

The Influence of Implementation Kanban System on the Service Rate: A Case Study

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One approach to maximize profit, as the company objective, is to eliminate all kind of inefficiency in production process, including inventory. Efficient inventory system by providing only materials needed at the time and at the place needed, is called the Just In Time System which using Kanban as tool to determine the need. Kanban System is assumed to have positive significant influence on Service Rate level. The result is expected to provide empirical evidence regarding academic concept thought operational productively as well as emphasizes the need to conduct improvements as well as the need of management in conducting continuous quality improvement.

Keywords: Kanban System, Case Study, Service Rate

1. Introduction

Japan nowadays is known as a developed industrial country in the world which successfully built its industrial system out of the crisis in the 50's. One of the results of its industrial development is Toyota Production System (TPS) which developed and promoted by Toyota Motor Corporation, who become world's number one automotive company.

One advantage of Toyota Production System is its achievement to eliminate all kind of inefficiency in the production process including inventory. Minimizing the inventory is known as Just in Time System, which is using Kanban as its tool.

1.1 Kanban System

Kanban in general is a part of Toyota Production System and especially it is a subsystem support for Just in Time system.

Some people misunderstood the Kanban System and interpret it as the Just in Time (JIT) system itself. Actually, Kanban is only a tool in JIT system. Kanban often referred to as the 'nervous system' of lean production, Kanban is a key technique that determines a processes production quantities, and in doing so, facilitate JIT production and ordering system. Kanban is a component tracking system to increase the productive maintenance flow (Silberstein, 2005).

Originally Kanban is Japanese word for "Card". In order to reduce inventory, Japanese using system that pull inventory through work center. Often they used card to inform the need of more material, these cards is called Kanban. The card is endorsement to produce the next material (Heizer, 2001)

Type of Kanban

There are 2 (two) types of Kanban (Monden, 1995):

- Taken Kanban, specified type and amount of product must be taken from previous process.
- Production Order Kanban, specified type and amount of product to produced in previous process. This Kanban often called In Process Kanban or Production Kanban.

Benefit of Kanban System

Roos(1992) identified that Kanban represents an efficient tool to continuously rationalize the production process and find the source of problems. Especially for PT. Toyota Astra Motor, Kanban give benefit as follows:

- For the dealer in term of inventory value, improve flow of product and efficient inventory. Better inventory control also prevents dead stock.
- In term of warehouse space, the dealer can reduce the space needed
- In term of inventory system, the dealer can reduce the lead time
- In term of sales, dealer can improve supply and the availability of stock
- While for Toyota Astra Motor (TAM), can stabilize the order system, incoming and outgoing. Also reduce safety stock, improve building space use efficiency and increase productivity.

Kanban Rules

To have optimum implementation of Kanban, there are rules that need to be following (Monden, 1995):

Rule number 1: Next process must take the product needed from previous process at the amount needed at the time needed

Rule number 2: Previous Process must produce at the amount taken by the next process.

Rule number 3: Reject Product must not deliver to the next process.

Rule number 4: Minimize number of Kanban

Rule number 5: Kanban must be used in adjustment for small fluctuation in demand (production tuning with Kanban)

Culture and Kanban

Culture could become constraint in implementation of Kanban System outside Japan in general, and outside Toyota in specific. According to Taiichi Ohno, Toyota Production System created from the real practice in Toyota Factory, its main characteristic is the emphasized on practical effect, practice and real implementation than theoretical analysis. Therefore, base on observation, even in Japan people outside the company having trouble understanding this system, more over foreigner (Monden, 2000)

To overcome this constraint it is very important for the company to make the workers feel involve in the company activities. The success of module production is independent on a social organization the production process intended to make workers feel "obligated" to contribute to the economic performance of the enterprise (Briggs, 1992).

2. Service Rate

Customer satisfaction is one indicator of the productivity of company which is reflected in its service rate in serving its customer needs. Hence, Service Rate is a reflection of productivity level of company.

Service Rate according to PT. Toyota Astra Motor (TAM) is the effectiveness in using current stock in both point of view, internally and externally. In external view service rate is the ability level to handle customer demand or the level of service provided with current stock.

Service Rate Function

Service rate functions according to PT. Toyota Astra Motor (TAM) are:

- a. Service Rate as customer satisfactory index, is clear that the responsibility of the spare part team is focusing on the satisfaction of owner and user of Toyota car in term of assurance smooth supply of spare parts. If the service rate is 60%, that means 40 out of 100 customer demand is not fulfilled.
- b. Service rate is the key to improve inventory control including Horizontal Service Rate, Vertical Service Rate and Overall service Rate.
 - I. Horizontal Service Rate, to test wether the stock is fulfilled or match with the spare parts demanded by customer.
 - II. Vertical Service Rate, is the number of stock in the warehouse to determine wether the demand for that stock can be fulfilled immediately or not. This service rate is to test wether the number of stock is adequate to fulfil demand.
 - III. Overall Service Rate is for measuring the efectiveness of stock against the target of inventory.

3. The Study

The framework of reasoning in this study is presented in diagram below:

This study has 3 goals as follows:

1. To study the implementation of *Kanban* system at PT. Astra Internasional, Tbk. Operational Sales AUTO 2000 Car Service Station, Asia Afrika Branch - Bandung during period of January-August 2006.
2. To study the *service rate* at PT. Astra Internasional, Tbk. Operational Sales AUTO 2000 Car Service Station, Asia Afrika Branch - Bandung during period of January-August 2006.
3. To study the influence of *Kanban* system implementation to the *service rate* at PT. Astra Internasional, Tbk. Operational Sales AUTO 2000 Car Service Station, Asia Afrika Branch - Bandung during period of January-August 2006.

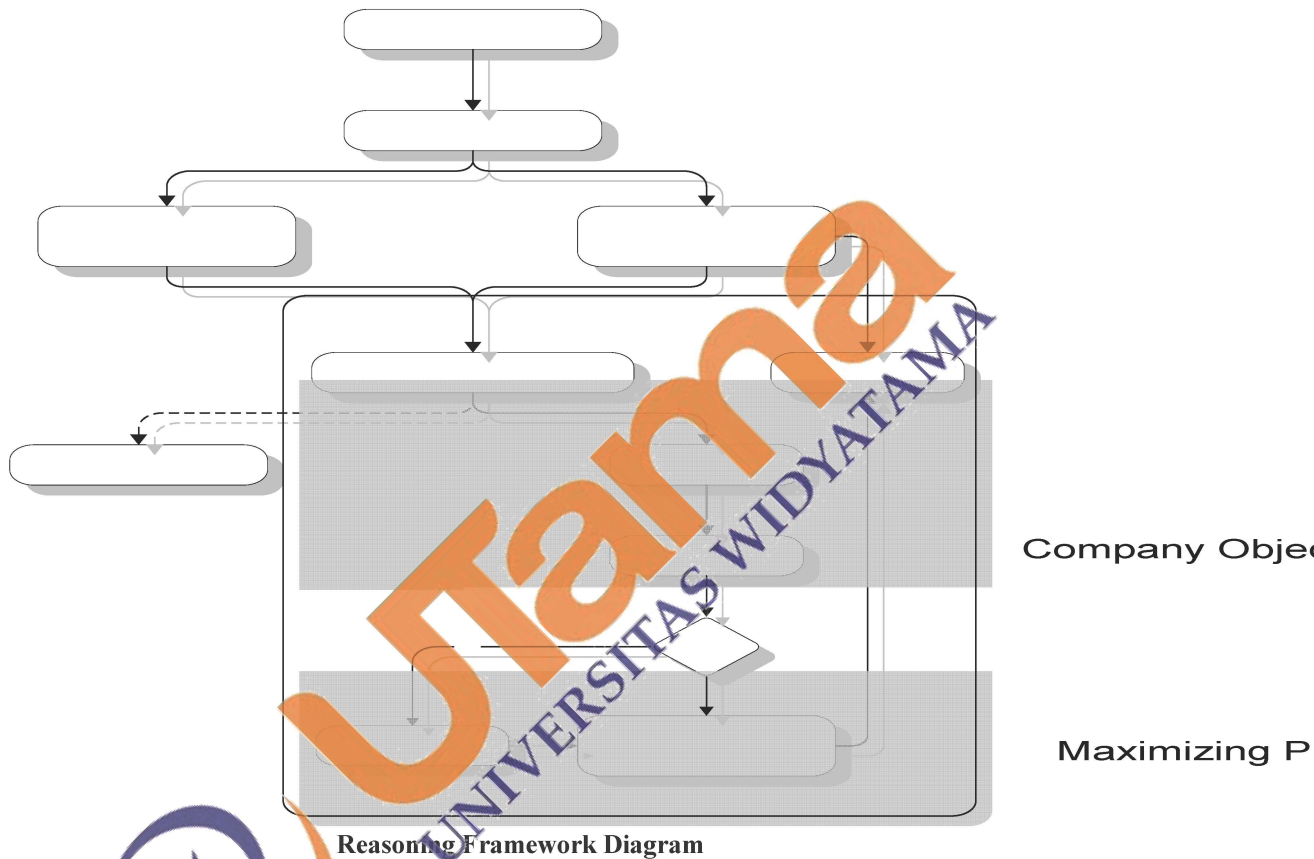
Research Methodology

This study use descriptive methods, a descriptive study tries to discover answers to the questions who, what, when, where and sometimes, how. The descriptive study is popular in business research because of its versatility across disciplines. In not-for-profit corporations and other organizations, descriptive investigations have a board appeal to the administrator and policy analyst for planning, monitoring, and evaluating. In this context, how questions address issues such a quantity, cost, efficiency, effectiveness and adequacy (Cooper, 2003).

Data Collection Method

Authors has determined that surveying is the appropriate data collection approach, various means may be used to secure from individuals. Survey was conducted by personal interview(i.e., face to face communication) is two-way conversation initiated by an interviewer to obtain information from a participant.

Beside conducted personal interviewing, reseacher also conducted observation. Observation qualifies as scientific inquiry when it is conducted specifically to describe the researcher objective/question, is systematically planned and executed, uses proper controls, and provides a reliable and valid account of what happened (Cooper, 2003).



3.1. Kanban system evaluation at PT. Astra Internasional, Tbk. Operational Sales AUTO 2000 Car Service Station, Asia Afrika Branch - Bandung during period of January-August 2006

The evaluation of *Kanban* system is conducted to find out whether its implement at PT. Astra Internasional, Tbk. Operational Sales AUTO 2000 Car Service Station, Asia Afrika Branch – Bandung is running well view from the efficiency level of inventory. Inventory efficiency is chosen as performance indicator because on of the goal of *Kanban* system is achieving efficient inventory.

Inventory efficiency is good when the value of efficiency deviation is positive or the actual efficiency value achieved or exceeded the target value given bay TAM (i.e. 65%). Deviation value calculated as follows:

$$\text{Deviation Value}_{ep} (\%) = \text{Actual Value}_{ep} (\%) - \text{Target Value}_{ep} (\%)$$

On table 3.1 presented the deviation, actual and target value of inventory efficiency at PT. Astra Internasional, Tbk. Operational Sales AUTO 2000 Car Service Station, Asia Afrika Branch - Bandung during period of January-August 2006.

Autonomation (Jidoka)

Tabel 3.1 Key Performance Indicator (KPI) Inventory Efficiency

Periods	Actual	Target	Deviation
January	62.10%	65%	-2.90%
February	51.11%	65%	-13.89%
March	85.86%	65%	20.86%
April	82.77%	65%	17.77%
May	76.71%	65%	11.71%
June	76.23%	65%	11.23%
July	84.39%	65%	19.39%
August	82.57%	65%	17.57%

Source: PT. Astra Internasional, Tbk. Operational Sales AUTO 2000 Car Service Station, Asia Afrika Branch - Bandung.

On chart 3.1 is presented the performance of deviation value of inventory efficiency at PT. Astra Internasional, Tbk. Operational Sales AUTO 2000 Car Service Station, Asia Afrika Branch - Bandung during period of January-August 2006.

**Chart 3.1** Performance of Deviation Values of Inventory Efficiency

Source: Data calculation

As seen on Table 3.1 and Chart 3.1, deviation value has stable movement on period March-August on averager of 16.42%. While on 2 previous period of January-February is under target (min = 0%), especially on February which is the lowest deviation value of -13.89%. Low deviation happens because of accumulation 8 months of dead stock which influences the inventory efficiency. After the dead stock is eliminated (by auction or removal) then the inventory efficiency is increasing starting from March.

3.2. Service rate at PT. Astra Internasional, Tbk. Operational Sales AUTO 2000 Car Service Station, Asia Afrika Branch - Bandung during period of January-August 2006

Service rate calculation at PT. Astra Internasional, Tbk. Operational Sales AUTO 2000 Car Service Station, Asia Afrika Branch - Bandung, is similar to the calculation of inventory efficiency. It is comparing the actual value to target value set by TAM (i.e. 95%) to get the deviation value, as formulated as followst:

$$\text{Deviasi value}_{sr} = \text{Actual Value}_{sr} (\%) - \text{Target Value}_{sr} (\%)$$

On table 3.2 is presented deviation, actual, and target values of service rate at PT. Astra Internasional, Tbk. Operational Sales AUTO 2000 Car Service Station, Asia Afrika Branch - Bandung during period of January-August 2006.

Table 3.2 Key Performance Indicator (KPI) Service Rate

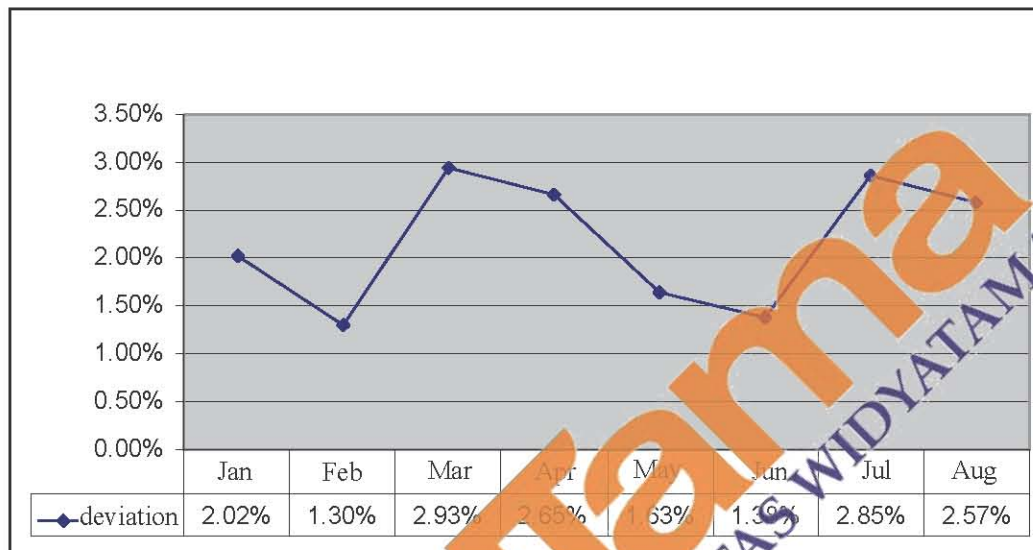
Periods	Actual	Target	Deviation
January	97.02%	95%	2.02%
February	96.30%	95%	1.30%
March	97.93%	95%	2.93%
April	97.65%	95%	2.65%
May	96.63%	95%	1.63%
June	96.38%	95%	1.38%
July	97.85%	95%	2.85%
August	97.57%	95%	2.57%

Source: PT. Astra Internasional, Tbk. Operational Sales AUTO 2000 Car Service Station, Asia Afrika Branch - Bandung.

On Chart 3.2 the performance of deviation value of *service rate* at PT. Astra Internasional, Tbk. Operational Sales AUTO 2000 Car Service Station, Asia Afrika Branch - Bandung during period of January-August 2006 is presented.

From the tables and pictures above we can see that the deviation value of *service rate* has linear relation with the deviation value of inventory efficiency, if the deviation value of inventory efficiency is decrease, the deviation value of *service rate* also decrease.

Chart 3.2 Service Rate Deviation Value Performance



Source: Calculated data

3.3. The Influence of Kanban system implementation to the *service rate* at PT. Astra Internasional, Tbk. Operational Sales AUTO 2000 Car Service Station, Asia Afrika Branch - Bandung

Variables used in this study are *Kanban system* as independent variable (causal) using deviation value of inventory efficiency indicator and *service rate* as dependent variable using its deviation value. The study is conducted to determine the value of influence of independent variable to dependent variable using Pearson *Product Moment*.

T-test is used to determine whether there is a significant influence of independent variable to dependent variable by Pearson *Product Moment*. Level of confidence 5% is used.

Data Study

Data used in the study are monthly deviation value of inventory efficiency and monthly deviation value of *service rate* during periods of January-August 2006 as presented in table 3.3 :

Table 3.3 Study

Periods	Inventory Efficiency	Service Rate
January	-2.90%	2.02%
February	-13.89%	1.30%
March	20.86%	2.93%
April	17.77%	2.65%
May	11.71%	1.63%
June	11.23%	1.38%
July	19.39%	2.85%
August	17.57%	2.57%

Source: data calculation

Influence of Kanban system (X) to Service Rate (Y)

Statistical analysis used in this study is Correlation Analysis Pearson *Product Moment*, determination coefficient and hypothesis is tested with t-test.

a. Pearson Product Moment Correlation Analysis

$$r = \frac{n \sum_{i=1}^n X_i Y_i - \sum_{i=1}^n X_i \sum_{i=1}^n Y_i}{\sqrt{\left[n \sum_{i=1}^n X_i^2 - \left(\sum_{i=1}^n X_i \right)^2 \right] \left[n \sum_{i=1}^n Y_i^2 - \left(\sum_{i=1}^n Y_i \right)^2 \right]}}$$

Using SPSS 12.0 software the result as follows:

		Service Rate	Inventory Efficiency
Pearson Correlation	Service Rate	1.000	.732
	Inventory Efficiency	.732	1.000
Sig. (1 tailed)	Service Rate	.	.19
	Inventory Efficiency	.19	.
N	Service Rate	8	8
	Inventory Efficiency	8	8

$$r_{YX_1} = 0,732$$

It means that the relation between *Kanban* system variable (X) with *Service Rate* (Y) calculated with *Pearson Product Moment* is 0,732. This result shows strong and positive relation the higher inventory efficiency deviation, *Service Rate* deviation will also increase.

b. Determination Coefficient Analysis

Determination Coefficient is used to measure the influence of independent variable to the dependent variable, in this study is *Kanban* system (X) to *Service Rate* (Y). Formula to calculate Determination Coefficient is :

$$KD = r^2 \times 100\%$$

Using SPSS 12.0 software the value of Determination Coefficient (R square) is as follows :

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.732 ^a	.536	.458	.49178

a Predictors: (Constant), inventory efficiency

The result shows that *Kanban* system (X) has influence of 53.6% to *Service Rate* (Y), while the rest of 46.4% influence by other factors.

c. Hypothesis test

In this study the hypothesis is tested using 2 variable *Kanban* system (X) and *Service Rate* (Y). Statistical analysis is used to determine whether *Kanban* system (X) has significant influence to *Service Rate* (Y). Test conducted with parameter r and to prove hypothesis with step as follows:

Declaration of H_0 and H_a

$$H_0 : r = 0$$

There is no significant influence of *Kanban* system (X) to *Service Rate* (Y).

$$H_a : r \neq 0$$

There is significant influence of *Kanban* system (X) to *Service Rate* (Y).

Determine level of confidence

$$\alpha = 0,05$$

$$\text{and } db = n-2 \rightarrow df = 8-2 = 6$$

from the table of distribution $t_{tabel} = 2,447$

Statistical test using t-student two side with formula as follows :

$$t = \frac{r\sqrt{n-2}}{\sqrt{(1-r^2)}}$$

Using SPSS 12.0 software we get :

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.761	.232		7.583	.000
	Inventory Efficiency	.040	.015	.732	2.631	.039

a. Dependent Variable: Service_rate

$$t_{calculated} = 2,631$$

Criteria

Ho accepted, if $-t_{table} \leq t_{calculated} \leq t_{table}$

Ho rejected, if $t_{calculated} < -t_{table}$ or if $t_{calculated} > t_{table}$

From the result above we get $t_{calculated} > t_{table}$ since $2,631 > 2,447$, therefore Ho is rejected. Hence, there is significant influence and positive relation between *Kanban* system to *Service Rate*

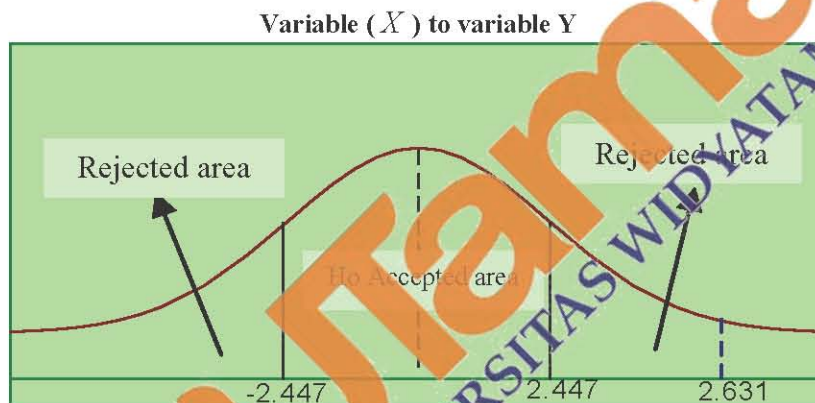


Chart 3.3 Accepted dan Rejected Result of Ho(t-test)

Source: Calculated Data

5. Result

From analysis and test above, we conclude that there is a significant and positive influence of *Kanban* system (deviation value of inventory efficiency) (X) to *Service Rate* (deviation value) (Y) of $t_{calculated} > t_{table}$.

6. Conclusion

The conclusion of this study is that the implementation of *Kanban* system could increase the company's service rate. Implementation of *Kanban* system could make more efficient inventory and achieve KPI exceeded the target, and also achieved service rate performance exceeded the target. This conclusion only valid for the period of study and could not be extended to generap conclusion since the period of study only covers 8 months. Further study needed to determine the influence for extended period.

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