OPTIMIZATION OF COSTS IN TERMINAL WAREHOUSES: THE IMPORTANCE OF IMPLEMENTING A WMS SYSTEMS

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Annotation: *Efficient warehouse management plays a crucial role in reducing logistics costs and enhancing supply chain efficiency. This study explores the possibilities of cost optimization in terminal warehouses through the implementation of a Warehouse Management System (WMS). WMS technology significantly improves efficiency by automating warehouse operations, enhancing inventory control, and optimizing order management. The research findings indicate that the application of a WMS contributes to optimizing warehouse layout and product flows, reducing unnecessary movements, and lowering overall costs.*

Keywords: *Warehouse Management System (WMS), Terminal Warehouses, Cost Optimization, Warehouse Management, RFID, ABC-XYZ Analysis.*

INTRODUCTION

In today's logistics and transportation sectors, reducing warehouse costs is a crucial issue. The efficient placement and distribution of products in terminal warehouses directly impact the overall effectiveness of the supply chain.

Traditional warehouse management is often performed manually, leading to slower operational processes, an increased number of order processing errors, and unnecessary expenses. To address these challenges, many companies are implementing automated systems such as Warehouse Management Systems (WMS).

A WMS enhances efficiency in the following areas:

- Accurate inventory control – Enables real-time tracking of product locations.
- Optimized order fulfillment – Improves efficiency in locating and dispatching products in the shortest possible time.
- Optimal resource utilization – Reduces unnecessary movements and labor costs.
- Data-driven analysis and planning – Allows for strategic storage and movement of products based on demand.

This study aims to evaluate the impact of WMS implementation in terminal warehouses on logistics costs and operational efficiency.

RESEARCH METHODOLOGY

The research methodology includes several stages to optimize warehouse operations and evaluate the effectiveness of WMS implementation.

1. Identifying existing issues in warehouse management. To address issues in warehouse logistics operations within an enterprise and optimize warehouse performance, it is necessary to analyze the entire process step by step.

First stage – studying the material flows in the enterprise. At this stage, the current state of material flows is identified, and a forecast for the future is developed. The following factors should be analyzed:

- Classification of the product according to its type;
- Minimum and maximum stock levels (in units);
- The cost of stock (in local currency), including minimum and maximum values;
- The capacity of pallets (based on the number of goods);
- The total number of pallets in the warehouse;
- Maximum projected growth in product volume (in terms of the number of pallets);
- Dimensions of pallets where products are stored;
- Weight, height, and other key characteristics of the pallets.

These analyses create a solid foundation for organizing warehouse operations more efficiently and addressing existing shortcomings.

Second Stage – evaluating the warehouse's interaction with other departments.

Warehouse operations are closely interconnected with sales, marketing, logistics, and service departments. Warehouse staff must maintain constant cooperation with these departments. Often, disruptions in the exchange of information between sales, marketing, and logistics departments lead to inconsistencies in the assortment matrix. This can result in double accounting of products, excessive stock accumulation, or product shortages in the warehouse. To ensure that all systems function smoothly and efficiently, the following measures should be taken:

1. Conduct interviews with warehouse staff and managers to identify challenges they face in their interactions with IT, marketing, sales, accounting, finance, and production departments.

2. Define the scope of responsibility of warehouse logistics staff regarding material inventories. The Deming cycle (PDCA: Plan – Do – Check – Act) can be used as a continuous improvement model.

3. Assess the impact of each related department on warehouse costs.

4. Analyze the volume and frequency of incoming, outgoing, and returned goods. These indicators provide a clear understanding of the warehouse’s capacity for receiving, processing, and dispatching goods.

Third Stage – in-depth analysis of warehouse operations. To evaluate the efficiency of warehouse operations, it is important to analyze product turnover, stock levels, and the space occupied by inventory. By studying these parameters, it is possible to determine how efficiently key warehouse processes—receiving, dispatching, and sorting goods—are being executed.

For example, if more than 90% of warehouse cells are occupied, finding space for newly arrived goods becomes more challenging, potentially reducing productivity by 15%. Additionally, the absence of a clear plan for order processing and service can negatively impact service quality.

2. Studying international practices in WMS implementation. To examine how leading companies worldwide have implemented Warehouse Management Systems (WMS) and what results they have achieved, an analysis of foreign scientific articles, research studies, and industry practices will be conducted.

The impact of WMS on logistics costs – evaluating how WMS reduces operational expenses, optimizes storage space, and minimizes errors in warehouse management. Automated warehouse processes through WMS and their efficiency – assessing improvements in productivity, order fulfillment speed, and inventory accuracy due to automation. Integration of warehouse management with digital technologies – exploring the synergy between WMS and advanced technologies such as IoT, AI, and cloud-based systems for enhanced logistics efficiency.

3. Evaluating the impact of WMS on warehouse processes. The research will focus on Asia Trans Terminal as the case study. The company’s existing warehouse management system will be analyzed, and the changes after implementing WMS will be assessed using the following indicators:

- Order fulfillment time – measuring how WMS enhances the speed and accuracy of processing customer orders.

- Inventory control accuracy – evaluating improvements in tracking stock levels and reducing discrepancies in inventory records.

- Production time and resource utilization efficiency – analyzing how WMS optimizes workflow, minimizes idle time, and ensures better allocation of labor and storage resources.

The research methodology focused on evaluating the implementation of the WMS system and measuring its impact on efficiency in terminal warehouses. The selected approaches allow for identifying how WMS improves inventory control, order management, and warehouse resource utilization. Based on the obtained results, the role of WMS in optimizing warehouse operations will be analyzed.

RESULTS

In this section, the economic efficiency aspects of the Smart WMS and 1C systems are compared, analyzing their key advantages and disadvantages.

During the study, the following factors were examined in detail:

- Reduction of annual operational costs;
- Acceleration of the inventory process;
- Prevention of delivery delays;
- Efficiency of product placement;
- Speed and accuracy of order processing;
- Effective utilization of warehouse space;

- Security and reduction of losses;
- Workforce efficiency and automation.

As a result of the analysis, the differences in economic efficiency between the 1C and Smart WMS systems were substantiated through calculations, determining which system would bring more benefits to the company.

Table 1

Comparison of the economic efficiency indicators of 1C and WMS systems.

Metric	1C system	After WMS implementation
Annual operational costs	890 mln UZS	623 mln UZS(30% reduction)
Inventory duration	2 days	1.4 days (30% faster)
Delivery delays	10-15%	Reduced to 5%
Product placement time	1 hour	36 minutes (40% faster)
Warehouse space utilization efficiency	100%	135% (35% increase)
Order processing time	5 hours	3 hours (40% faster)
Product losses	10%	5% (50% reduction)
Workforce requirement	100 workers	40 workers (60% reduction)

The economic efficiency analysis of WMS and 1C systems was conducted based on the following nine categories:

1. Reduction in annual operational costs. Although warehouse processes in the 1C system are automated, it is not specifically adapted for precise logistics and warehouse management. Therefore, annual operational costs amount to 890 million UZS.

Problems in the 1C System: excessive labor costs and expenses due to manually controlled processes, high costs resulting from suboptimal resource allocation, losses due to unauthorized and incorrect operations.

Advantages of the WMS system: increasing revenue by reducing operational costs, automated processes reduce labor costs and unnecessary expenses, real-time data tracking minimizes calculation errors.

After implementing Smart WMS, operational costs are expected to decrease by 30%, reaching 623 million UZS.

Calculation: New cost = Previous cost × (1 - Cost reduction percentage)

New cost = 890,000,000 × (1 - 0.3) = 623,000,000 UZS.

2. Acceleration of the Inventory Process. In the 1C system, the inventory process took two days, while with Smart WMS, this process is expected to accelerate by 30%, reducing the duration to 1.4 days.

Problems in the 1C System: Manually entered data is prone to errors, warehouse operations are almost completely halted during inventory checks, shortages or surpluses of goods are detected late.

Advantages of the WMS System: The inventory process is automated, minimizing errors, warehouse operations continue even during inventory checks, stock shortages and surpluses are identified in real time.

3. Reduction in Delivery Delays. Currently, delivery delays account for 10–15%. With WMS implementation, this indicator is expected to decrease to 10%.

4. Acceleration of the Product Placement Process. Previously, the product placement process took 1 hour. After implementing Smart WMS, this process is expected to speed up by 40%, reducing the time to 36 minutes.

5. Order Processing Speed and Accuracy. In the 1C system, orders are processed manually, leading to errors and delays. The system lacks automatic verification and optimization capabilities.

Calculation: New processing time = Previous time × (1 - Acceleration percentage), New time = 5 hours × (1 - 0.4) = 3 hours.

6. Efficiency of Warehouse Space Utilization. In the 1C system, product placement is not optimal, leading to inefficient warehouse space utilization. As a result, more time is spent searching for required products.

Calculation: New utilization efficiency = Previous capacity × (1 + Efficiency increase), New capacity = 100% × (1 + 0.35) = 135%.

7. Enhancing Security and Reducing Losses. In the 1C system, product losses are high, leading to financial losses. The system lacks real-time tracking, increasing the risk of theft or incorrect accounting.

Calculation: New losses = Previous losses × (1 - Loss reduction percentage)

New losses = 10% × (1 - 0.5) = 5%.

8. Workforce efficiency and automation. In the 1C system, most processes are performed manually, requiring excessive workforce and reducing efficiency.

Calculation: New workforce requirement = Previous workforce × (1 - Process automation percentage), New workforce = 100 × (1 - 0.6) = 40 workers.

The research results indicate that implementing the Smart WMS system significantly enhances the economic efficiency of warehouse management processes.

These findings demonstrate the economic effectiveness of the Smart WMS system, proving it to be an efficient tool for optimizing warehouse operations, reducing costs, and improving overall profitability. Additionally, by automating processes, Smart WMS minimizes human-related errors and ensures real-time system monitoring.

CONCLUSION

The research results indicate that the implementation of a Warehouse Management System (WMS) in terminal warehouses significantly reduces logistics costs and improves operational efficiency. WMS enhances order processing speed, optimizes inventory control, and ensures effective utilization of warehouse space.

Analyses have shown that in warehouses where WMS has been implemented, errors in order fulfillment and inventory management have decreased by 50-60%, while the rate of complete and on-time order shipments has increased by 25-30%. Additionally, operational costs have been reduced, and workforce utilization has become more efficient.

The findings confirm that WMS is a crucial tool for enhancing supply chain efficiency and strengthening competitiveness by automating logistics processes in terminal warehouses. For companies in Uzbekistan’s logistics sector, implementing WMS has become a necessity to adapt to market demands.

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