WHAT ARE MANAGERS THINKING ABOUT WMS?

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Abstract: *The aim of this study is the identification of the main benefits and costs of installing a Warehouse Management System (WMS) in a company. Logistics managers of 7 big 3PL's in Greece using WMS were interviewed. The survey was conducted from December 2021 to March 2022. According to the responses, businesses have been able to minimize errors by saving time. Moreover, WMS along with Radio Frequency (RF) gives its user the essential information about the operation he has to perform with precision and speed. Some suppliers have access to their customers' systems and thus anticipate the demand themselves, avoiding not only shortages but also the accumulation of goods in the company's warehouses. Customers are more satisfied as they receive their orders at the right time, quality and quantity. Costs in purchasing, maintaining and supporting software and equipment increased while labor cost, error cost and destruction of goods decreased. The current study confirms the literature and highlights specific pros and costs that might lead to new WMS installations.*

Keywords*: Warehouse Management Systems, Warehousing, Cost, Benefits, Thematic Analysis.*

INTRODUCTION

The development of e-commerce brought great changes in product distribution. Logistics services providers in order to adapt to the new environment expand their warehouses and create more delivery points for their products to the last mile customer. They try to achieve faster deliveries to cover the whole territory. They also invest in IT applications to minimize delivery errors. Moreover, they try to be flexible in high mobility periods such as Black Friday, Christmas, discounts, etc. This can only be achieved by using a Warehouse Management System (WMS).

As Folinas and Fotiadis (2017) defined "*WMS helps companies to automate, simplify, optimize and redesign the related business processes and also helps the decision-makers to make better decisions regarding warehousing and inventory control*". WMS deals with all processes that take place in one or more warehouses or branches. Assists in the organization, supervision and execution of daily procedures in the warehouse. It is

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therefore clear that the warehouse management information system needs to be studied more thoroughly and scientifically and also the benefits and costs arising from its installation in a business.

The aim of this study is the identification of the main benefits and costs of installing a WMS in a company. Logistics managers of 7 big companies in Greece using WMS were interviewed. The survey was conducted from December 2021 to March 2022. According to the responses, businesses have been able to minimize errors by saving time.

The following the paper is organized as follows. In the next section a synoptic literature review is given that defines the WMS and identifies their expected benefits.

1. LITERATURE REVIEW

A Warehouse Management System (WMS), is a software application that supports everyday tasks that take place in a warehouse. WMS allows centralized management of work in a warehouse, from tracking the amount of inventory to placing it in appropriate locations within the storage area. It is developed to speed up loading/unloading time, improve the validity of the stock list, optimize the management of warehouse space and enhance its productivity. Typically, a WMS performs a variety of warehouse operations essential to its day-to-day operation (Richards, 2014; Tompkins et al. 2010).

WMS application is an informative system whose role is to manage inventories moving within a warehouse or more. It works in real-time and guarantees fast and accurate information. Operates with the help of barcode and radio frequency (RF) detectors and manages the operations of a warehouse or distribution center. It consists of a database server, an application server, and a client (Entersoft, Installation & architecture, configuration and add-on development tools, 2010). The main modules of a WMS according to Entersoft are Receipts, Shipments, Returns, Production, Stock, Inventory, Overview, Items, Layout and Resources (Entersoft, Entersoft WMS-UserGuideEN, 2020).

Businesses today aim to make better decisions so that they can have better financial results and improve their relationships with their suppliers and customers (Laudon & Laudon, 2009). Also, orders tend to become smaller and more frequent and customers have higher demands. Finally, businesses aim for economies of scale and maximize storage capacity (Folinas and Fotiadis, 2017).

The advantages of installing a WMS system in a company are: systems integration (Software Market, 2022), improved employee productivity and customer satisfaction (Hitchings, 2022), automated and upgraded warehouse processes, and data immediacy (Treadaway, 2020), and remote access. In addition, cost reduction, optimal layout, reduced time, shortage management, better control of all production phases, and faster inventory procedures are achieved.

On the other hand, there are some drawbacks such as:

- The constantly evolving technology: Because each system is compatible with specific hardware & software, new versions being developed create barriers and additional costs,
- Staff: Such a system needs specially trained staff to operate it, which is quite difficult as the system is constantly improving and becoming more complex, and

- Time: Installing an application and upgrading it takes time for user training and debugging.

2. RESEARCH METHODOLOGY

The research method used in this research is in-depth interviews. The survey was conducted from 14 February 2022 to 1 March 2022 in Thessaloniki. The sample was Logistics managers of companies based in Northern Greece. Due to anonymity, we name the companies: LM1, LM2 to LM7.
The business domains of the targeted companies are presented below:

- LM1: super market,
- LM2: beverage industry,
- LM3: flour mill industry,
- LM4: 3pl,
- LM5: pharmaceutical compounding development industry,
- LM6: thermal insulating industry and
- LM7: sporting goods retailer.

Each manager answered a questionnaire with open questions that, first, aims to sketch the profile of the companies and their warehouse systems. According to the responses, the examined companies have organized warehouses that act as distribution centers for their customers/points of sales. The number of employees in the warehouses of the above companies ranges from 5 to 1000 people. The installation date of WMS ranges from 2000 to 2013. The total size of their warehouses is from 2,000sqm to 125,000sqm.

Before installing WMS, many used ERP systems while the rest either manuscript or custom applications, or had WMS since the founding of the company. The number of physical warehouses ranged from 1 to 5 with most having answered 5. The storage systems used by companies in their warehouses are shown in the following diagram.

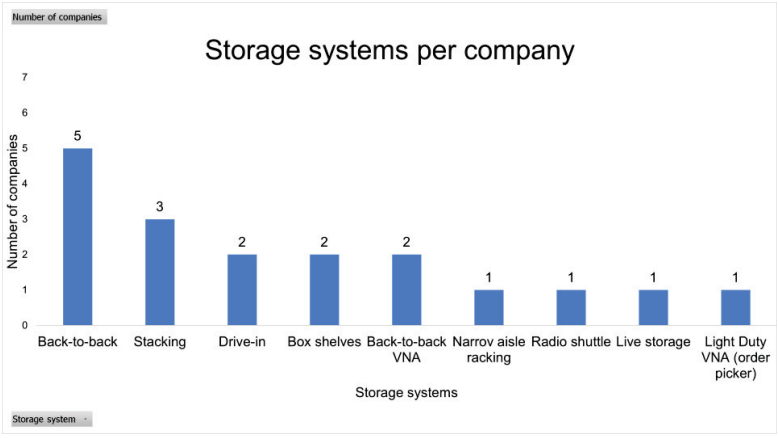

Figure 1: Storage systems

Then, some questions aim to answer the research questions, and specifically:

1. Why did you invest in WMS?

2. After the installation of WMS, was there a decrease or increase in the company's storage needs?
3. In which basic functions of your warehouse was a reduction in human error observed?
4. How was the warehouse clerk assisted in finding the exact location of the stocks and their current balance? How was this achieved?
5. How is now your cooperation with your suppliers in terms of the exchange of information concerning stocks?
6. The execution time of the order consists of three sub-times: the processing time of the order, the collection time of the products and the loading and delivery of the products to the customer. How were these times affected by WMS?
7. How are stock shortages now addressed and how is it possible to avoid the accumulation of large quantities of warehouse items?
8. How has your customers' experiential experience been affected?
9. What sub-operating costs of the warehouse have been affected?
10. How has the productivity of the workers in the warehouse been affected?
11. To what extent the process of tracking product expiration dates help economies of scale?

3. RESEARCH FINDINGS

In this section, the responses to the questions that were provided in the methodology section are presented as quotes.

3.1 Why did you invest in WMS?

LM2: The increase in project volume and the need for tracking across the supply chain spectrum "forced" the upgrade to a WMS system.

LM3: Season and evolution require WMS.

LM4: In the context of the reorganization of the company, it was strategically decided to purchase a WMS to have the necessary tools and to support the functions that a reliable 3PL company must provide, as well as to have the conditions for quick and complete adaptation to their customers' needs.

LM5: The reasons for investing in a WMS system are the following: Better order management, reduced order shipping time, reduced errors, better inventory management and finally reduced time in other warehousing processes.

LM6: The main reasons for investing in WMS were the optimization of spatial planning, employee performance and physical inventory.

LM7: WMS system is essential for warehouse productivity which with traditional picking lists can be up to 5 times higher.

3.2 After the installation of WMS, was there a decrease or increase in the company's storage needs?

LM2: Initially, there was a better settlement of the existing stock. Later, the growing volume of the project forced the increase of warehouses by 60%

LM4: There was a rapid increase, 60% since 2013, in both the number of customers and the required space as it became possible to manage, through the WMS, customers with greater complexity.

LM5: Neither was observed. The space was sufficient during the first years of operation of the warehouse.

LM6: WMS installation did not affect storage needs. The increase in storage space is mainly attributed to an increase inactivity.

LM7: In general WMS reduces space requirements.

3.3 In which basic functions of your warehouse was a reduction in human error observed?

LM1: In all functions, the guidance through specialized software leads to error reduction.

LM2: In all functions, there was a reduction in errors and time-saving.

LM3: Picking and movings.

LM4: On the one hand All the basic operations (receipts, picking) became faster and on the other hand the errors were reduced and mainly they were detected faster thanks to the immediacy of the information provided by the WMS.

LM5: There has been a reduction in human error in order management, product shipping, inventory management and product receipt.

LM6: Incorrect loading of items and quantities.

3.4 How was the warehouse clerk assisted in finding the exact location of the stocks and their current balance? How was this achieved?

LM1: There is a better perspective on the stock layout and higher access speed. The general way to achieve this is the normal recording of all physical movements with systemic procedures in real-time.

LM2: Due to the multi-storage space, the storekeeper does not "look" for the batches. He knows where they are through the system and saves time. Also, the First-Expired-First-Out (FEFO) service system that the company has set in sending the products helps a lot the employee.

LM3: The system with multiple search modes from its menu can lead the warehouse employee to the right position.

LM4: Helped a lot through standard search forms that a modern WMS has.

LM5: By using WMS he knows exactly at any time where each product is located as well as the exact stock. The stricter the procedures defined, the more accurate the results.

LM6: Spatially we divided the warehouse into, 2,000 warehouse spaces with an easily identifiable number. It is possible to search inventory per location or collectively from a portable RF scanner. When collecting inventory for a sales order, the WMS displays in the RF scanner exactly the quantity of the item at a specific location. During the inventory, it is possible to continue the work due to the many separate locations.

LM7: WMS systems drive the picker to the product position. At picking, he scans the position and the product and the WMS removes it from the systems.

3.5 How is now your cooperation with your suppliers in terms of the exchange of information concerning stocks?

LM1: Some suppliers self-manage their stocks in our warehouses through Vendor Managed Inventory (VMI) and common monitoring goals regarding inventory and customer service.

LM2: The information is immediate and complete as I know what I have and when it was produced and will expire.

LM3: Much better in terms of traceability and error logging.

LM4: As we are not a commercial company, VMI does not apply. But sending the stock daily and in real-time to the customers helped a lot.

LM5: We have an accurate picture of each stock so we can make our orders to suppliers easier and even give a forecast for our future needs.

LM6: It has not changed. We still rely on ERP. Of course, the uncertainty regarding the accuracy of quantities has been greatly reduced.

LM7: The accuracy of the stocks is one of the most important points, especially now that the e-shop is developing. WMS systems offer this accuracy in stocks.

3.6 The execution time of the order consists of three sub-times: the processing time of the order, the collection time of the products and the loading and delivery of the products to the customer. How were these times affected by WMS?

LM1: Reduced due to standardized and fast processing and the direct distribution of information between production phases.

LM2: Collection time significantly reduced by about 40%.

LM3: Gradually not affected at all. Only initially did we have delays until users get used to it.

LM4: There was a great improvement mainly in the processing of the order by the customer service as the receipt of orders was reduced to a minimum through import files, registration errors are avoided and stock control procedures are done directly through the WMS. Clearly, the collection of orders via RF terminals has improved compared to the paper picking list but mainly the quality of stock information has improved.

LM5: The collection time has been reduced a lot as with the use of Personal Data Assistants (PDA) scanner the application leads you to exactly the place you need to collect the product. Also, having mapped the warehouse in the appropriate way we now can

follow the shortest route to collect our order. Respectively the lead time has been reduced as everything is done exclusively with the use of a scanner.

LM6: Office processing time increased. The remaining times were reduced.

LM7: Order processing is also done by WMS but the main benefits come from the fast pick n pack. At the moment we use 400 lines with 600 pcs per hour per picker.

3.7 How are stock shortages now addressed and how is it possible to avoid the accumulation of large quantities of warehouse items?

LM1: Inventory adequacy ratios with quantitative and qualitative characteristics are monitored. Good visibility in stocks allows you to get an immediate picture of the needs and automate checks or refills.

LM2: Through parameters provided by the WMS one can configure the limits within which he wants his warehouse to operate.

LM3: By forecasting through the recorded consumables.

LM4: This does not apply to our type of company. However, we provide better and more immediate stock information.

LM5: We depend on our ERP system to address these issues.

LM6: It didn't change. We still rely on ERP. Of course, the uncertainty regarding the accuracy of quantities has been greatly reduced.

LM7: With gradual receipts and with the planning of imports.

3.8 How has your customers' experiential experience been affected?

LM1: Better service at the service point, quantitatively and qualitatively.

LM2: Because many customers set rules for accepting products regarding expiration dates and old batches, these kinds of failures have been minimized and the customer now gets what he has asked for as he has requested.

LM3: Positive. Organization and good image.

LM4: Reducing errors, stock information and orders, available KPI's enhanced our customers' loyalty with mutual financial benefits.

LM5: Our customers are more satisfied as the service time is shorter and the quality of our services is higher (fewer mistakes).

LM6: It has not changed. We still rely on ERP. Of course, loading errors in terms of items and quantities have been reduced.

LM7: It has been affected quite positively.

3.9 What sub-operating costs of the warehouse have been affected? (Decrease or increase)

LM1: Reduction of labor costs, reduction of goods disasters, smaller stocks, an increase of costs for purchase, maintenance and development of software, increased costs in technological equipment and its renewal.

LM2: 30% reduction in inventory, 40% reduction in safety stock, 25% reduction in warehouse costs, and increase in IT costs.

LM3: Increased maintenance costs of WMS and RF. The cost of a mistake was reduced.

LM4: The main cost in a 3PL warehouse is labor cost. By using WMS employees produce more work at the same time. Employee costs as a percentage of income have been reduced.

LM6: No quantitative comparison can be made because the size of activity is completely different before and after the implementation of WMS.

LM7: Labor costs have fallen due to increased productivity.

3.10 How has the productivity of the workers in the warehouse been affected?

LM1: Productivity is more directly and transparently measurable. In some processes, it is increased and in others, it is decreased due to the imposition of a stricter framework. The previews and after situations are not comparable as the whole production system changes at the same time in goals, duration, and quality.

LM2: Increased by 40%.

LM3: Productivity remained stable despite the additional needs of the WMS.

LM4: Simplification of procedures and promptness of information has rapidly reduced the execution time of any task. The operation of WMS in combination with the use of RF and Vision Picking systems ensures the correct and fast execution of orders.

LM5: Significantly increased, shorter response time and fewer errors.

LM6: Increased.

LM7: Increased over 30%.

3.11 To what extent the process of tracking product expiration dates help economies of scale?

LM1: Less returns and product damage as well as quality stock analysis.

LM4: As a 3PL provider tracking expiration dates is just a stock feature. The customer has the economic advantage since the goods to be destroyed and/or the returns to the factory have been reduced to a minimum.

4. CONCLUSIONS AND DISCUSSIONS

The main reasons for investing in a WMS are: time saving, reduction of errors and better control-tracking of goods. All these increase the productivity of the employee as well as the productivity of the entire warehouse and thus the company achieves economies of scale while increasing its activity. Warehouse needs were not affected by the WMS as it was the increase in project volume and not the WMS that led them to increase storage.

Businesses with a WMS succeed in reducing errors in almost all operations with an emphasis on the picking of goods. The employee helped himself the most in finding the position and the current balance. The WMS in combination with the RF scanner through the standard forms, that provide, give to the employee with precision and speed the

necessary information for the operation that he has to perform. The processing, picking and loading times of the goods were reduced to a greater extent due to the speed and flexibility provided by the system.

It seemed that in some companies their suppliers have access to their customer systems and thus anticipate demand themselves, avoiding not only shortages but also the accumulation of goods in the company's warehouses. Deficiencies are also addressed through the feedback limits, re-ordering that they set in the system. Customers themselves are more satisfied as they receive their products exactly as requested, at the right time, quality and quantity.

Another important factor is cost. Research has shown that the cost of purchasing, maintaining and supporting its software and equipment has increased. On the other hand, labor costs, error costs and destruction of goods decreased due to increased productivity and reduced errors.

In this study a number of limitations exist. First, the small number of respondents. However, the examined companies are leaders in the corresponding sectors. Another limitation is the geographical area (North Greece), although in this area there is a big number of companies that fulfil not only Northern Greece but Balkan and Central European countries/markets.

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