 billion in 2016 to 4 billion in 2017. Average decrease in inventory cost per month from 2016 to 2017 by 44% or Rp 3.15 billion. In figure 6 (c) lead time in total also decreased 42%.



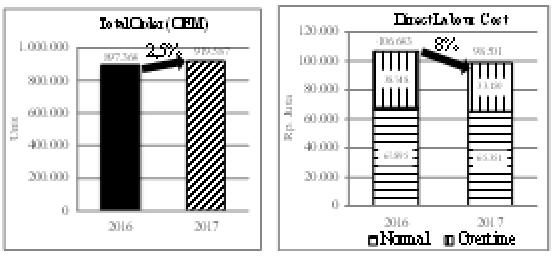
(a) (b) (c)

Figure 6: (a) Finished Goods Inventory (b) Inventory Cost (c) Lead time

Significant decrease of FG inventory, inventory cost, and lead time were obtained after applying the kanban system. The previous condition of IGP uses a production schedule that is not based on consumer demand. Determination of the order of withdrawal and previous production sequence is highly dependent on a scheduling staff, in which to make the production schedule does not give priority to consumer pull but the availability of material (push system). This research changed the previous condition of push system into pull system by applying kanban system. Implementing a kanban system can effectively lower FG inventory, inventory costs, and lower lead time.

4.5 Managerial Implications

The decrease in FG inventory is also associated with decreased production overtime. The previous condition of excess inventory due to over production or producing goods not in accordance with consumer demand. In the implementation of kanban system, FG inventory value will be calculated as needed. So that inventory amount will be maintained and controlled. In figure 7 (a) total order in 2016 amounted to 897,364 units and in 2017 increase 2.5% to 919,587 units. Although there is an increase in orders, in Figure 7 (b) direct labor cost down 8% from Rp 106.6 billion in 2016 to Rp 98.5 billion in 2017. The decrease in direct labor costs was due to 2 factors, the first decrease in overtime production cost of Rp 5.6 billion and the second from a decrease in the number of employees amounted to Rp 2.5 billion. Total cost reduction from implementation of kanban system amounted to Rp 8.75 billion of which Rp 5.6 billion of decreased overtime production costs and Rp 3.15 billion of decreased FG inventory cost.



(a) (b)

Figure 7: (a) Total Order (b) Direct Labour Cost

5. Conclusion and Suggestion

5.1 Conclusion

1) Based on design step of kanban system obtained takt time value of 50 seconds / unit, decreased lead time from 2.4 days to 0.8 days using Value Stream Mapping, pulling ratio 1-2 PWK / 16 minutes using heijunka, and total PIK circulating as much as 659 kanban where the inventory value finished good assembly line of rear axle - b maximum 397 kanban or 397 units.
2) Based on the results of research can be concluded that the implementation of kanban system can reduce inventory, finished goods inventory costs, and decreased lead time.
3) Implementation of kanban system also can be concluded can decrease overtime production cost.

5.2 Suggestion

1) Identify continuous improvements by remapping waste potentials by using Value Stream Mapping, and applying kanban systems to all production lines in order to lower inventory even more. The more the production process is made in Just In Time it will greatly affect the company's operating costs. Kanban system can be applied from customer to supplier to get lean process or called lean. In the future automotive industry competition will be more stringent, consumers will choose the supplier with the most competitive price and high quality.
2) In line with the development of kanban system manual technology can be transformed into the form of E-Kanban. So that its implementation will be easier and effective no need to rely on staff for kanban rotation. With E-Kanban there is no need to create a kanban card because the kanban cards require care and fees. Information for the sequence of production in real time can be adjusted with the pull of customer based on heijunka.

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