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INVENTORY MANAGEMENT SYSTEM OPTIMIZATION OF THE UKRAINIAN PLANT

Summary. *The article is devoted to the problems of the efficient operation of enterprises and increasing of their competitiveness through the fast-changing market conditions in Ukraine.*

Investigated problem is reducing the costs and obtaining the maximum productivity from the inventory system of Ukrainian Engineering Plant "FED".

The article presents the results of a study conducted by the authors on the inventory management process optimization of Ukrainian Engineering Plant "FED". The main scientific results: the study of the inventory system of Ukrainian Engineering Plant "FED" identified low inventory turnover, due to which their growth occurs, lack of own warehouse, the use of the principle of cell storage is inappropriate for this organization, which also causes an increase in stocks. The following solutions were proposed: reducing the share of stocks, that is, maintain constant sales and prevent them from stocking up in warehouses, using of an inventory management system with a fixed order size, the need of a properly equipped area for storing goods - a project to create a customs warehouse, implementing an automated inventory management system at Stock-M.

Reducing the share of stocks and using of an inventory management system with a fixed order size will decrease the average annual inventory, the turnover ratio, respectively, the duration of the turnover period will also decrease. Implementing an automated inventory management system at Stock-M will have the great economic effect. The creating of customs warehouse, will save more than 3 million UAH per year, while it will also make a profit by offering storage services to other organizations.

Research results can be used for increasing the level of inventory management system, optimization of inventory management processes and achieving higher economic results.

Key words: *inventory management, inventory management system, inventory management system optimization.*

Statement of the problem. Nowadays, the problems of the efficient operation of enterprises and increasing their competitiveness are of great importance in the development of the economy. To take a stable place in the market, you need to be a manufacturer of high-quality products that meet

international standards. The ability to operate the main advantages of company qualitatively is the key element in increasing competitiveness. Moreover, the competitiveness of domestic enterprises is becoming a problem of national state security and is of particular importance on a national scale.

Analysis of recent researches and publications. There are many relevant scholars that begin to pay attention to inventory optimization and control in enterprises, owing to the significance of this. Schreibfeder John have provided a complete approach for managing a large and often troublesome asset, inventory, based on most recent research and the most up-to-date best practices [1]. There are also researches, in which economic order quantity (EOQ) model based on stock-dependent demand was established [2]. Besides, the production-inventory model for perishable items with definite productivity and with demand linearly depending on inventory level was considered [3]. Some scholars explored the inventory issue with allowable shortages under inventory-level-dependent demand; at the same time, they also took monetary value as well as the expansion rate caused by external and internal costs into consideration [4]. Krishnamoorthy and Narayanan considered the stability and performance analysis of a production-inventory system [5]. Yadavalli et al. studied the problem of updating service facilities for inventory system to achieve production and service synchronization. From the inventory cost and the cost of order to determine the optimal order point and quantity [6].

Formulation purposes of article (problem). Since the main cash investments in the enterprise are inventories, at the same time they are the main source of profit. That is why the aim of the work is to study the practical aspects of organizing stocks at the enterprise on the example of Ukrainian Engineering Plant "FED".

The main material. State Enterprise Kharkov Engineering Plant "FED" is a leading industrial enterprise in the city of Kharkov for the manufacture of hydraulic units, fuel and electrical systems for aircraft, armored vehicles, and

railway products. The company manufactures high-precision fuel control equipment, integral hydraulic drives, hydraulic motors, hydraulic pumps, pumping stations for the aviation industry and other engineering industries.

These warehouses are located on the territory of the plant, some of which are leased, and some are owned by the factory with an area of 10,000 m2.

"FED" uses the storage of goods based on the principle of cell storage, that is, a system of statistical address storage.

Static storage of goods involves the assignment of a specific address to a specific product. So, for one type of product, a storage cell or a group of cells is allocated. Such a system is the simplest and most transparent: a group of goods is always stored in one place; an employee can pick up orders without special training.

The information system of the plant stores information about which position is stored in which cell of the warehouse. Each cell is assigned a barcode to quickly recognize and associate a new product with the cell.

In order to determine the main optimization paths, firstly we need to determine the main problems of the enterprise storage system and to analyze the dynamics of stocks. This analysis includes the following steps:

- analysis of indicators of the total amount of reserves: the pace of its dynamics, the specific weight of current assets;
- analysis of the structure of stocks: their types and main groups;
- analysis of the efficiency of use of the main groups of stocks, their volume, which is characterized by indicators of turnover and profitability.

From the table 1 we can note that from 2018 to 2020 there was an absolute increase in current assets, which include stocks, the absolute increase in reserves and costs. The growth of stocks in this case can lead both to a decline in the activity of the enterprise, and to an increase in the possibility of immediate customer service.

By studying the structure of current assets, stocks and expenses from the table 2, we see that stocks and expenses have the largest share in current assets.

Table 1

The Dynamics of stocks of the enterprise for 2018-2020

Indicators	Indicator values Thousand UAH			Absolute increase		Growth rate, %	
	2018 y.	2019 y.	2020 y.	2018 y.- 2019 y.	2019 y.- 2020 y.	2019 y. to 2018 y.	2020 to 2019
Current assets including	205458	239251	302450	33793	63199	116,45	126,61
- stocks and expenses	117565	157671	171248	40106	13577	134,11	108,61
Including:							
raw materials, materials, other similar assets	49908	57262	95064	7354	37802	114,74	166,01
- costs in unfinished production and semi-finished products	41432	61240	37179	19808	-24061	147,81	60,71
- finished production and goods for implementation	16891	26673	30355	9782	3682	157,91	113,81

Source: own study

Table 2

The Structure of working capital of the plant "FED" from 2018 to 2020

Indicators	Structure,%		
	01.01.2018	01.01.2019	01.01.2020
Current assets including	100	100	100
- stocks and expenses	57,22	65,90	56,62
Including:			
raw materials, materials, other similar assets	24,29	23,93	31,43
- costs in unfinished production and semi-finished products	20,16	25,59	12,29
- finished production and goods for implementation	8,22	11,14	10,03

Source: own study

A significant share of stocks can save the company in case of an unexpected shortage of them or from the purchase of more expensive substitute materials, but in this case, their growth in the structure of stocks is evaluated negatively. Raw materials, materials, and other similar assets also have a rather large specific weight, their growth is also not evaluated in a positive direction for the enterprise.

The growth of raw materials is a negative fact in the table 3, but the positive point is the reduction in the share of costs in unfinished production and finished products.

Table 3

The structure of the stocks of the enterprise for 2018-2020

Indicators	Structure,%		
	01.01.2018	01.01.2019	01.01.2020
stocks and expenses	100	100	100
Including:			
raw materials, materials, other similar assets	42,45	36,31	55,51
- costs in unfinished production and semi-finished products	35,24	38,84	21,71
- finished production and goods for implementation	14,36	16,91	17,72

Source: own study

Now, according to table 4, we can analyze the indicators of the profitability of stocks.

Table 4

Indicators of efficiency of use of stocks for 2018-2020

Indicators	Coefficient of turnover			Profitability,%		
	01.01.18	01.01.19	01.01.20	01.01.18	01.01.19	01.01.20
stocks and expenses	5,19	5,42	4,53	12,51	13,65	13,29
Including:						
raw materials, materials, other similar assets	11,13	10,04	9,23	27,33	28,18	24,26
- costs in unfinished	13,85	14,47	12,96	28,48	42,36	47,58

production and semi-finished products					
- finished Production and goods for implementation	26,92	26,83	19,87	87,54	77,79	67,21

Source: own study

For the 2018-2020 margin on inventories increased, including the profitability of raw materials in 2019, which increased but in 2020 decreased. Profitability of costs in unfinished production and semi-finished products increased significantly in 2019, at the end of 2020 this indicator was higher. The profitability of finished products and goods for implementation as a whole fell at the end of 2020.

The decline in the profitability rate of finished products and goods for sale indicates about a decrease in the overall level of efficiency in the use of current assets of the enterprise, exactly stocks, in the current economic activity of the enterprise "FED", therefore this dynamics is unfavorable for the plant. In addition, the main problem of the enterprise is the lack of only its own warehouses, where the stocks can be planted. Firstly, the company incurs huge losses because of spending money on the renting of premises for its warehouses.

The application of the principle of cell storage in warehouses has its disadvantages. This principle is most often applied in enterprises with a smaller assortment of goods. In this case, the plant's products are expanding, and the application of this principle is not advisable:

- There is idle cells in the absence of goods;
- Uneven filling of different groups of storage areas with goods.

In this way, based on the analysis, at the plant were identified the problems of storage facilities:

- Reduction in inventory turnover;
- An increase in stocks;

- The use of the principle of cell storage, which is not entirely suitable for this enterprise;
- Lack of own storage warehouse, which incurs additional losses to the enterprise;
- Inefficient use of stocks, having a strong impact on the profitability of the enterprise.

As a result of these problems, the urgency of the problem of optimizing the enterprise's material stocks and their effective management arises due to the fact that the state of stocks has a decisive influence on the company's competitiveness, its financial condition, and financial results. It is impossible to ensure a high level of product quality and reliability of its deliveries to consumers without creating the optimal stock of finished products, as well as stocks of raw materials, materials necessary for the continuous and rhythmic functioning of the production process.

Based on the analysis, some problems of the warehouse system of the enterprise were identified, among which the main ones are:

- low inventory turnover, due to which their growth occurs;
- lack of own warehouse;
- the use of the principle of cell storage inappropriate for this organization, which also causes an increase in stocks.

In order to improve the inventory planning system at the enterprise, it is necessary, firstly, to increase the accuracy of forecasting the commodity-group structure of consumer demand, since the value of the planned volume of sales of goods for each item in the assortment list depends on the accuracy of forecasting. And the planned volume of sales is the basis for supply planning and inventory management. The more accurate the planned indicators are the higher the inventory turnover and the lower the costs of storage and execution of orders.

The plant needs an efficient system for prudent and proper inventory management. There are two main inventory management systems:

- with a fixed order size;
- with a fixed time interval between orders (with a constant level of stock).

For this enterprise, an inventory management system with a fixed order size would be more suitable, since the demand for products is variable, the cost of goods is high and there are costs for storing stocks. In addition, for effective inventory management, we need a properly equipped area for storing goods, that is, a warehouse. The enterprise "FED" has its own warehouse as well as a leased one, which brings considerable losses. To solve this problem, the plant is preparing to implement a project to create its own customs warehouse. The customs warehouse has two meanings:

1. Customs warehouse - a customs procedure in which foreign goods are stored under customs control in a customs warehouse for a specified period without payment of customs duties, taxes and without the application of non-tariff regulations.

2. A specially defined and equipped structure, premises and (or) open area intended for storage of goods in accordance with the customs procedure is recognized as a customs warehouse. Designed for temporary storage of export or import goods.

In this case, the customs warehouse will act as a certain equipped facility designed to store goods. Of course, this project requires a large amount of cash investment, but it is beneficial for the organization and will soon pay off, because:

- firstly, the plant will save money on renting premises;
- secondly, the company will be able to store its goods under the customs procedure of the customs warehouse, which involves storing products

without paying customs duties, taxes and without applying non-tariff regulation measures;

- thirdly, with the proper arrangement of the customs warehouse and saving space in it, the plant will be able to lease some part of the warehouse to other organizations, from which it will ultimately make a profit.

In addition, due to an increase in the volume of performed work and obsolescence of knowledge, it will be proper to increase the efficiency of the production and warehouse management department by introducing a new software product. The management process itself consists of many interrelated stages, preparation and calculation of various documents; therefore, it is a good idea to implement the software product Stock-M.

Stock-M is an automated enterprise inventory management system designed to calculate the required inventory level at any storage point daily, in accordance with actual fluctuations in demand. Stock-M differs from other inventory management systems in that their level changes along with the demand for goods (raw materials), which means that the level of inventories decreases with decreasing demand and vice versa. The system automatically determines daily inventory rates, analyzes actual sales, estimates available surpluses and shortages, and based on these data automatically creates replenishment orders for each SKU. Thus, inventory management is not based on a ghostly forecast, but on the specific demand of consumers, which is very dynamic.

Stock-M inventory management and automation helps keep track of the dynamics of sales levels, lost sales, inventory, surpluses throughout the company, every warehouse, every store, every supplier. The main reports are displayed in a compact form, allowing you to evaluate the whole picture and, if necessary, delve into the analysis of a specific report.

Benefits of the Stock-M System:

- Quick payback period on investments;

- The implementation of the Stock-M turnkey inventory management system is fast using proven technology;

- Stock-M is a cloud service, compatible with any accounting system;

- A simple and accurate reporting system.

Each report is designed to solve a specific problem, reports are detailed by position. Competent forecasting of stocks and finding their optimal level are equally important. This will allow the company to timely sell the delivered consignment of goods, and not to store illiquid goods.

In order to optimize the inventory management system of the enterprise "FED" our team have developed a method to determine the main problems of the enterprise storage system.

The method consist of:

- analysis of indicators of the total amount of reserves: the pace of its dynamics, the specific weight of current assets;

- analysis of the structure of stocks: their types and main groups;

- analysis of the efficiency of use of the main groups of stocks, their volume, which is characterized by indicators of turnover and profitability.

The following measures were proposed to solve these problems:

- reduce the share of stocks, that is, maintain constant sales and prevent them from stocking up in warehouses;

- the use of an inventory management system with a fixed order size;

- the need of a properly equipped area for storing goods - a project to create a customs warehouse;

- implementing an automated inventory management system at Stock-M.

As a result of the proposed innovations, the following economic effect will be achieved:

1. The average annual inventory will decrease, the turnover ratio will increase, respectively, the duration of the turnover period will also decrease.

2.   The economic effect of the implementation of the Stock-M software product;

3.   When creating a customs warehouse, the company will save more than 3 million UAH per year, while it will also make a profit by offering storage services to other organizations.

These proposals are aimed at improving the inventory management system, at more efficient use of stocks, as a result of which both the economic and financial performance of the enterprise will increase.

Whatever method of inventory management the "FED" chooses, there are minimum requirements for this system to be manageable and provide the opportunity to implement various methods of inventory planning. In addition, their implementation directly affects the reduction in the cost of delivery and storage of goods. These requirements relate to the establishment of the necessary logistics of operations, as well as the establishment of management accounting.

Monitoring the status of stocks should ensure continuous comparison of regulatory parameters with actual ones, that is, work as a "tracking system". Determination of the corresponding volumetric, spatial and temporal parameters of stocks will allow us to move on to optimizing the placement of goods in the warehouse, and, therefore, to minimize costs. The development of rules for determining the moment and volume of an order, the determination of priorities for replenishment of stocks will provide relatively simple ways of regulating the parameters of the order.

Insights from this study and perspectives for further research in this direction. Creating the optimal inventory management system at the enterprise - Kharkiv Engineering Plant "FED" plays an important role, as the reserve in modern business ceases to be only a calculated indicator of activity and becoming one of the main objects of management that ensure the success of the enterprise.

To maintain inventory levels at an optimal level, a well-established inventory management system is needed. Effective inventory management allows the company to achieve the best performance in financial and economic activities, to withstand the conditions of a market economy. Optimization of inventory leads to minimizing the costs advanced in them.

So, no matter what inventory management system the "FED" organization chooses, there are minimum requirements for this system to be manageable, provide the opportunity to implement various methods of inventory planning, and positively affect the financial and economic performance of the plant. Properly built, logical and effective inventory management system is the key to the success of any enterprise.

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