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The use of telematics tools in controlling the flow of materials in a production process

M. TOPOLSKI, A. BUJAK
WSB UNIVERSITY IN WROCŁAW, Fabryczna 29-31 Wroclaw, Poland
EMAIL: mariusz.topolski @wsb.wroclaw.pl

ABSTRACT
In production enterprises the production logistics is the most important link of the company. We particularly pay attention to wastage and look for possibilities of reducing costs. Improvements in the production area, the supply chain or warehouse management generate financial benefits. In order to improve the existing situation appropriate decisions must be made and available tools must be used involving the application of "lean management" or system tools such as telematics. The research aims to indicate that through the usage of telematics tools in the production, it is possible to eliminate unnecessary inter-operational time from the production process. This will allow for smoother work, elimination of wastage and the growth in the value added. The application of RFID production IT project to accelerate and eliminate mistakes in the production of doors, to facilitate planning the purchase of raw materials and to analyse the stock and order execution on an on-going basis is an important element..

KEYWORDS: telematics tools, production logistics, modelling, production

1. INTRODUCTION

The production logistics links the procurement logistics and the distribution logistics by manufacturing finished goods and semi-finished goods. It encompasses all processes related to procurement, the manufacturing process into relevant goods and transferring semi-finished goods and finished goods into warehouses" [6]. The production logistics is a sub-system of logistics where the production determines the main activity of a production system. It deals with a transformation of „work objects into goods through work means and labour"[7].

An appropriately organized production logistics secures:

- full accessibility of raw materials and materials necessary for order execution,
- continuity and rhythm of the production,
- appropriate stock of work in progress and finished goods,
- striving to shorten production cycles,
- application of automatic identification,
- minimization of defects.

An enterprise is able to achieve high results thanks to the implementation of appropriate methods, tools and information processes and systems accompanying the flow of goods. While making decisions about manufacturing, solutions concerning the flow of goods and information are being developed according to arising needs and determinants [10].

Problems in the solutions implementation arise during the development. In many cases the implementation of ideas depends on:

- the type of production organization,
- the layout of equipment taking part in the process,
- features of a particular good or its design, structure, difficulties and the type of processing technology,
- principles and organisation of the production supply with materials and raw materials.

2. The flow of materials and stock in a production enterprise

In most production enterprises the choice of a logistic strategy and solutions applied largely depend on the organization of the flow of materials. The type of production is one of the most important factors determining the specialization and stability of a production process. We differentiate the following productions:

- piece production,
- small lot production,
- medium lot production,
- big lot production,
- mass production.

Organisation of production flows is the next determinant of material flows. It denotes „the way of linking work stations with technological operations in a production process of specific goods" [6]. We differentiate the following forms of production:

- non-rhythmic (non-repetitive),
- rhythmic (repetitive).

The product that is manufactured in the production process is one of factors determining the flow of materials.

Another important factor affecting the smooth flow of materials is the location and the layout of a production hall. We distinguish the following types of layout:

- technological,
- subject-related (a production line),
- mixed,
- permanent.

The principles of material procurement are the last determinant of the flow organization. They are about supplying materials on the basis of a demand or a minimal stock.

The input stock originates from supplying an enterprise with materials and raw materials necessary for the production as well as from the stock at suppliers.

The internal stock is created during the production process and includes materials which have already been issued for production and not processed, work in progress and manufactured products which remain "on stock" of the production department" [7].

The output stock includes finished goods and the stock at wholesalers. In practice the flow of materials and the policy of creating the stock depend on the selection of a stock management method namely "a pull approach" or "a push approach" [3].

3. The use of telematics tools in a production enterprise – the research methodology

In the examined enterprise, the awareness of the benefits generated by the implementation of modern tools is greater and greater. The implementation of TQM or JiT could not happen without supporting an enterprise with integrated systems with appropriately selected modules. The implementation of telematics tool in an enterprise also generates a lot of benefits and will enhance effectiveness of the enterprise.

The main problems diagnosed in the company were as follows:

- incorrect stock levels disturbing the determination of current purchases,
- no information about current change-overs enabling the implementation of SMED,
- problems with the TPM implementation and with efficiency of machines,
- no information about current down-times.

Charts will be presented to graphically illustrate changes triggered by factors affecting this problem. They have been prepared to generate and show the data based on downtimes entered into the system by means of a manifold. A list of possible downtimes in the form of bar codes is available on each line.

Two lines L2 and L3 will be compared, where a regular production takes place and standardization of machines allows for manufacturing the same goods. The downtimes accounted for in the charts constitute the total of the time of raw materials and materials missing for the production as well as an additional service of the manifold. Chart 1 illustrates downtimes right after introduction of Impuls 5 and WMS. It encompasses months June, July, and August of 2013.

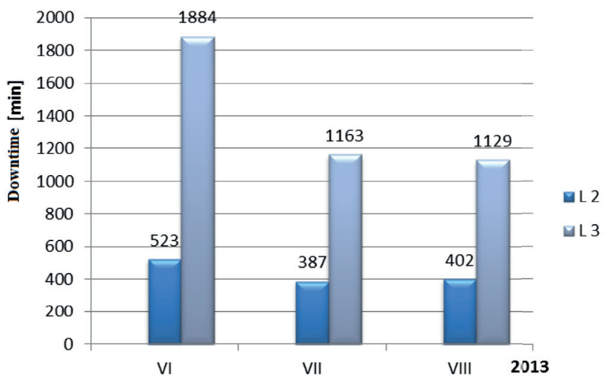

Fig. 1. Downtimes after the introduction of Impuls 5 [own study]

The above data shows that the two lines had problems with dealing with orders in WMS. It was caused by a bad operation of manifolds and the lack of material carriers for orders. On L3 the loss of time in April in respect of these operations amounted to about 31.5 hours. It is easy to notice that L3 had more downtimes than L2 during this period. The situation depended on the number of changeovers also involving the need of changing the product range on particular lines. Over three months L3 observed 413 changeovers whereas L2 had changed orders 292 times. Table 1 below presents a detailed situation from that period.

Having finished basic implementation works on Impuls 5 some problems were solved. The production smoothness increased. The inter-operational time was shortened due to a more efficient operation of manifolds. Some data entered manually was replaced with barcodes. For example:

- identification of people,
- various types of defects,
- descriptions of lines and work centres.

Table 1. Downtimes after the implementation of Impuls 5 [own study]

Type of downtime	L-2		L-3		2013 month
		Total		Total	
NO RAW MATERIALS, MATERIALS FOR PRODUCTION	314	1046	247	1884	VI
ADDITIONAL OPERATION OF THE MANIFOLD	732		1637		
NO RAW MATERIALS, MATERIALS FOR PRODUCTION	146	656	33	1163	VII
ADDITIONAL OPERATION OF THE MANIFOLD	510		1130		
NO RAW MATERIALS, MATERIALS FOR PRODUCTION	123	385	597	1129	VIII
ADDITIONAL OPERATION OF THE MANIFOLD	262		532		

After a full implementation of improvements and smooth work of interested departments we could have a look at the data again. Despite accepting the application in March, data from the next month April could not have been compared because organizational changes were made. Another data generated from the system and presented in chart 6 is for the months May, April, June, and July 2014.

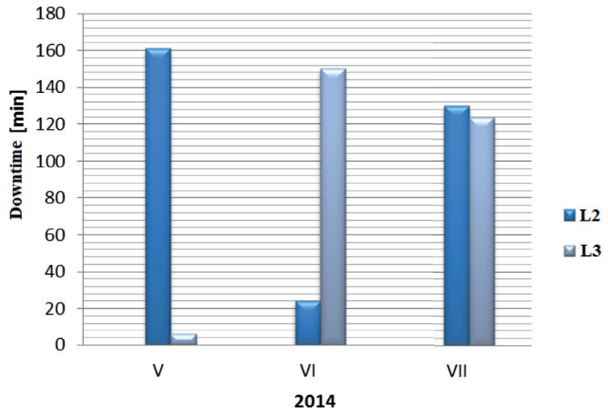

Fig. 2. Chart of downtimes after improvements[own study]

Next steps in improvements would involve implementing telematics tools in the company. The elaboration of a project of RFID implementation in the entire logistics supply chain of an enterprise could be an example.

The RFID technology utilises the transmission of a radio signal of low power between a tag (an electronic system consisting of an antenna and a chip –Fig. 3) and a reader. Radio waves transmit the data between a reader/transmitter and an object with an attached tag/label with an RFID device – a transponder.

The system consists of three basic elements (Fig. 4): an antenna, a transmitter-receiver with a decoder and a transponder (a radio location transponder device) marked as RF including written information. The antenna transmits a radio signal activating a tag which sends a radio signal with written information which is received and processed in the decoder. The range of such impulse in typical systems is 1 meter.

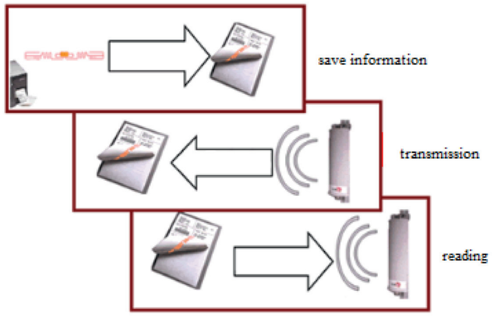

Fig. 3. Principle of RFID system operation [11]

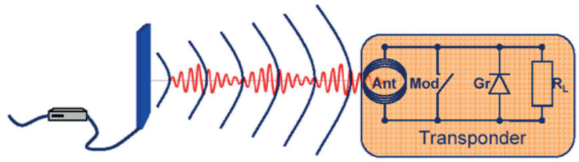

Fig. 4. Principle of passive RFID tag operation [11]

Active tags powered with a battery are used and when responding to a signal from the antenna they transmit radio impulses of higher power ranging a few hundred meters. These tags are programmed in such a way so that the information could be recorded and modified remotely. There is also an active-passive system as a combination of the two systems. The battery is used as an external supply to an electronic system e.g. a temperature sensor or to record data on a chip. Thanks to waves from an external device, the information from a chip is excited and sent to a reader.

The radio RFID system shows a lot of significant advantages as compared to other previously used ways of automatic identification. Thanks to RFID we may remotely read information, adverse weather conditions do not affect the work of the system, tracing the material flow is automated in the company. The disadvantage is that there are problems with global standardisation. At present, none of RFID standards is universal as the case is with bar codes. Another disadvantage is the possibility of carrying dangerous software on tags which may infect databases or IT systems. RFID has no good algorithms encrypting the data in transponders so the coding of information is risky as codes can be easily broken.

Fig. 5 presents a flowchart illustrating the flow of information and goods on the example of a supply chain.

A computer programme will be prepared for the purposes of managing the process of accepting orders, the production and forwarding. It will collect and process the information from RFID readers. The programme may be called RFID production. Orders from a distributor are electronically sent to a producer. They will be collected from a server through the Internet. The file or data from the order will be entered into the RFID production programme. An operator chooses orders for which the goods must be produced on a particular day. In particular:

1. a summary statement – a current equivalent helps to organise the production,
2. statements-requirements – a report showing which elements, materials will be used for the production,
3. a statement allowing for appropriate pallet formation,

4. a printout of labels on the product packaging – as so far,
5. a printout of double labels put on the product – a new label,
6. a printout of labels on sub-assemblies – a new label,

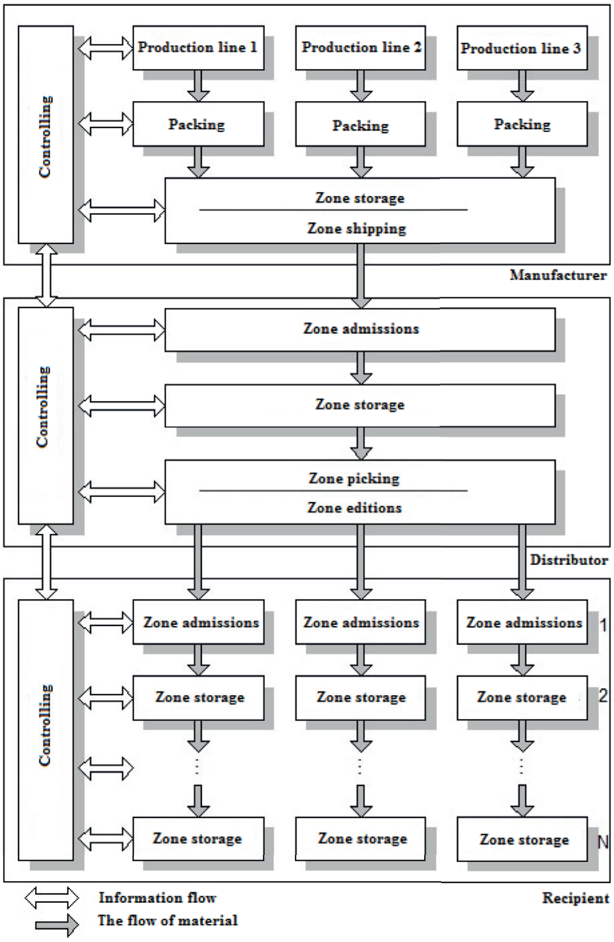

Fig. 5. Flowchart illustrating the flow of information and goods in the supply chain [own study]

The application of RFID and RFID production should facilitate production processes:

- accelerate and eliminate errors in the production of finished goods,
- facilitate the planning of raw materials purchase,
- enable a current analysis of the stock levels and order execution.

The following equipment is needed to complete and implement the project:

- a TT printer with an RFID module – 1 piece,
- a mobile RFID reader – 2 pieces – warehouses of finished goods,
- RFID labels for product application – two parts,
- RFID labels for semi-products application,
- RFID labels for the application of auxiliary elements,
- dispensers, applicators of labels – 2 pieces,
- RFID production software,
- access points – devices enabling communication between a computer in the office and mobile RFID readers – 1-4 pieces.

4. Conclusion

The changes that were made in management of the flow of materials from the *push* into *pull* method caused shortening the production time of orders. The production could start executing orders without changing a weekly production plan a few times. An enterprise began to generate profits and to meet deadlines agreed with the customers. The preparation of telematics tools implementation was also positively viewed by the enterprise. After the test carried out with all participants of the chain, it should be ascertained that the environment where RFID is to function does not cause disturbances when applying a gate with four antennas to control goods as well as reading by a manual terminal. Beyond doubt, positive results of the first stage of tests do not guarantee a success of the entire undertaking but it should be emphasized that the RFID technology opens new possibilities for integration of this simple logistics chain.

Statistical analyses have indicated that management representatives in most production and commercial enterprises declare that implementation of RFID technology to the supply chain contributes to the growth in the turnover of 19.9%-21.2%. Whereas the number of products sold increases by 15.5%-18.8%.

Bibliography

[1] BLAIK P.: Logistyka Koncepcja zintegrowanego zarządzania PWE Warszawa 2010.
[2] CIESIELSKI M.: Instrumenty zarządzania logistycznego PWE Warszawa 2006.
[3] GOŁEMBSKA E.: Kompendium wiedzy o logistyce Wydawnictwo naukowe PWN Warszawa 2010.
[4] LIKER J.K., CONVIS G.L.: Droga Toyoty do lean leadership Osiągnięcie i utrzymanie doskonałości dzięki kształtowaniu przywódców, MT Biznes, Warszawa 2012.
[5] MATUSZEK J.: Logistyka produkcji, PWSZ, Wałbrzych 2012.
[6] SZYMONIK A.: Logistyka i zarządzanie łańcuchem dostaw, część 2, Warszawa 2011.
[7] SZYMONIK A.: Logistyka produkcji Redakcja naukowa Difin Warszawa 2012.
[8] WATERS D.: Zarządzanie operacyjne. Towary i usługi, PWN, Warszawa 2001.
[9] WITKOWSKI J.: Zarządzanie łańcuchem dostaw Koncepcje, procedury, doświadczenia, PWE, Warszawa 2010.
[10] WOEPPEL M.: Jak wdrożyć teorię ograniczeń w firmie produkcyjnej: Poradnik praktyka, MINT Books, Warszawa 2009.
[11] Materials made available by the COMEX company – PPU „COMEX" sp. z .o.o. 54-516 Wrocław; ul. Graniczna.