MODIFICATION OF PERFORMANCE INDICATORS USING KANBAN METHOD AND GROWTH IN PRODUCTION LEVEL

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Abstract: *The Kanban method is based on the principle of taking over the tasks by the team members as they become available (pull system), and not on the placement of the tasks without their being requested by the person to execute them (push system).Using the Kanban method, components are manufactured only when needed, so extra components are eliminated. As there is no extra production, waste cuts and scrap are reduced.*

Keywords: management, marketing plan, KANBAN

Introduction

Kanban as a Lean-type production system was developed in the mid-twentieth century by Japanese Toyota by engineer Taiichi Ohno.
The Kanban method as a method of managing and improving the knowledge work process originated in the early 21st century, inspired by the Toyota Production System (TPS). In Japanese, Kanban stands for display panel, the Kanban table being a key element used by the teams adopting the method. Work tasks received by the team are symbolized by labels placed on the Kanban table. Work processes for task execution are divided into working phases (works, activities) delimited very clearly and represented by columns of the table. Labels are shifted from time to time from one column to another as their tasks advance in the workflows - the right direction for advancing the processes is from left to right.
Currently, Kanban is not only used in the production of physical goods. The method is generally used in project management to view the workflow and to identify potential obstacles in a project's evolution. However, Kanban is equally effective in other areas, or even used to organize personal activities.

Structure of Kanban

A basic Kanban table has the following three components, whether physical or virtual:
The table: a workspace where you place the tasks that lead to the completion of the project and by which you monitor the entire project activity,
The lists (columns): contain similar or interrelated tasks belonging to the same stage of the project,
The tasks: contain details regarding the activities that are related to the project.
The Kanban system is currently used in the business environment for some good reasons:
1. It helps you visualize the whole activity of a project in a visual way.
2. You can identify and remove any obstacles during the course of the project.
3. Enhances team spirit, improving employee collaboration and project success rate.
4. It increases the speed of workflow through the transparency that the whole process involves.

Using this system, you can precisely distribute tasks between your team members and identify unnecessary activities that may be temporarily ignored. In addition, this method can solve your productivity, concentration, and time division problems.
In essence, the Kanban method consists of creating tables divided into three columns ("To Do", "Work", "Finished"). Work optimization can be done through a table where tasks can be moved from one stage of the project to another until they are completed.
Kanban's primary goal is to eliminate losses by streamlining workflows and presenting activities in a visual way to help identify potential hazards that may delay the completion of the project.
Kanban is a simple label that corresponds to a product reference. This label sends information to the production to make the necessary references before the stock reaches stage 0. To carry out the Kanban label, it is important for each actor to show absolute rigor:

- the production operator - must place a Kanban production on each product unit and warn the Supervisor or Gap Leader to stop the car when there is no Kanban in order to avoid overproduction.
- Conveyor driver - must remove the Kanban label from the packaging and place it in the batching box, then place the consignment set up in the launcher or directly into the launcher.
- GAP - must stop the machine when the batch assembly has been produced. He must also carry out Kanban card audits to ensure that no label has been lost;
- The supervisor - is the guarantor of the good functioning of the system. He must print the Kanban audit forms each week and ensure that each actor complies with the instructions.

Managing production through the Kanban

A leveled production system is one that delivers a great deal of service or demand with very little stock. Despite its significant success, the Kanban control system is not a perfect mechanism to control a lean production system. The Kanban system uses buffer levels to regulate the production system. When a buffer reaches its set maximum level, a signal is sent to the upstream machine to stop production of a particular type of parts [1].
This is often implemented through a Kanban card system in circulation, between a machine and a downstream buffer. The machine must have a card before it can begin an operation. You can choose the raw material from the upstream buffer to perform the operation, then attach the card to the finished product, placing it in the downstream buffer. The number of cards in circulation determines the size of the buffer because once all the cards that have been placed on the parts are in the buffer zone, others can not be produced. When the downstream machine takes over the raw material to perform an operation, the card is released. The card is then transmitted back upstream to give the production signal for that machine. In this way, a request for a finished product unit is registered up to the supply chain [2].
In Figure 1 the movement of the pieces is shown in blue, the Kanban circulation in red. The machines are displayed as circles and buffers as triangles. (FG) - finished product buffer zone.

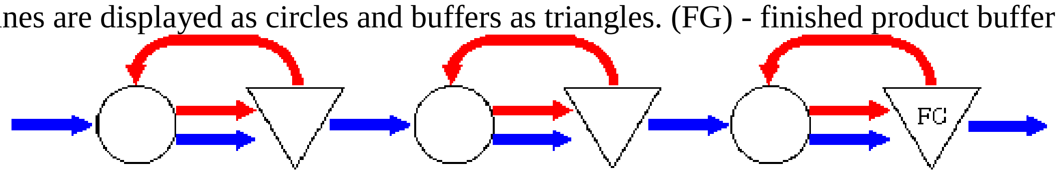


Figure 1. Kanban Control System.

The Kanban control system ensures the production of the parts according to the customer's request. This is compared with the supermarket system: only the goods sold are repopulated on the shelves. However, this system has a major disadvantage: goods are used as carriers of information. A machine is sent to stop production when the output buffer is full. This requires that a number of pieces stay in the buffer zone without serving any apparent purpose, but only to block the machine upstream. However, this is not the case, the parts waiting in the buffer area serve a purpose: they act as a stock, partially dismantling the operation of the machines downstream of any upstream production interruptions. In the event of a machine failure, the downstream machine may continue production, consuming parts already in the buffer zone.
Determining the number of Kanbans is done according to the formula: [3]

$$N = (d \times L + Ss) / C$$

where: N = the number of Kanbans or containers
d = average demand over a period
L = manufacturing time
Ss = security stock
C = container size

Kanban cards are of two types:

- Kanban Kanban of withdrawal or supply (KR): Supply Kanban contains information about where the products originate and which is their destination and which circulates between the customer and the supplier.
- Kanban Production (KP): Manufacturing Kanban flows within the enterprise and production processes and contains information about two consecutive processes.

There are two types of Kanban:

- Kanban for the production instruction:
  a) the production lot = 1 Kanban card (there is no time to change the tool)
  b) the production lot = n Kanban cards (tool change)

When we are in a position to produce more than one landmark within the same process that includes a tool change, the production order is given by a batch of Kanban cards. The production order is not given until the consignment of cards is formed. A batch of "n" cards corresponds to a number of "n" packing units..

- Kanban withdrawal: is a withdrawal order of a reference. It is used between processes to order withdrawals made by a subsequent process.

Figure 2 shows Kanban flows and types:

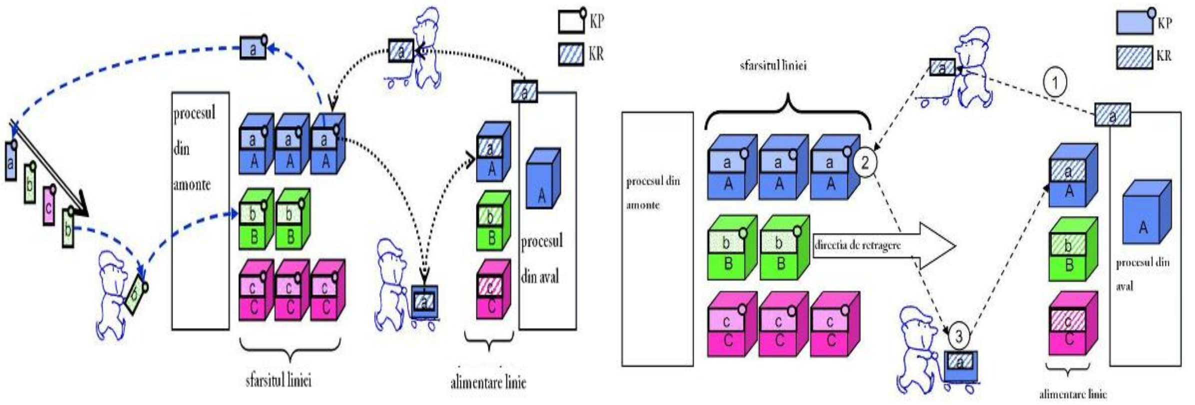


Figure 2 Kanban flows and types

Calculation of an additional stock of finished products

Due to the large variations in customer demand, the decision to implement an additional stock of finished products called "POOL STOCK" was taken. For this, the customer's variation in demand was identified and the maximum level for each reference was calculated. Only references with high requirement have been considered. Table 1 lists the Pool Pool values.

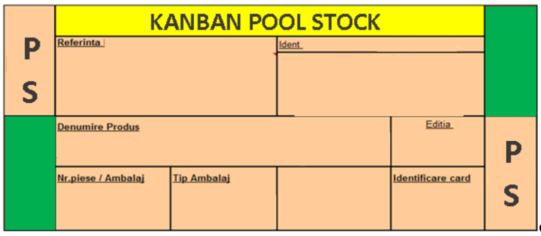
Table 1 Calculation of Containers Required in the Pool Stock

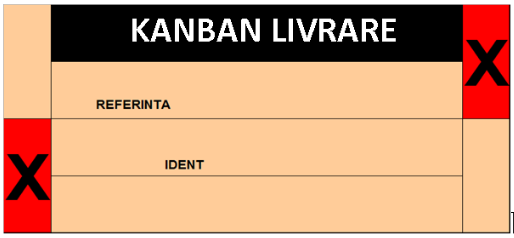
Reference	Maximum requirement (container / truck)	Medium delivery / truck (container)	Size shopstock (container)	Difference between average delivery and shopstock size	The difference between the maximum requirement and the shopstock size	Pool Stock Size (container)
Matrix nr. 1	2	1.4	3	-1.6	-1	0
Matrix nr. 2	7	3.5	6	-2.5	1	3
Matrix nr. 3	12	6.6	6	0.6	6	9
Matrix nr. 4	1	1	2	-1	-1	0
Matrix nr. 5	1	0.3	2	-1.7	-1	0
Matrix nr. 6	2	0.9	3	-2.1	-1	0

To complete table 1, customer order values were recorded over a week. The maximum values required for each reference per truck were taken and entered in the table. The average requirement with which they are delivered was then made, the values being recorded in the table. On the "shopstock size" column, the number of calculated pallets has been entered. The difference between the average delivery and the shopstock size was calculated, the extra values resulting in a single reference produced on the assembly line, that is, the reference being worked on the mold number 2. The difference between the maximum demand and the size of the shopstock resulting extra values only for two references – matrix 2 şi matrix 3.

The Pool Stock size was entered in the table on the last column and the values were rounded according to the allocated space in the deposit. It is noted that for the references worked on mold 2 and matrix 3 respectively, an additional stock of finished products of 3 and 9 containers respectively was created.

As a result of inventory implementation for variance absorption, it was necessary to create a different card than the normal, for finished product. It keeps the same information as the serial, but it will be clearly specified with a different color and writing that it comes from the Pool Stock. The card is shown in the figure 3.a.

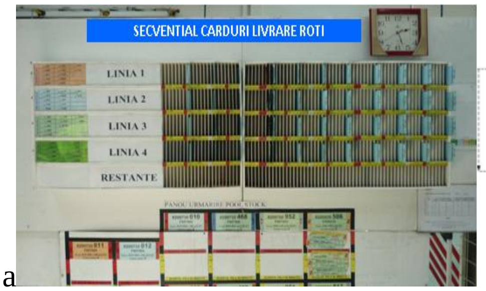


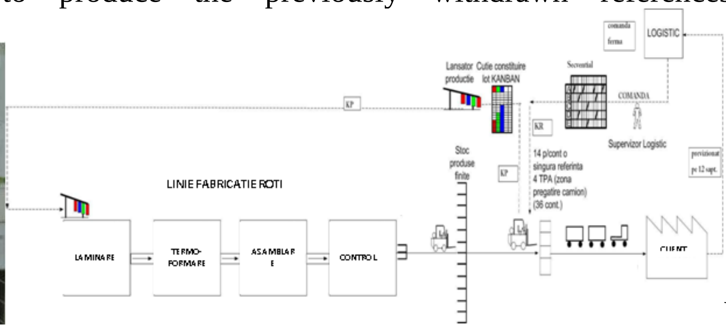
a


b

Figure 3: a. Kanban card for Pool Stock, b. Kanban card for delivery

In order to level the customer orders and not to interfere with production on the wheel assembly line, it has been decided to implement a delivery sequence (figure 4a.).
A Pool Stock tracking panel was placed at the bottom of the sequencer and the cards for the boxes removed from it were placed. Upon reaching the minimum alert level on the board, an alert to production is made to produce the previously withdrawn references.

a




b

Figure 4 a.Sequencer delivery cards, b. Efficiency chart of the manufacturing line.

Figure 4 b shows the Kanban flow of production and of withdrawal (delivery) for assembly line 1 after sequencing. Based on firm orders from the customer, the Shift Supervisor completes the sequential delivery lists, and this information is forwarded to the fork load worker on delivery cards. The fork load worker withdraws at fixed time intervals in the shopstock only the pallets / boxes of the Kanban delivery cards in sequential order and put them on the truck preparation area. When the stocks are almost finished, the customer issues a new order to the supplier, reaching the Logistic department. Container cards removed from the shopstock are placed in the Kanban lot and are produced by the assembly line to restore stocks.

Influence of Kanban method on performance indicators of production level

After the Kanban method was applied to the chosen benchmark, performance indicators were recalculated. Their results are rising up.

$$Efficiency = \frac{actual\ worked\ time}{total\ plannedtime} \text{ x } 100$$

where: Actual worked time = Cycle time x Number of good pieces
Total planned time = Number of operators x Work time (in minutes)

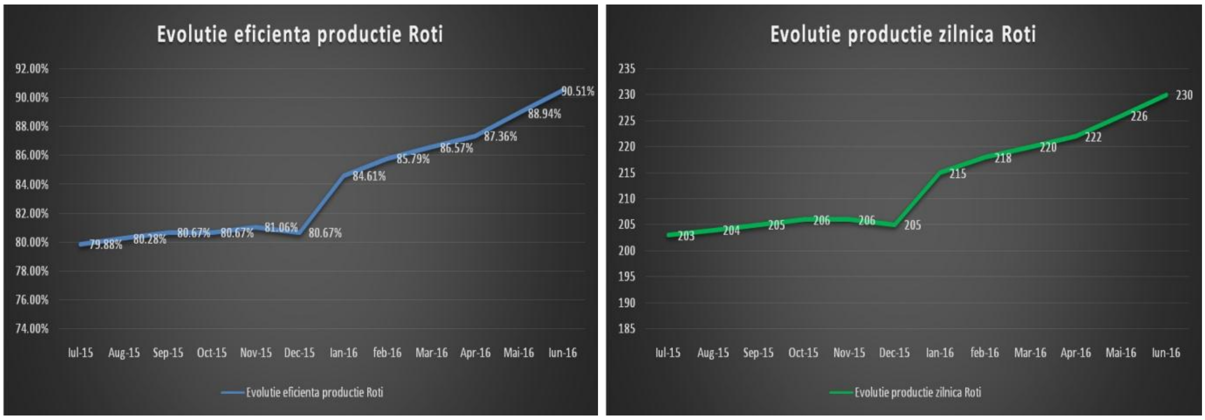
The data with which the calculation was made shall be entered, namely: total working time, actual time worked, number of operators and stations, for June 2016.

$$Efficiency\ \text{June} = \frac{1173}{1296} \text{ x } 100 = 90.51\ \%$$

Table 2 shows the evolution of efficiency before and after Kanban's implementation. Thus, in the months before implementation, the efficiency was at an average of about 80%, according to statistical data, while after the implementation of the system it reached 90.51%, according to the June 2016 efficiency.

Table 2 Efficiency evolution after Kanban implementation

Data	Cycle Time	Cycle numbers /day [average]	Actual work time [average]	Total planned time [average]	Efficiencycient a
Jul-15	5.1	203	1020	1296	78.70%
Aug-15	5.1	204	1030.2	1296	79.49%
Sep-15	5.1	203	1045.5	1296	80.67%
Oct-15	5.1	205	1045.5	1296	80.67%
Nov-15	5.1	206	1040.4	1296	80.28%
Dec-15	5.1	208	1040.4	1296	80.28%
Jan-16	5.1	215	1096.5	1296	84.61%
Feb-16	5.1	218	1111.8	1296	85.79%
Mar-16	5.1	220	1147.5	1296	86.57%
Apr-16	5.1	222	1162.8	1296	87.36%
May-16	5.1	226	1193.4	1296	88.94%
Jun-16	5.1	230	1224	1296	90.51%



a. b.

Figura 5 a. Evolution of performance indicators before and after the Kanban,
b. Evolution of daily production.

In the "Wheels" section, an analysis of the performance indicators between July 2015 and June 2016 (Figure 5) results in a considerable increase in the efficiency of their operators and productivity, since in the months before the Kanban method the average daily production was 204 wheels / day, while in June 2016 the average daily production reached 230 pieces (Figure 6).

Conclusions

By using the Kanban method we can reduce inventory.

Because the components are not delivered until they are needed, the need for a large stock and a large storage space is greatly reduced.

Reduction of waste and scrap.

The Kanban method brings flexibility to production.

If a fall in demand suddenly occurs, Kanban ensures that the manufacturer does not remain on stock. In this way, production flexibility is achieved to respond quickly to new demands and changes, ie it can produce at any time different landmarks than the ones produced up to then, depending on demand.

Kanban also brings flexibility in the way the production line is used. Production lines are not fixed to a single product, they can produce minor changes with other items. The only limit is given by the type of machine, used equipment and employee sentiment.

Using the Kanban method to increase production.

The Kanban flow (labels) stops if a production problem occurs. By stopping Kanban flow, it is immediately noticed that a problem has arisen and can be solved as quickly as possible. Kanban reduces waiting times by making more affordable stocks and breaking administrative barriers. This results in an increase in production using the same resources.

By applying the Kanban method, total cost can be reduced by:

- Prevents additional product production
- Develop flexible workstations
- Reduction of waste and scrap
- Reduction of waiting time and logistics costs
- Reducing stock levels and additional costs
- Saving resources by organizing production
- Reducing inventory costs.

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