

JIT AND KANBAN METHODS AS THE TOOLS FOR PLANNING, RUNNING AND OPTIMIZATION OF MATERIAL FLOW

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Abstract: This paper is focused on the methods, which are used for planning, running and optimization of material flow. These methods are very important element of each production and company. There are several methods which are used, for example JIT (Just in Time), Kanban, TOC (Theory of Constraints), TQM (Total Quality Management), MRP (Material Resource Planning) etc. A selection of appropriate method affects largely production costs, efficiency and produced quantity. The most common methods used in planning, running and optimization of material flow are included the JIT and KANBAN methods. This paper highlights their main features, differences and use in the material flows issue. The paper solves the issue of the material flow monitoring in the intelligent assembly cell.

Keywords: Just in Time, kanban-method, production, material flow

1. Introduction

Increasing requirements for the quality and reliability of the production lead to requirements increasing for the logistics, logistics systems and fluent material flow.

In the issue of planning, running and optimization of material flow are currently used the more methods, for example JIT (Just in Time), Kanban, TOC (Theorie of Constraints), TQM (Total Quality Management), MRP (Material Resource Planning), etc.

The most common methods, which are used for the material flow issues are JIT and Kanban. The paper is focused on the main features of these methods and solves the selection of appropriate method for the material flow monitoring in the intelligent assembly cell.

2. Intelligent assembly cell

Intelligent assembly cell is the machines system, which are able to work with auxiliary devices in the limited time without the operator. The auxiliary devices are used mainly to the handling with the products, parts and tools.

The intelligent assembly cell is possible to divide into three subsystems:

1. assembly – the aim is to assembly the basic elements of part to the whole, the automatic exchange tools and automatic compensation for tool position include here,
2. handling – handling activity and object exchange of processing in the machine and in the input-output cell place with the inter-operational transport, also included is the handling of production utilities and waste,

3. running – the aim is the running, coordination and monitoring of cell production functions [4.].

2.1 Intelligent assembly cell in the Institute of Production System and Applied Mechanics (IPSAM)

Intelligent assembly cell in the IPSAM (fig. 1.) is the multifunction assembly devices, which realizes four production stages and there are:

- ▲ the semi-finished product and final products storage before its expedition,
- ▲ the transport and handling with the semi-finished products and final products,
- ▲ the assembly of individual parts to the final product,
- ▲ the expedition [5.].



Figure 1. Intelligent assembly cell in the IPSAM

The several papers have been devoted to this area – Intelligent assembly cell. There are in more detail described its principles – [5.], [6.], [7.].

3. JIT method

The change of production character to production to order with small supplies leads to implementation of JIT method in the many cases. This method synchronizes the transport, production, storage and assembly processes in the whole logistics chain.

JIT system is characterized by two basic principles, there are:

- ◆ supplies are harmonized with the needs and deadlines, it means, that the ordering must be synchronized with the production,
- ◆ the production is harmonized with the needs and deadlines too, which implies, that the production must be synchronized with the sales.

JIT method is generally advantageous to be applied only for the repeated large-scale production. This production is seen as the production of the products, which are regularly ordered – without the big deflections in the demand. This system is appropriate for the mass production too. The problematic application of some principles is only in the pieces and small batch production, where are produced the big quantity of variant products. The introduction of some principles of JIT method (the solving of quality questions, the reduction of preventive maintenance, suppliers, POKA-YOKE, JIDOKA, ...) can be the significant way to influence the production efficiency in the all cases (fig. 2.).

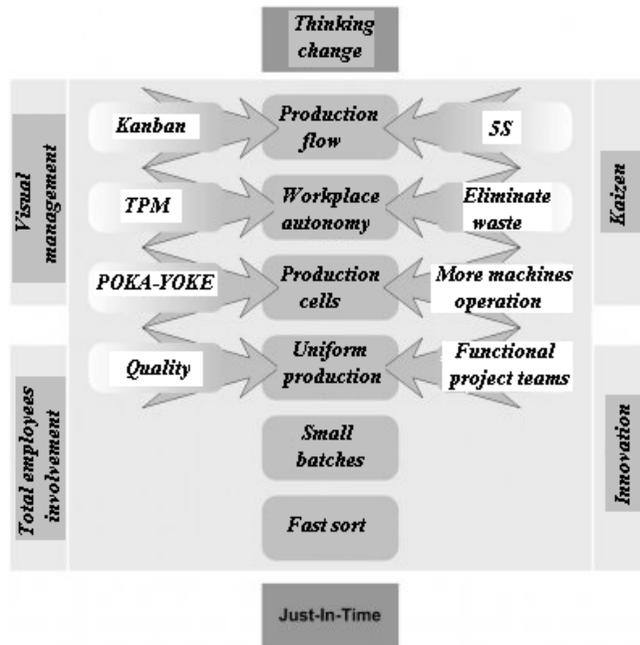


Figure 2. Principle of JIT system [1.]

4. Kanban method

Kanban method (Pull system of production running) is Japanese system of production running, which uses Kanban cards (system for easier running and supply of production). Kanban method (fig. 3.) is one of the methods, which are used in the issue of flow synchronization. The biggest production losses from the aspect of transversal time of production causes the supply of unfinished production. The easiest way (practice, the hardest by applicable) is to remove it, for example merger process – creation of fluent material flow.

In the Kanban system are used these basic means:

- ◆ Kanban card – it serves as an ordering card (it orders the production of parts on the previous production level), it serves as the identification card too (for the new produced parts),
- ◆ Kanban board – it is the place, where the internal supplier obtains the information about the requirements of internal buyer. It is the basic visual element,
- ◆ Kanban box – it serves to store the cards, where the buyer inserts his requirements [3.].

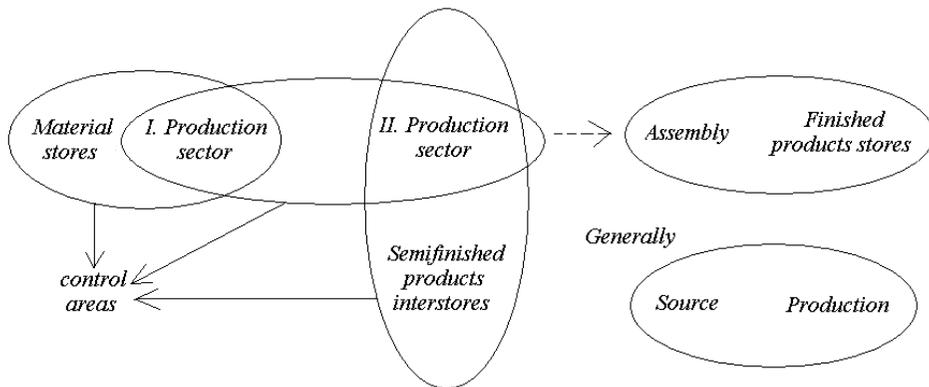


Figure 3. Principle of Kanban system [2.]

Reason for the introduction of Kanban system:

- ◆ reducing the size of production batch – allows to responds flexible to customer needs,
- ◆ less production batch means less elements in the production and less space requirements (storages) and losses reduction in poor quality production,
- ◆ less space requirements and losses from poor quality – it means the costs reduction,
- ◆ clarify of flow in the production – all information are on the Kanban board,
- ◆ transition from push system to pull system of material flow.

The material flow is going to monitor through the Kanban method in the intelligent assembly cell, because it enables precise monitoring of material flow. Kanban enables to monitor exactly – the production in the current time by the real inputs. And it is advantageous to use in the intelligent assembly cell. The advantages of Kanban method convinced us of its use in the intelligent assembly cell.

5. Conclusion

Different methods are used in the issue of planning, running and optimization of material flow. There are for example: JIT (Just in Time), Kanban, TOC (Theory of Constraints), TQM (Total Quality Management), MRP (Material Resource Planning), etc. Each method has its characteristics, features, procedures and principles, which are characterized. This paper is focused on the two main methods and there are: JIT and Kanban. In the paper were determined its main differences. Method JIT is based on the principle, that all products are delivered in the right time, quality, place and in right quantity. In the issue of material flow is assumed, that the products are produced on the based the order and the production is realized in the small batches (1 production batch=1 product). Kanban-method is focused on the principle, that the products are produced in the bigger batches, it means, for example 1 production batch=50pcs. The further important feature of the Kanban-method is, that the rejects transformation in unacceptable to the further workplace. For each company is very important to determine the right method of planning, running and optimization of material flow. In the intelligent assembly cell is going to use the Kanban-method on account its advantages.

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References

- [1.] (2009) <http://e-api.cz/article/69450.lean-manufacturing/> - Lean Manufacturing, Lean Management, Accessed on: 2011/08/26
- [2.] (2008) www.exos.sk/GDFS/Integrované_IS/2_Funkcie/typy_vyrob_procesov.htm - Organization types of production processes, Accessed on: 2011/08/27
- [3.] (2011) www.ipaslovakia.sk/slovník_view.aspx?id_s=116 - Kanban - pull system of production running, Accessed on: 2011/08/28
- [4.] KOVÁČ, J., SVOBODA, M. LÍŠKA, O.: **Automatizovaná a pružná montáž**. Viena, Košice, 2000, 375s.
- [5.] DANIŠOVÁ, N. - RUŽAROVSKÝ, R.- VELÍŠEK, K: **Design methodology of automation equipment and control system in the intelligent assembly cell**. In: Applied Mechanics and Materials. - ISSN 1660-9336. - Vol. 58-60 (2011), s. 2407-2412doplniť tie články čo sú v texte
- [6.] DANIŠOVÁ N., VELÍŠEK K.: **Intelligent assembly system**. In: Annals of MTeM for 2009 & Proceedings of the 9th International Conference Modern Technologies in Manufacturing : 8th - 10th October 2009, Cluj-Napoca, Romania. - Cluj-Napoca : Technical University of Cluj-Napoca, 2009. - ISBN 973-7937-07-04. - S. 57-60
- [7.] DANIŠOVÁ N., VELÍŠEK K., HORVÁTH Š.: **Intelligent camera system at the workplace of intelligent assembly cell**. In: IMCIC'10 : The International Multi-Conference on Complexity, Informatics and Cybernetics. April 6th - 9th, 2010 - Orlando, Florida, USA. - Orlando : International Institute of Informatics and Systemics, 2010. - ISBN 978-1-934272-89-3