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ECONOMIC JUSTIFICATION OF THE INTRODUCTION OF COMPUTERISATION IN THE STORAGE PROCESSES

Globalization and the growth of the market effect on increasing of the costs of logistics and distribution with simultaneous continuous pressure to lower prices of goods and services due to a competition. Breakthroughs into new markets, increasing share in existing markets and achieving sustainable customer satisfaction through quality satisfaction of his needs are the most important objectives of the company. The most important user requirements are aimed at cutting costs in the distribution chain and the administration and achieving faster and more flexible responses to market changes. Fulfillment of these requirements can be achieved only by computerization and integration of processes of storage, fast processing of orders and insight into real needs of the market. The paper presented the analysis of the applicability of the information system in the storage systems in terms of its good and bad characteristics, opportunities and feasibility of application through the application of side effects in storage systems.

Introduction. For business to survive in the market, especially in order to be successful, they must minimize the total cost of operations with continuous improvement and rapid adaptation to market changes. The potential savings in the business process lies precisely in the area of logistics, in the manipulation of material and information [1].

The main purpose of introducing of information systems (IS) is to control the movement and storage of goods in business operations. Direct storage, filling and exclusion are key processes in the IS. Characteristics and IS modes, different users vary depending on the combination of data processed by the system. These data may be related to the quantity (unit of measure), the location, information about orders that are used for supply and choice of the order of process.

Information systems of storage processes. Information systems for storage should be composed of [2]: systems that support only the basic processes in the warehouse, systems with extended range of functions that cover multiple storage processes and systems that support all warehouse processes and linking to partners.

The hardware basis of IS has a role to facilitate the functioning of this systems and its seamless integration within one or more storage. On the market there is a wide selection of parts hardware IS with different prices depending on the quality of workmanship and working conditions provided. When it comes to organization and connection of these components in practice there are different solutions, but the principle is the same everywhere and is presented in Figure 1.

The technologies that enable automation of distribution and storage processes with IS are mobile RF terminals (for workers and forklifts), RFID (Radio Frequency Identification) tags for automatic product software for the terminals, LAN (Local Area Network) and WLAN (Wireless Local Area Network) network infrastructure with access stations, bar code printers and software for the development and deployment of encrypted data (for example NiceLabel).

Figure 1 – Display of hardware components that support the IS system

A wireless radio network allows data exchange in the warehouse between fixed elements of IS and workers who are in constant movement and change of work. It is based on a docking station (Access Point or Base Station), which act as antennas for the submission of data and RF terminals that act as receivers and vice versa. In Figure 1 (left) it shows the places of use of IS hardware components in a storage systems, while those components are separated in Figure 1 (right).

Figure 2 shows a preliminary design of IS at the network level and structure of users who access the network in different ways. The core of the network makes the IS server, representing the central computer (the heart of the system) which collect, process and transmit information to other peripheral users and it is directly connected to the server of ERP systems, and communication between them is done by the appropriate protocol.

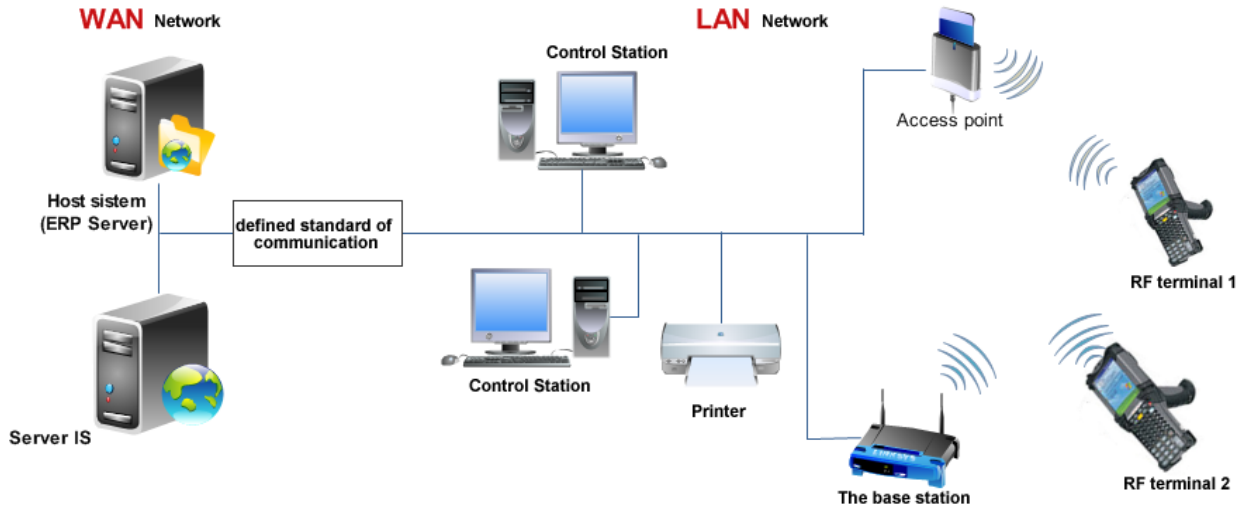

Figure 2- IS network architecture for storage

Figure 2 shows that the IS network architecture should include mostly LAN network, but WAN network is used to communicate with the ERP.

Mobile RF terminals greatly facilitate the work of stockmen who are often circulating by the warehouse. The role of this technology lies in gathering data from users and forwarding this data to IS (online) and visibility of results presents at the RF terminal screen. Each RF terminal has a radio receiver/transmitter and antenna through which it establishes a connection to the IS network. When selecting the RF terminal is necessary to respect the fact that these are devices that suffer the most in the work of the IS. The reason for this is that they always used in difficult conditions (temperature, humidity, dust), and often subjected to physical loads (falls, shocks, etc.). It is therefore very important to purchase high-quality solutions, which must not be too expensive (it is good to analyze the payback period).

The basic operating principle of this technology is shown in Figure 3. Control Center does the transaction data with all mobile devices that are used in the

warehouse through the base station. Upon receipt of message by the computer, over a network, the base station finds the requested device and sends him a message. Message arrives via terminal wireless network protocol. A wireless network allows sending messages in the opposite direction where the same process takes place only in reverse order.

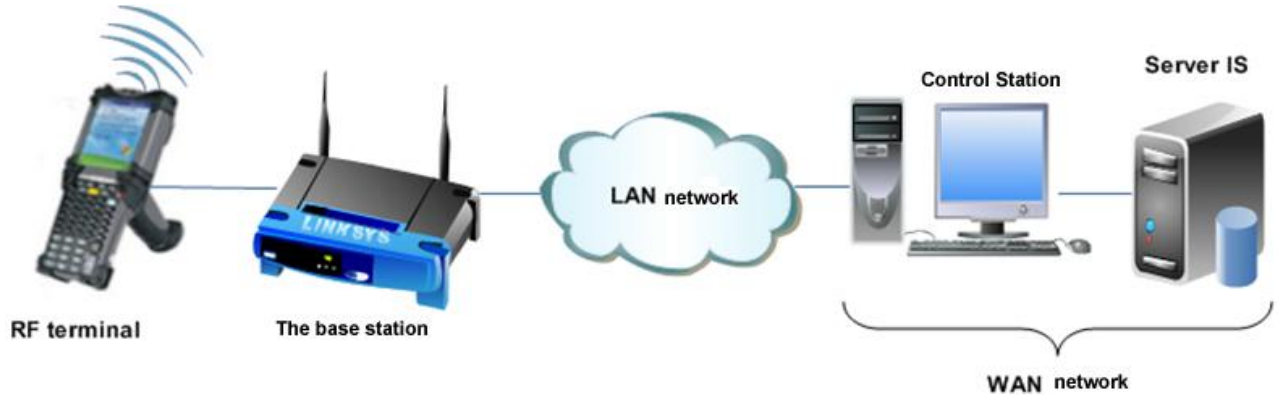

Figure 3 – The working principle of RF terminals

It is anticipated that all data sent by the RF terminal are automatically saved in the computer control center. The computer temporarily stores the data until the process is complete, and then sends the data to the IS server, where the data are permanently stored.

The process of implementation of IS in storages. The implementation of a WMS is often complex. Project planning is critical to the success of any WMS implementation. The project requires warehouse resources to collect data on the physical warehouse, materials, inventory as well as defining the strategies required to operate the warehouse [3].

The basic obstacle to the introduction of IS in the storage system are the large investment costs which entail significant operational costs. In order to be able to predict recovery period, it is necessary first to analyze the external and internal costs included in the total cost. Then you should analyze the cost savings which would be achieved in the first year of operation, and then to predict the expected savings for a period of years. It is necessary to define the model of the present analysis (net present value) and the required rate of return. This analysis performs management of the company in order to determine whether the costs of introducing IS are greater than

the potential benefits. There are numerous methods for conducting this analysis as, for example, analysis of profitability or net present value calculation.

According to reports by vendors and experts who participated in the study of return of funds, it leads to information that we can save up to 40% due to the optimal utilization of manpower, a savings of up to 30% of the costs associated with goods [2]. Of course, these savings may vary depending on the type of storage and the type of IS in the market which has very much.

Table 1 shows the price of WMS (Warehouse Management System) software, which supports only basic modules, in order to better overview current market conditions. These prices are only part of the costs that companies have for the introduction of IS. The total costs of companies are more than double the price of these manufacturers because of the cost of implementation, training, modifications, etc. Therefore it is important that companies analyze their options before considering the need for the introduction of IS.

Table 1

WMS software with the basic modules

Software manufacturer	Name of Software	Price
PSC Inc [4]	IntelliTrackWMS	20.000$
CIM Vision International [5]	Warehouse	from 27.000$ to 126.350$
MontegoSystems Inc. [6]	WinWhereWMS	from 40.000 $ to 100.000$
Manhattan Associates [7]	PkMS	from 150.000$ to 300.000$

The need for computerization of storage occurs in the following situations: under-utilized storage space, vast classified goods, constant growth in demand for warehouse space, failure to monitor and control entry and exit of goods, slow the flow of goods through the warehouse, insufficient use of labor, a strong possibility of human error, incomplete information, the need for analysis and plans, tardiness of orders, wrong delivery, downloading poor quality goods, problems with the complaints, borrowing goods with data, aging goods in storage – shelf life, forgotten,

lost, hidden goods, frequent involvement of personal in order to search goods in stock, and poor space utilization due to planning allocation of reserved sites.

Justification for the introduction of IS. ***Quantitative and qualitative justification for the introduction of IS.*** The key advantage of IS is that it is intended to conduct inventories of all the goods and handling of goods to the specificity that IS RF is conceived and allows timely access to data at any location in the warehouse. Warehousemen get into the hands of a powerful tool to become more productive because they are guided and directed by IS actions.

The quantitative benefits of the introduction of IS in warehouses are: maximum cost reduction, logistics, information technology storage, the greater the possibility of accurate, reliable and available management of goods, storage organized work, optimal use of storage capacity, control the flow of goods through the warehouse, increased control of the storage process, the direction of work in the warehouse, data analysis and planning, improved management of storage space, …

A qualitative justification for the introduction of IS is achieved by improving inventory accuracy and elimination of manual systems and the problems that accompany them. In order to obtain adequate supplies of accuracy it is necessary to: reduce the percentage of returned shipments, improve planning and arrangement of warehousing units, minimize obsolete inventory and reduce the cost of missed earnings due to lack of goods in demand, improve level of order fulfillment, reduce order cycle and improve utilization of space. Other qualitative advantages of the introduction of IS in storages [8]: standardized system of making goods between the company and its business partners, elimination of work on maintenance of data, improvement of tools for reporting and monitoring, improve management control functions, eliminate data entry errors and visibility, the flexibility of the system on changes in requirements of storage system (modifications), a great relationship with clients (relationship and constant communication), connections to external systems (customs, etc.), the possibility of expanding the scope of business – the expansion of market opportunities, security and data protection, timely receipt of orders to ensure timely planning of activities, simultaneous of material and information operations,

the possibility of direct transmission of data in MS Office, history of operations, and ensuring continuity of processes and operations.

Justification for the introduction of IS storage processes. Justification for the introduction of IS systems in the warehouses can best be explained by analyzing the needs of the individual systems. In this way, first we analyze the potential problems points then determined the rationalization that can be achieved by the information system.

Receiving and storage. In the process of receiving and storage problem spots are ramp for loading and filling of paper. Specifically, on the ramp for loading in practice often leads to congestion due to the inefficient system of monitoring shipments and unloading activities of non-compliance. This process is very slow by using the paper system where are significant losses of time between entry of goods into the warehouse to the planes installation site. It can be concluded that the application of IS achieves significantly improvement of the quality of information about goods and locations, thus eliminating the maximum negative impact of downtime. System synchronized storage process affects the ramp discharge time and thus increases the productivity of warehouse. The reasons for poor effectiveness of the process of receiving and storage may be the unavailability of information necessary to compare the items received with the goods specified in the order, and qualitative and quantitative variations of goods received in respect of the ordered. Information that is characterized the product: serial number, amount and expiration data must be entered into the database immediately upon receipt. It is preferable to realize this activity as soon as possible because the delay entails risk of delays on ramps.

Picking and shipping. Those activities waste 75% of total operating costs of warehouse work [8]. Interestingly, the picking is more important than storage (keeping), as the expenses incurred by storage are typically much higher than the cost of storage. This is due to the fact that the picking is usually dispatched significantly lower average amount of goods than is the case in the reception. Hence the primary drive to minimize costs in the warehouse is handling the materials in processes of picking. Efficient implementation of the IS for realization of process of picking and

shipping reduces costs and handling and it is of great importance to the storage system. Some of the important causes of bad unfolding of these activities may include: loss of time due to the manual assignment of commission list to the commissioners, commissioners intuitively selects the best route for a visit to the location of goods, commission lists are overloaded with information, lack of conditions for separation of multiple units in a single iteration through the passage, which distinguishes the goods received but not recorded in the host system, set of products with low frequency of request on the shelves (this product is better commissioning with the pallets in racks), un-synchronizing of commissioners work with the operators, waste of time because of inappropriate use of equipment, goods which are temporarily located in the aisles and waiting for storage are major obstacle to commissioners, each commissioner manually filled his commission list, too long handling of units (poorly planned dispatch), loading units formed in the wrong vehicles, exceeding the interval of patience and completeness of units shipped…

Accuracy and reliability of picking. Service level of the process of picking is measured by the number of items returned by the recipient due to mistakes made in the warehouse. Any returning of goods to the warehouse cost and that cost is eliminated only by improving the accuracy of the formation and dispatch of orders. It is necessary to monitor the number of returned shipments at certain periods, and then to assess the costs that are incurred while (transport costs, administration, paperwork). Accuracy and reliability of picking has a growing impact on the company, because it influencing the quality of services provided to customers' requirements.

Reducing the costs of shipment. Regulating the costs of shipping is done by the planning approach, based on which is done the consolidation of segments in one whole order. This order will not be realized if all segments are not fully completed through the process of picking and loading into a means of transport. Here comes to the fore the possibility of IS that automatically generates documentation of transport while enabling simultaneous commissioning of units of goods that can now be transported to a lesser extent funds with a significantly lower load area.

Fill. The process of filling the storage of goods can take place only at specific storage locations in the warehouse, where is planned allocations of goods. So, if the pallet is assigned a random location to extract the product units filling cannot be implemented. Causes of poor unfolding of this process in the warehouses may be: the large path taken by a warehouseman due to poor layout distribution of goods in the warehouse, inability to monitor inventory levels in real time (poor control of trade, service life and waste of time to search for product in stock), and a number of activities of filling due to the lack of an automated system to initiate these activities, when the quantity of goods on the storage site falls to a certain level.

Inventory control. Inventory control is a process which in non automatized systems must be performed periodically; the frequency of checks depends on the type and characteristics of the goods to be stored and the characteristics of storage system. Rugged handheld computers with wireless communications give real-time capability and integrate stock control into wider software systems for efficient resource management [9]. In automated systems can be provide continuous control of stock and always up to date position of goods in the warehouse, which increase comfort of business and reduces inventory costs, as shown for example in [10], with the use of RFID.

Conclusions. The power of IS storage processes represents a number of adjustable settings, which provides detailed insight and control methods and parameters of processes in the warehouse. In this way it allows to each functional aspect of the business to be aligned with the business policy of the company.

Decision on the implementation of IS depends on the analysis of return on assets in the future, conducted by the management. After the analysis and definition of variant information system solutions, which could meet the needs of a particular storage, it requires the implementation of cost-feasibility study of introducing such a system.

The key advantage of IS is that it is intended to conduct inventories of all goods and handling of goods to the specificity that the IS RF is conceived and allows timely access to data at any location in the warehouse. A qualitative justification for the

introduction is achieved by improving inventory accuracy and elimination of manual systems and the problems that accompany them. All this gives a tremendous competitive advantage to companies that have developed IS storage process.

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