FUNCTIONING OF WAREHOUSE MANAGEMENT SYSTEM PROGRAMS

Dr inż. Marek Tabert,
dr hab. inż Wojciech Lis prof. nadzw.
Department of Economics and Wood Industry
Management,
Poznan University of Life Sciences, Poland
ul. Wojska Polskiego 38/42 60-627 Poznań
E-mail address: mtabert@up.poznan.pl,
wlis@up.poznan.pl

Abstract

The paper presents principles for the operation of Warehouse Management System (WMS) programs, which are used to manage goods turnover in distribution centers and warehouses of production enterprises. Moreover, the range of functions was discussed, which will be realized by those programs. It was indicated that the WMS programs are applicable first of all in those objects, in which large numbers of diverse products are assembled and dispatched. Conditions are presented for the cooperation of WMS programs with Enterprise Resources Planning (ERP) programs, which are used when handling production processes. Requirements are indicated which should be met by an enterprise so that the implementation of a WMS program may bring economic benefits in the form of a reduction of logistics costs, a limitation of the number of errors in goods dispatch as well as quality improvement of customer service.

Key words

WMS programs, Enterprise Resources Planning, bar codes and RFID.

Introduction

The logistics chain is operated using a class of programs applied in the management of goods movement (turnover) in warehouses. Such programs are referred to as the Warehouse Management System (WMS) or systems for the operation of high stock warehouses. They are used to coordinate warehouse jobs, follow physical material and goods flows and streamline processes taking place in warehouses. All warehouse operations aided by a WMS program may be performed with no need for paper documentation.

The necessary precondition for the application of WMS programs is to use labels with bar codes. Efficiency of programs increases considerably when the RFID (Radio Frequency Identification) technology and mobile terminals operating in the WiFi (Wireless Fidelity) network are used. Electronic devices such as e.g. RF (Radio

Frequency) readers, belts, scales, packaging machines, code printers, etc. may be connected to the WMS (Książkiewicz 2004). Figure 1 presents a radio terminal with a screen recording deliveries to a warehouse, equipped with Windows CE / mobile software.

Figure 1. A radio terminal with a screen recording deliveries to a warehouse
Source:
http://magazyn.wysokiego.skladowania.pl/demo.aspx.

WMS programs are applied first of all in logistics companies (e.g. wholesale companies, distribution centres) and in warehouses of production enterprises, where they handle large amounts of packages, accepted from many suppliers and directed to many customers. In Poland WMS programs have been implemented starting from around 2000 in large branches of foreign companies, e.g. Kronopol and Mondi Packaging (former Frantschach Świecie).

WMS programs cooperate most commonly with Enterprise Resource Planning (ERP) supervisory programs (systems), where they handle management processes in the enterprise. In the ERP system decisions are made which are executed in warehouses, resulting in the translocation of materials and goods. Data are exchanged between both types of programs. This exchange is based on unified standards of information transfer. Such a solution facilitates full automation of goods movement in warehouses managed under the control of WMS software. Some ERP packages are already equipped with WMS functionality in the form of a separate module. In such a situation a complete integration of WMS programs with the ERP system takes place.

Functions and tasks of WMS programs

The primary task of a WMS program is to provide efficient and faultless localization of individual lots of goods or individual items in the warehouse and to monitor their turnover. The program handles three basic types of warehouse processes:

- Acceptance of materials (goods) to the warehouse (PM) – as a result of purchase, acceptance from outside suppliers, acceptance from production, return, customer's complaint, etc. In the ERP program this process is described by documents: Pz (acceptance from outside suppliers), Pw (acceptance from inside units).

- Issue of materials (goods) from the warehouse (WM) – as a result of sale, issue to outside customers, issue to production, issue related to a complaint, etc. In the ERP program this process is described by the following documents: Rw (internal issue), Wz (external issue).

- Translocation (MM) – a change in the location of a material or goods within a warehouse, described by an Mm document - translocation between warehouses. The result is not recorded in the ERP system.

When accepting goods to a warehouse the operator may generate an adequate label and use it to mark a goods item. In case when the label was already assigned by another unit from the logistics chain, the operator may read information placed on the label and enter it in the program.

Figure 2 presents an example of a logistics label for a standard logistics unit, which contains a constant number of commercial items, determined by the supplier. The logistics unit described by the label is composed of one type of commercial units, which have the same GTIN (Global Trade Item Number), e.g. a pallet containing 50 boxes of a shampoo. Each commercial unit is identified by its own GTIN and constitutes a part of a regular supply offer. The label contains a production lot (batch) number, facilitating identification of commercial units, subjected to the same production processes and the date of production.
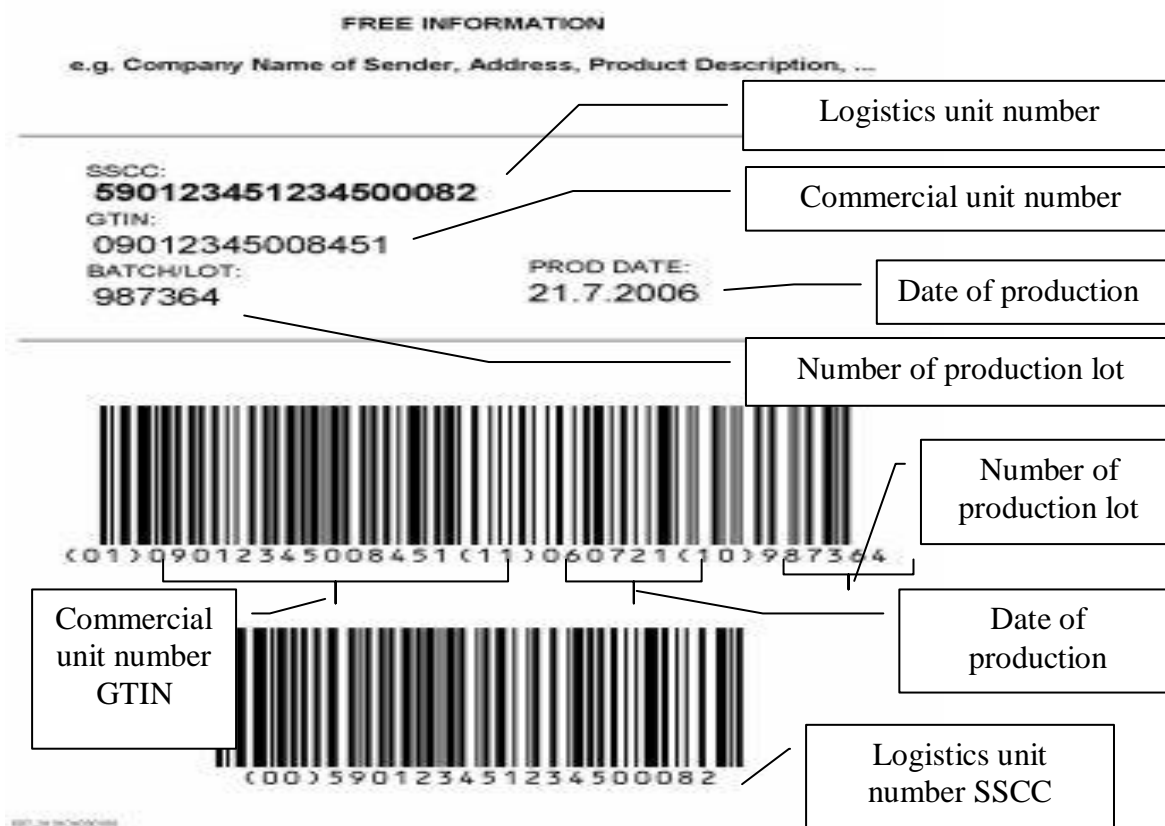

Fig. 2. An example of a GS1 logistics label for a logistics unit with a constant number of commercial units
Source: based https://ssl27.inode.at/gs1-labelview.at/display_result.php, modified by the author.

Using information presented on labels the WMS program monitors the conformity of the supply of goods with the order in terms of its quantity and assortment. A similar control is realised during the completion and dispatch of goods. It is executed with no need to count goods on warehouse racks. The system facilitates the maintenance of the FIFO (First Input - First Output - principle, according to which these materials and goods, which were accepted first, are issued first), both in reference to materials issued for production and in relation to finished products.

An important function offered by WMS programs is planning of dispatches, connected with the optimised utilisation of warehouse stock and transport facilities of an enterprise. This function also facilitates a reduction of storage time. This leads to a reduction of storage costs and reduces the demand for working capital. A WMS program also enhances labour efficiency, eliminates errors and supplies online information on warehouse stocks and on the planned and performed warehouse operations.

A WMS program realises the following functions:
- in terms of recording of warehouse operations:
  - acceptance of materials or goods and the selection of storage location,
  - translocation between warehouses or between storage locations within the same warehouse,
  - issue of materials to a production shop floor, acceptance for production and return of unused materials to the warehouse;
- in terms of control of produced goods:
  - storage in the data base of information on orders for goods (type of goods, quantity, etc.),
  - selection of packaging,
  - control of quantity of goods in a bulk container;
- in terms of control of stored materials and goods (finished goods):
  - monitoring of the type and amounts of materials issued for production as well as the order of acceptances and collections,
  - monitoring of the type, quantities, locations of storage of finished goods and dates of their issue,
  - storage of identification numbers of containers, in which finished products are packaged.

Offered WMS programs are generally designed in such a way that they may operate in any type of IT environment. During the implementation of a program it is adapted to the infrastructure already existing in the enterprise. The program operates using the central application server (computer / server), e.g. Sun – Java Application Server, IBM – WebSphere, BEA WebLogic, Oracle – OC4J, SAP – NetWeaver, as well as JBoss or Tomkat.

Applications with which the user executes operations may be available from any computer connected to the intranet or the Internet (with a browser). Such a solution does not require software to be installed on end computers. Access to the system is available after user's name and password are entered.

Characteristics of a MaGS1 program

The Institute of Logistics and Warehousing (Instytut Logistyki i Magazynowania - ILiM) in Poznań developed a multifunction and flexible WMS program named MaGS1, which offers IT handling of warehouses (http://www.ilim.poznan.pl/produkty/ai/pliki/mags1 _ogolny_opis_systemu.pdf). This program is designed first of all to aid in the management of such warehouses, in which GS1 (Global System One) standards are applied. The MaGS1 program uses a system comprising identification numbers of objects, being unique on the worldwide scale:
- GLN (Global Location Number) – a 13-digit number of the enterprise and storage location, e.g. warehouse, rack,
- GTIN (Global Trade Item Number) – a 14-digit number of a commercial unit of any container, containing a standard quantity of goods,
- SSCC (Serial Shipping Container Code) – a 18-digit registration number of each logistics unit, e.g. a pallet.

The application of the GS1 identification system makes it possible for the company to cooperate with suppliers and customers worldwide. At the same time in the market segments, in which GS1 standards are not used, the MaGS1 program makes it possible to use internal identifiers without any loss of significant advantages and functionality of the program. The program is adapted to cooperate with ERP and FK programs (IT systems used to aid in financial and accounting settlements), as well as apply the RFID technology, which is used to monitor goods flow based on automatic (via radio waves) reading and recording of data contained in the Electronic Product Code (EPC).

The MaGS1 program is designed for users with varied requirements. In terms of its scope it includes the last phase of production management, warehousing processes, quality control, recording of work time and efficiency of warehouse workers as well as completion and dispatch of goods. Moreover, it makes possible the management of

printing of standard logistics labels, automatic interception and identification of data concerning different logistics units and central management of labeling equipment.

The implementation of the MaGS1 system brings several benefits to the enterprise, enforcing arrangement of logistics processes. In the course of warehouse processes the program facilitates the emission of typical warehouse documents (Pz, Wz, Pw, Rw Mm) and their entry in the books. Paper documents are used only in those enterprises, in which the MaGS1 system does not yet fully cooperate with ERP or financing and accounting programs, or when such programs are not installed. The system improves the utilisation of warehouse facilities and provides constant access to information on the actual location of materials or goods in the warehouse.

It also facilitates the application of the FIFO, LIFO (Last Input - First Output – the principle consisting in the issue as first of those materials or goods, which were accepted as last) and FEFO (First Expired - First Output – the principle consisting in the issue as first of the materials with the soonest expiry date) principles. This reduces warehousing and training costs, thanks to the shorter and easier training of employees to work in the warehouse. It is a self-inventory system, which means that data collected in the data base fully reflect the reality. However, irrespective of the entries of warehouse stocks in the data base, financial regulations frequently require the performance of stocktaking. Then its realisation, supported by the program, is much less labour-intensive. The program monitors efficiency and quality of employees working in the warehouse. This reduces the number of errors committed during the completion of dispatches and minimizes the risk of misappropriations.

The MaGS1 system enters in the data base only the code numbers expressed in safe bar code symbols, reserved for GS1, i.e. UPC-E, EAN-8, EAN-13, ITF-14 and GS1-128. The other types of bar codes are ignored, because they do not meet the requirements of integration of the supply chain. The GS1 standards are used by all enterprises. Thus the MaGS1 system admits a temporary use of identifiers defined independently by the user. In such a case the enterprise has to ensure the uniqueness of used numbers. The GS1 standards provide such uniqueness automatically.

The manager, when managing the warehouse using the MaGS1 program, from the ERP system via the XML (Extensible Markup Language) interface, collects orders for acceptance or issue of materials and goods and records them in the MaSG1 data base. In turn, he transmits data on the current warehouse stocks to the ERP program.

Next the warehouse manager assigns tasks for warehouse workers, sending them to a selected terminal. Tasks are displayed on individual terminals of warehouse workers. The warehouse manager may monitor the actions of his subordinate workers, identified using a personal identifier, on an on-going basis on the monitor screen. Warehouse workers communicate with the MaGS1 system using portable terminals, equipped with bar code scanners via wireless radio connections.

An individual task indicates what may be transferred from a specific location to another during the acceptances or issues of materials or goods. Each location in the warehouse is identified with a unique address symbol expressed in the GLN bar code. Similarly, all unit and bulk containers are identified by a unique GTIN code. The unique SSCC numbers are then used to identify individual logistics (transport) containers. If unit or bulk containers are not yet assigned identification numbers, the system makes it possible to print and attach appropriate labels with codes. Packages supplied to the warehouses are recorded in the system already at the time bar codes are scanned.

Each operation of translocation of goods or materials from location A to location B requires successively the scanning of the bar code of:

1. the source storage location (the site of collection),
2. the collected packaging with goods or materials,
3. the final storage location,
4. the container with goods or materials placed in the new location.

For the MaGS1 system the ERP system generates only orders to accept (MP – the warehouse accepts) or to issue (MW – the warehouse issues). After an appropriate operation the MaGS1 program returns information on these operations to the ERP system. On this basis appropriate entries are made in the books.

The MaGS1 program communicates with the user through screen display forms, which make it possible to collect data with the confirmation of their accuracy and reports presenting aggregated information.

Concluding remarks

The WMS programs constitute an exceptionally useful element in the practice of the logistics chain in enterprises cooperating in goods turnover. Pioneers in their application included large warehouses of trade companies and wholesale companies. At present they are also used by manufacturers. Transport and logistics frequently generate high costs in enterprises. WMS programs make it possible to considerably reduce these costs

and streamline all processes they are connected with. The management staff in enterprises more and more commonly also sees the need to implement and use WMS programs.

The foundation and the first stage in the implementation of software is to adequately perform the analysis of all processes in the existing logistics chain in an enterprise. Errors committed at this stage are difficult to eliminate at a later time. The second important element in the implementation procedure is to design a logistics system, adapted to the financial situation of the enterprise. Financial limitations may have a significant effect on a reduction of efficiency in the whole system. The next stages in the implementation include parametrisation of the system, installation and configuration of the equipment and possibly its integration with software already used in the enterprise, testing of the system and training of the operating staff. Generally these stages are well managed by implementation companies and do not pose any serious problems.

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