RESULTS OF KANBAN METHOD IMPLEMENTATION ON A FLEXIBLE MANUFACTURING SYSTEM

Nicolae(Mănescu) RALUCA[1]
Nedelcu ANIŞOR[2]

ABSTRACT:
MODERN MANUFACTURING SYSTEMS USING ADVANCED TOOLS AN TECHNIQUES SUCH AS STATISTICAL QUALITY CONTROL, TOTAL QUALITY MANAGEMENT (TQM) SYSTEMS, MANUFACTURING PLANNING AND CONTROL (MPCS), LEAN SIX SIGMA STRATEGY, KANBAN METHOD. IN THIS ARTICLE WE WILL SHOW THE ADVANTAGES AND RESULTS OF IMPLEMENTING KANBAN METHOD ON A FLEXIBLE MANUFACTURING SYSTEM. THE MAIN OBJECTIVE OF THIS ARTICLE IS TO PROVIDE REQUIREMENTS THAT THE DESIRED PRODUCTS ARE MANUFACTURED: THE DESIRED TIME, THE QUANTITIES PLANNED TO SATISFY SPECIFICATIONS FOR PRODUCT QUALITY AND MINIMUM COSTS [5]. ADVANCED METHODS SUCH AS TOTAL PRODUCTIVE MAINTENANCE (TOTAL PRODUCTIVE MAINTENANCE - TPM) SYSTEM JUST IN TIME (JUST IN TIME - JIT), WITH THE INTRODUCTION OF TYPE DRAWING (PULL SYSTEMS) AND KANBAN CARDS REQUIRE A PHASED APPROACH. IT WILL FOLLOW THE ESTABLISHMENT OF RELEVANT INDICATORS TO MONITOR PROGRESS AND CHANGES NEEDED TO ACHIEVE CLEAR OBJECTIVES, BUT MUST HAVE BEEN PREVIOUSLY CREATED CONDITIONS FOR IMPROVED RESULTS BECOME IRREVERSIBLE [6]. USING KANBAN METHOD LEADS TO REDUCED STOCK PRODUCTION IN THE TOYOTA PLANT THEM REDUCING THE NEED FOR A MONTH AND A HALF TO THREE DAYS NEEDED FOR PRODUCTION.

KEY WORDS: *MRP, KANBAN, FLEXIBLE MANUFACTURING SYSTEM, CARDS, CONTAINER.*

INTRODUCTION

Flexible manufacturing system (SFF) is an integrated complex system, commissioned by computer, automatic lathe, automatic installation tools and parts handling, automated measurement and test conditions minimized manual intervention and reduced time adjustment can process any items belonging to a specific family of products and capacity limits of a program (algorithm) manufacturing default [1].

Flexibility implies the ability of a manufacturing system to react quickly to changes in demand terms and conditions of delivery. Flexible manufacturing systems have been developed in a sequence of consecutive stages [3]. Kanban is often seen as a central element of the "Lean" manufacturing and is likely the most widely used application system. Kanban can be associated with Just-In-Time (JIT). However Kanban is another name for Just-In-Time

[1] PhD, Nicolae(Mănescu) RALUCA, Transilvania Universityof Brasov, Romania, nicolae_raluca3@yahoo.com.
[2] Prof. Eng., Nedelcu ANIŞOR, Transilvania University of Brasov, Romania, a.nedelcu@unitbv.ro.

system is a part of Just-In-Time, Kaizen and 5S ones. A requirement of the operation in Kanban method is for people to work together.

First Kanban system was now created more than 60 years at Toyota in trying to excel in the market for cars. Toyota could not compete on technology, market development and the volume of cars produced, chose to compete by redefining the organization of the production process [4]. Using Kanban system, linking all operations in production back through cards, signs, buffer stocks. For proper operation of the Kanban system, signaling the card is used while conducting surfaces Kanban or other methods from the same category [6].

METHOD

In translation, the Japanese word "Kanban" means the card. Toyota production system is one of the most improved in the world and is instrumental Kanban he leads. In figure 1, will show the characteristics of this system in parallel mode. Toyota Production System fulfills customer requirements efficiently and quickly by creating a connection between all the business of manufacturing and real market demands. In practice, more information on the implementation of Kanban method is very useful. These may be [2]:

- When consumers and producers are not close enough to be able to see and can not communicate with them, use a card, a flag, a light, empty space on the production platform to signal the lack of parts;
- When a workstation must be supplied with several types of components, use multiple sites or card Kanban to distinguish between them;
- In an MRP system production schedule can be analyzed as a construction authorization and method "Kanban" is a system that "Close" or initializes the current production, in construction of buildings. Process design approach and implementation of integrated systems for complete computerization of organizations / companies involves the stages preceding market research and choosing the right business solution, steps should include a comprehensive understanding of the concepts required MRP (Manufacturing Requirements / Resource Planning). If MRP is very important to know the necessary materials with certainty about the exact nomenclature, entity, quality and lead times of products;
- "Kanban" cards provides direct control over the workload for the production cells. It is a production management technique that uses cards attached to components / containers to monitor the flow of materials in the factory. The method was designed on the model of organization behavior observed in the teamwork of ants and bees.
- Kanban - kanban pull system is a visual production control using reusable containers, cards or areas / open spaces to facilitate pulling / pull products from the respective storage locations.

The Japanese were the ones who introduced a system where different products in manufacturing processes are "pulled" by the processing centers corresponding to each individual product, all to reduce stocks [2]. For this, they have created a system to signal when required parts to jobs by using a set of cards. The card authorizes the sending of a new container components.

Usually, a Kanban signals the need to supply container parts by submitting a power stage or suppliers. A command is initiated by the Kanban container and depending on the complexity of production so that can find in a production system with several "Kanban"-s. While the system had to change, so the card does not exist, the system still bearing the name of Kanban.

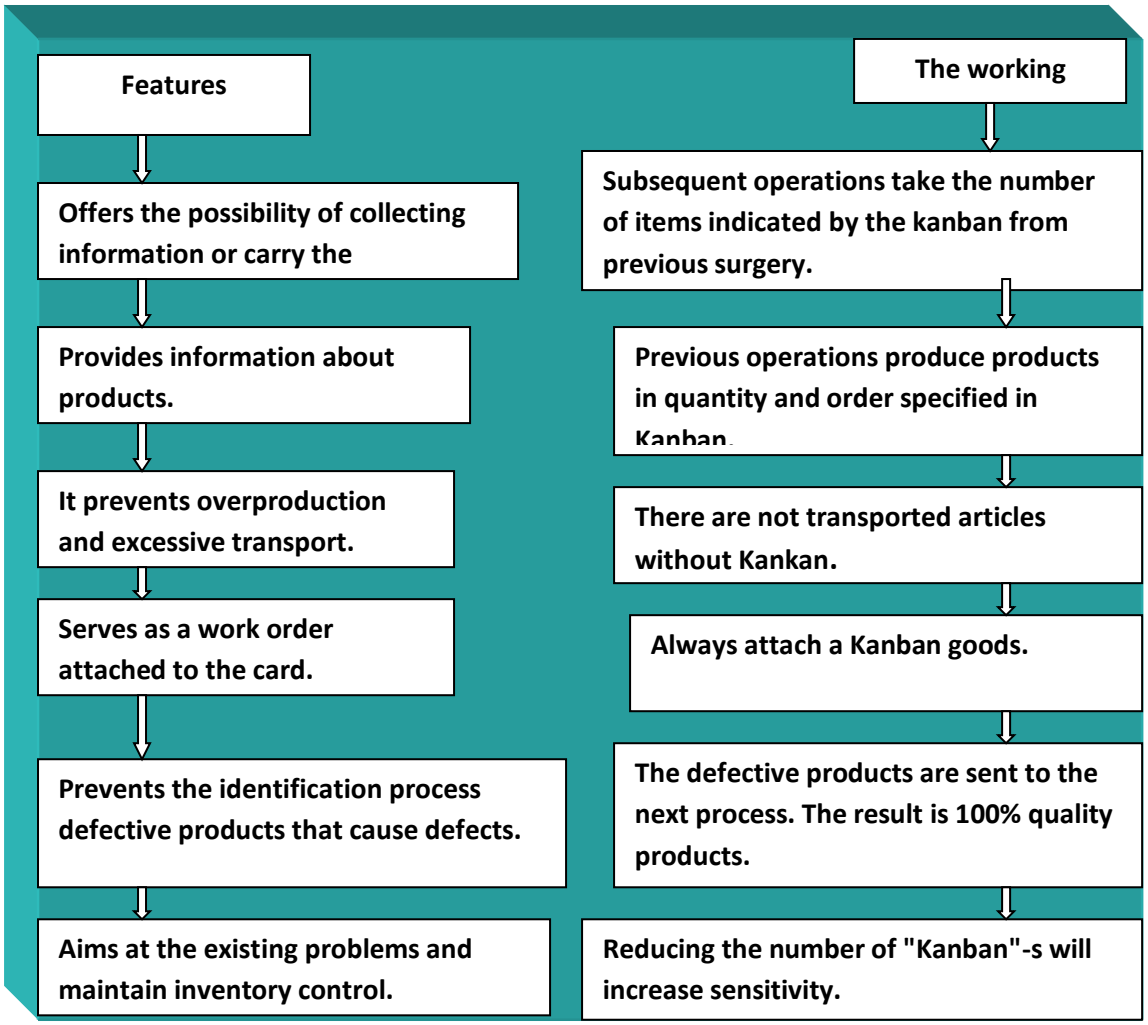

Fig.1 KANBAN system paradigme

STUDY CASE

The case study is conducted on a flexible manufacturing system that processes flat and spare parts to the exterior surfaces of revolution (like trees), as in Fig. 2, composed of:

- Cutter
- Lathe
- Robot
- Two semifrabricate lockers
- Transmission system loading / unloading of raw materials and spare parts finite elements

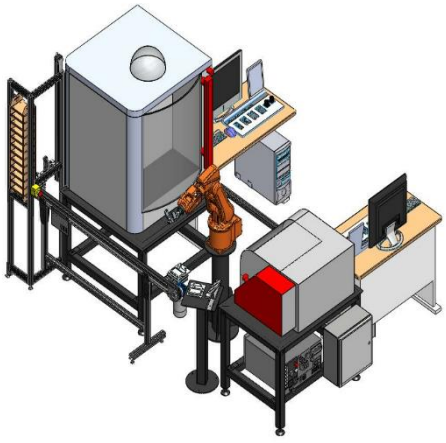

Fig. 2 Integrated manufacturing and assembly

Kanban system is a system for production scheduling indicating that occurs when to produce and how much to produce. In essence, the Kanban system is a method of "authorization" of production and material flow in JIT system.

In Fig.3 is shown how Kanban method works using all units produced by the succession of phases of production. By Kanban approach aims to remove those parts for production and to be just as many parts to replace parts removed after the system stops.

When stock is depleted computer system sends a signal to the warehouse, warehouse replenishment suppliers [2]. Operators sit idling systems have immediately seen by the human factor, which must act immediately to make things going better.

Authorized stock level is determined by the number of cards (containers) Kanban. To see the number of containers moving back and forth between the area of food production and the size of each container will be calculated. Thus we calculate the lot size; for this you have to know the time required to produce a container of parts and safety stock levels to cope with variability in the system. Finished products are made by leveling production by a series of buffer stocks associated with Kanban system that provides control over stock levels that are unfinished production on stream.

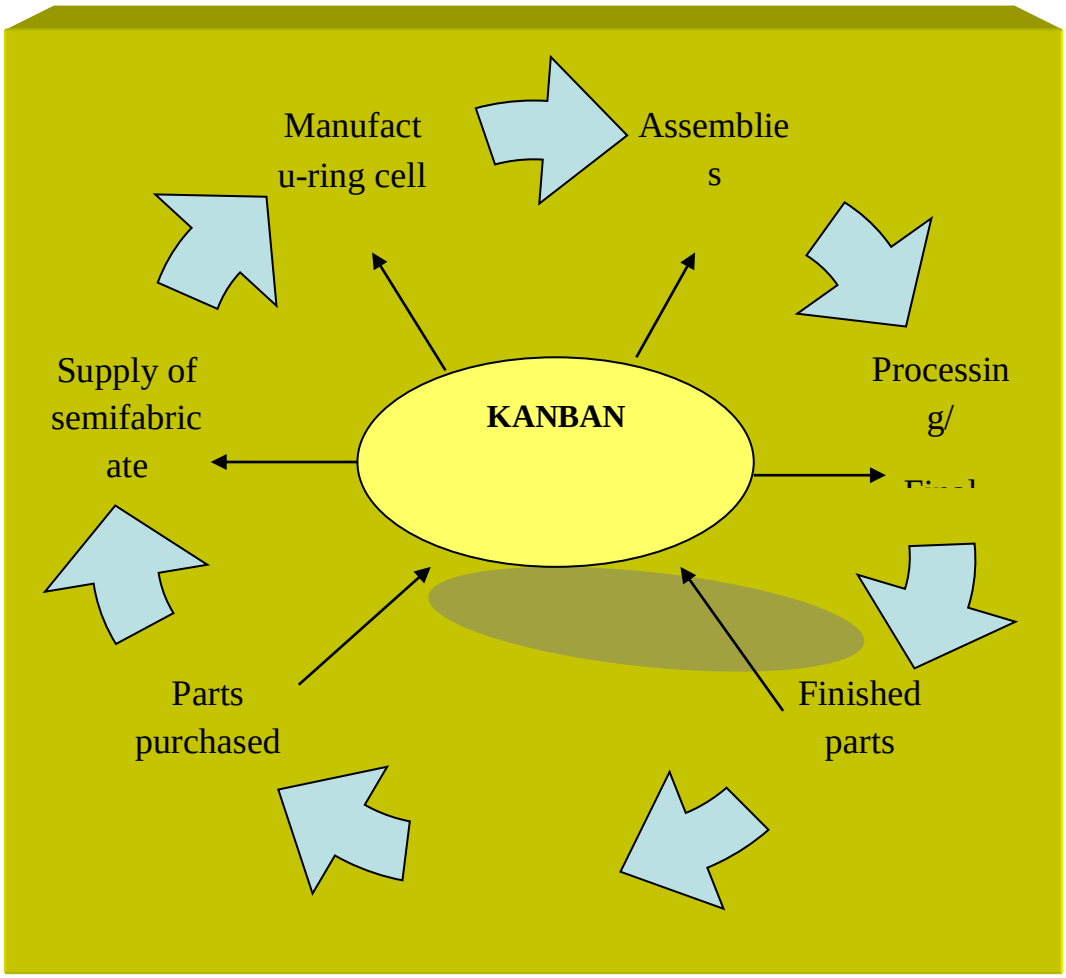

Fig. 3 Workpiece by Kanban method in manufacturing.

We consider a flexible manufacturing system as in Figure 2, which produce finished parts. We want to reduce the stock of parts by introducing a „Kanban". The data obtained are the following:

Table 1.

Daily demand	500 parts
Time for the production cycle	2 days
Safety Stock	0,25 days
"Kanban" size	300 parts

We determine the number of „Kanban"- s production process. For this you have to determine the demand for parts in [2]:

$$\text{Number of "kanban"- s} = \frac{PT \times AD + SS \times AD}{CQ} \quad (1)$$

PT - production time = waiting time + during the handling time of raw materials + processing time = 2 days

AD- daily demand = 500 parts

Demand for parts during a production cycle: 2 days × 500 parts = 1.000 parts ; (2)

SS - Safety Stock : 0,25× 500= 125 parts ; (3)

CQ - „Kanban" size= 300 parts

$$\text{Number of kanban containers will be: } \frac{1000+125}{300} = 3{,}75 \text{ , about 4 containers.} \quad (4)$$

RESULTS

The approach is based on manufacturing small batches, but in large numbers. Reducing a batch may not be economical so that it will resize lots eschewing the production process scheduled using Kanban system is that it will focus on reducing bad time wasted, production scheduling, cost reduction on manufacture and handling preparation for production.. The main objective of using kanban system is to ensure 100% availability of materials and constantly improve the level of inventories. Although the principle of Kanban was introduced more than half a century ago, its application in various fields in various forms continues to increase the interest of researchers. Among the advantages of this method still include: improving communication between production processes, reducing the number of defects and allowing total control and increase predictability (forecast). The containers are very small, the entire system has a very precise programming and manufacturing process must be conducted smoothly with little variability in the length of economically.

Basically applying this method of production scheduling is done so that the production of each day to meet the daily demand. We can talk about programming manufacture demand levels.

Advantages processing cycle for any additional storage has an impact on the entire flexible manufacturing system. All these advantages lead to greater flexibility, quality, employee involvement.

CONCLUSION

Flexible manufacturing systems need to be addressed in an interdisciplinary manner globalist, ie from the perspective of a science of production. Task analysis of production remains the fundamental element in the design of manufacturing systems where science has a crucial role. The reliability of flexible manufacturing systems is relatively little addressed in the literature.

The flexible manufacturing system is a very different nature. It generates accumulations that can maintain its operation upon failure of some components, thus ensuring time required reserve maintenance interventions. Resulting flexible manufacturing systems have a strong inertial behavior. Within enterprises an important way to raise the technical level of existing flexible manufacturing systems based on this input and technical progress in the enterprise is the upgrading.

This can be achieved either with incorporation of an integrated system or as a self-contained, aiming to remove the effects of obsolescence and the operation of their systems as close to the technical and economic parameters and indicators of a new machine built with a higher tech.

Upgrading equipment is an embodiment of extended reproduction, ensuring the constructive and technological improvements of renewal and improvement and increase its technical and economic performance. It is funded investment, resulting in increased baseline machine.

In conclusion we can say that any company that wants to remain competitive must adapt to the needs of the market by demanding the adoption of sustainable strategies by opening the new and the introduction of new technologies not only in all the areas: production, logistics, without limited to concepts and standard procedures that characterized the beginning of the century.

Kanban method application in different areas, "less is more" is true every time. Kanban is distinguished by the ease with which any process, and the basic principles of simplicity and rapid effects of quality improvement and process work

ACKNOWLEDGEMENT

This paper is supported by the Sectoral Operational Programme Human Resources Development (SOP HRD), ID134378 financed from the European Social Fund and by the Romanian Government.

REFERENCES

1. Duse P.; *Designing technologies in flexible systems*, Iasi: Technical University "Gheorghe Asachi", 1995.
2. Militaru G.; *Operations Production Management*, Bucuresti: ALL, 2006;
3. Buzatu C.;*Flexible systems for machining*, Bucuresti: Technical Publishing House, 1993;
4. http://kanbanblog.com/
5. http://en.wikipedia.org/wiki/six_sigma
6. Stoianovici G. V.; *Eliminating waste using lean manufacturing techniques*, Sebes, 2011