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CƠ HỘI VÀ THÁCH THỨC CỦA VIỆC ỨNG DỤNG HỆ THỐNG QUẢN LÝ KHO HÀNG (WMS) TẠI VIỆT NAM

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Tóm tắt

Trong số các hoạt động logistics, hoạt động kho bãi được coi là một trong những khâu quan trọng nhất trong quá trình thực hiện đơn hàng của khách hàng. Ngành logistic mở rộng tại Việt Nam kết hợp với sự công nghệ tiên tiến đòi hỏi các doanh nghiệp logistics Việt Nam phải áp dụng ứng dụng công nghệ vào quản lý kho bãi. Nhóm tác giả đã thực hiện nghiên cứu này nhằm tìm hiểu Hệ thống Quản lý Kho hàng (WMS), một trong những ứng dụng được sử dụng nhiều nhất để giám sát và tổ chức các hoạt động kho bãi. Thông qua phương pháp định tính, nghiên cứu chỉ ra những cơ hội và thách thức mà các công ty logistics Việt Nam phải đối mặt khi triển khai WMS. Một số giải pháp sẽ được khuyến nghị cho các cơ quan có thẩm quyền và các doanh nghiệp logistics của Việt Nam để tăng cường sử dụng WMS cả về chất lượng và số lượng.

Từ khóa: Logistics, Kho hàng, Hệ thống Quản lý Kho hàng, WMS, Việt Nam

OPPORTUNITIES AND CHALLENGES OF WAREHOUSE MANAGEMENT SYSTEM (WMS) APPLICATION IN VIETNAM

Abstract

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Among logistics activities, warehousing is considered one of the most significant steps during the realization of a customer's order. The expansion of the logistic industry in Vietnam combined with the advance of technology require Vietnam's logistics enterprises to apply technological application to warehouse management. The group of authors carried out this research to study Warehouse Management System (WMS) which is among the most used applications to oversee and organize the warehousing activities. Through the qualitative method, the study presents the opportunities for and challenges facing Vietnam's logistics companies when implementing WMS. Several solutions are recommended to Vietnam's competent authority and logistics companies to enhance the usage of WMS both in quality and quantity.

Keywords: Logistics, Warehouse, Warehouse Management System, WMS, Vietnam

1. Introduction

1.1. Rationale of the study

Warehousing is a fundamental factor in supply chain management. Playing the role of storing and coordinating the circularity of goods in the supply chain based on customer's demand and firms' supply, warehousing and inventory storage is the key to success for any Logistics enterprise. In the background of global integration, Vietnam is considered one of the promising nations in the production and logistics field. The Vietnamese government also affirmed to make Logistics the country's economic spearhead. And with the rapid development of technology, Vietnamese logistics enterprises have taken several managing software as a booster to enhance their operating system. Warehouse management system (WMS) – is one of the highly considered programmes for these enterprises.

Despite the prospective benefit of WMS once being implemented, few Vietnamese firms actually use WMS to track on their warehousing and inventory storing system due to mere understanding of the value and compatibility of the system to the pre-existed custom in Vietnam. Studies on implementing WMS into the Vietnamese logistics industry are limited; therefore, our research paper will discuss **"Opportunities and challenges of Warehouse Management System (WMS) application in Vietnam".**

1.2. Objectives and scope

The paper will analyze the current situation of warehousing and inventory storage management of Logistics enterprises located in Vietnam. The authors will also give an evaluation of WMS application, following by judging the compatibility of WMS with the Vietnamese market and give suggestions for both the government and Vietnamese enterprises in the process of implementing WMS efficiency and effectively.

1.3. Methodology

The research design follows qualitative research methodology. The research was carried out through collecting and analyzing previous observations and reports of Vietnamese enterprises' warehouse management and the application of WMS in their work process.

1.4. Structure of the study

The research paper will be in the following sequence:

Part 1. Introduction

Part 2. Literature review: An overall look of Warehouse and WMS

Part 3. Overview: A grasp of Vietnamese warehouse and WMS application

Part 4. Evaluation of WMS application in Vietnam

Part 5. Opportunities and challenges of WMS in Vietnam

Part 6. Recommendations

2. Literature review

2.1. Warehouse

2.1.1. Definition

Warehousing is the act of keeping tangible goods in a specialized warehouse or storage facility until they are sold or dispersed. Businesses can trace where items are housed, when they arrived, how long they have been there, and the quantity on hand thanks to warehouses. While a small, home-based business might keep its belongings in a spare room, cellar, or garage, larger businesses frequently buy or rent space in a building designed specifically for storage.

2.1.2. Warehouse's flowchart

Before the order fulfillment process starts, the warehouse management process flow must be established. A well-designed warehouse management process flow saves many business time and money. Here is a basic warehouse management process flow chart:

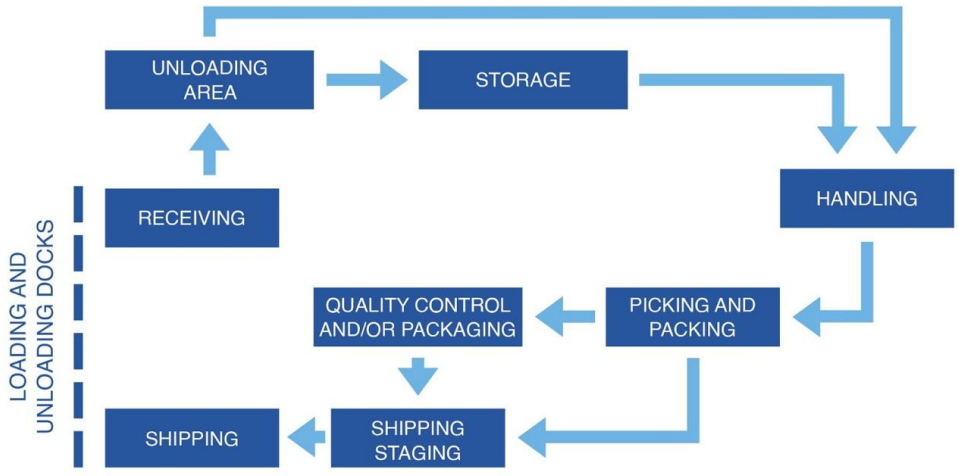

Figure 1: Basic warehouse management process

Source: *Blue Cart*

In short, the warehouse operation starts from the time the goods are delivered to the warehouse until the goods are transferred out of the warehouse to the carrier or the customer.

2.2.3. Warehouse classification

- Based on purpose of usage:

• **Distribution center:** its key duties include distributing and storing domestic items and providing value-added services.

• **CFS (Container Freight Station):** a station or warehouse where a variety of items are kept in preparation for shipping in one or more containers as a group.

• **Cold storage:** warehouse used to store meat, fish, dairy goods, poultry, fresh and frozen perishable fruits and vegetables, or any combination thereof, at a desired temperature to preserve the product's quality.

• **Cross-docking warehouse:** without long-term storage, goods are moved straight from receivables to departing freight.

• **Bonded warehouse:** a warehouse that is bonded and licensed in accordance with the Customs and Excise Act, in which products may be stored and secured without paying tax or until the Act's requirements have been met, and includes any store, house, shed, or other location where goods are stored in such a manner.

2.2. Warehouse management system (WMS)

2.2.1. Definition

A WMS is a software program that controls supply chain fulfillment activities from the distribution center to the retail shelf and provides visibility into a company's full inventory. It can help businesses make the most of their expenditures in equipment, manpower, and space.

2.2.2. Classification of WMS:

a. ***Standalone:*** It's the most basic system. It provides features that enable efficient day-to-day warehouse operations by monitoring and controlling supply chain flow from when goods arrive and leave the warehouse

b. ***Supply Chain Modules:*** It's an integrated supply chain management software system manages all the activities required to create and deliver a product, including inventory management, transportation and logistics

c. ***Integrated With ERP:*** It is a WMS module as part of a larger ERP system. They offer most of the core applications that streamline 3PL processes: from supply chain planning, procurement, accounting, customer relationship management, human resources and more.

d. *Cloud-based:* It began as on-premises systems. Cloud management is the process of monitoring and maximizing efficiency in the use of one or more private or public clouds. Organizations typically use a cloud management platform to manage cloud usage.

3. Overview

3.1. Overview about Vietnamese warehouse

3.1.1. Growth rate

The revenue of the warehousing industry has grown rapidly and steadily in recent years. Due to the Covid-19 pandemic, consumers have developed the habit of using e-money and shifted from direct shopping to online shopping, which has helped the e-commerce sector advance. Recent projections indicate that the Vietnam e-commerce business might generate 52 billion in US dollars in sales. In addition, many companies consider the necessity of enlarging warehouses to store raw materials, semi-finished goods, and final goods close to ports and manufacturing locations, which has been influenced by the busy commercial transactions that have occurred recently. Therefore, the Vietnam warehouse leasing market will expand remarkably with a forecasted growth rate of 11%.

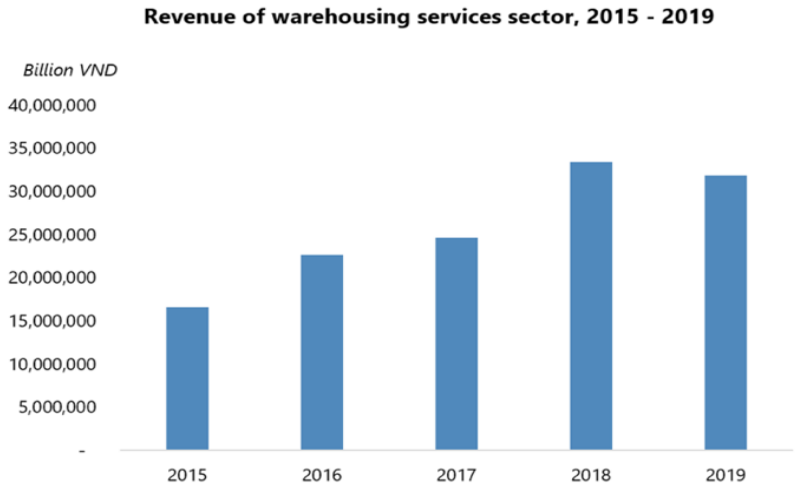

Figure 2: Revenue of warehousing services sector, 2015-2019

Source: *VIRAC, GSO*

3.1.2. Businesses and employee in the market

More and more businesses are engaged in the warehousing business. But up until this point, Vietnam has been unable to meet the warehousing requirements of both domestic and foreign businesses, particularly those for modern warehouses.

New established enterprises	The first 9 months of 2022	The first 9 months of 2022/The first 9 months of 2022 (%)

	Number of enterprises	Registered capital (billion dong)	Number of employees	Number of enterprises	Registered capital (billion dong)	Number of employees
Total number of enterprises	112.791	1.272.285	696.197	124,2	100,3	116,2
Warehousing and transportation enterprises	5.500	70.846	25.676	125,4	183,5	121,5
Proportion of Warehousing and transportation enterprises (%)	4,9	6	3,7			

Source: Calculation from the General Statistics Office data

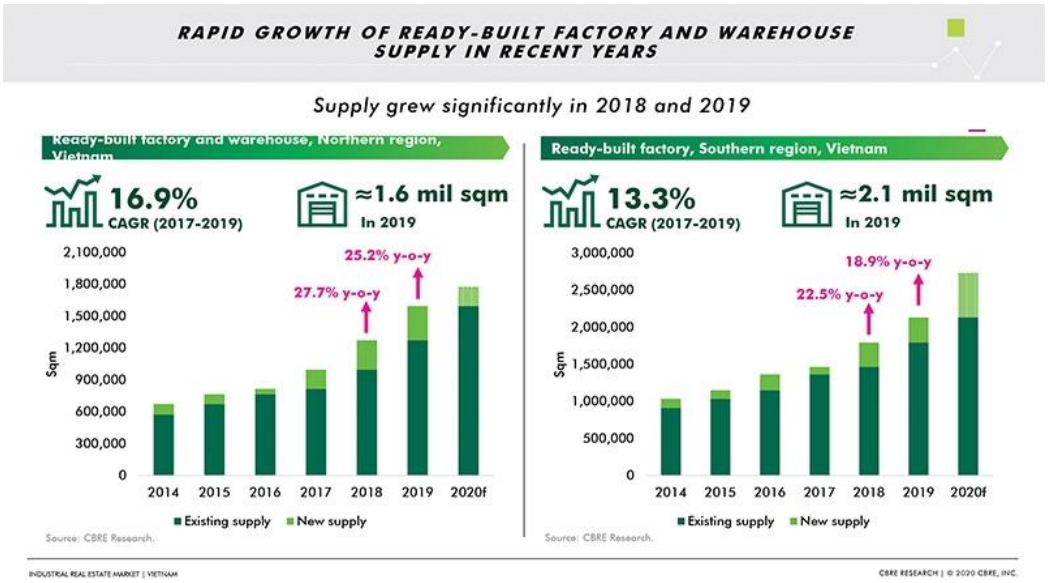

Figure 3: Rapid growth of ready-built factory and warehouse supply

Source: *CBRE Research*

The warehouse system's distribution is not even. Just 30% of warehouses are created in the North, in the area around Hanoi and Hai Phong, while 70% are built in the South. In addition, occupancy rates have notably grown in 2022 (in the southern provinces by 3% and in the northern provinces by 3.5% over the same period last year), while warehouse rentals continue to rise at a steady annual rate.

3.1.3. Investment in the warehousing industry

The warehousing industry is also attracting a lot of attention from foreign companies, especially investment in industrial land. Specifically, the number of investors interested in industrial land and warehouses will increase by 10% and 7% respectively in 2022 (GSO, 2022). In the period from 2023 to 2025, the government has also approved a plan to deploy new industrial parks with investment capital up to nearly 30 trillion VND (GSO, 2022).

In addition, investment in modern facilities, technology and equipment in warehouses is also focused to improve productivity and operational efficiency, however, the proportion is moderately low.

3.1.4. Trends in the warehousing industry

The warehousing industry in Vietnam has existed following development trends. The first is the increase in demand for cold storage, especially for the food industry. The food processing sector has grown recently as a result of the growing middle class. In the shift from traditional trade to modern trade, the cold chain (low-temperature logistics) has been a significant development concern.

The second is the trend of green logistics, focusing on reducing energy consumption and emissions to the environment. Lastly, there is the tendency toward technology and automation in the warehouse operation process through the employment of contemporary equipment and management systems.

3.2. Overview of WMS application in Vietnam

3.2.1. Overview of WMS application in the Vietnamese logistics industry

Historically, WMS were complicated, pricey and time-consuming to deploy, primarily used by developed countries. However, new digitalization platforms, technologies and integration tools have enabled Vietnamese enterprises to utilize more accessible and cost-effective WMS. In fact, the Vietnamese logistics industry has been observed to employ a WMS for almost every good and service . WMS has so far supported General Warehouse, CFS Warehouse, Distribution Centres, Bonded Warehouse, Crossdock Warehouse, Project Warehouse, Raw Material Warehouse, Finished Goods Warehouse, etc.

3.2.2. Investment of WMS in Vietnam

a. By logistics companies

Warehousing services are currently receiving escalated investment, i.e. WMS, to increase value and serve customers. The rate of application of WMS among companies reached 41.4% (HCMC Department of Industry and Trade, 2022). While multinational enterprises are equipped with and utilizing WMS with their parent company in the Vietnamese market, large domestic enterprises such as Saigon Newport Corporation, Vinafco, Transimex, Sotrans, etc., are self-developing their own WMS to achieve synchronized data between departments. However, the self-built WMS is currently causing many issues for businesses due to lack of digital technology infrastructure, qualified internal human resources; low investment cost; difficulty in changing habits and business customs; and low-quality services etc. Despite challenges, most Vietnamese logistics firms are eager to invest and apply information technology for better logistics performance.

International software firms like Oracle, Infor, and Epicor have therefore entered Vietnam. However, not all businesses have enough resources to apply and deploy these software. Over ages, the industry is expanding with more global software suppliers offering affordable prices and simpler installations, namely WMS360, Infor, Infolog, and Indigo Software. Besides, many domestic WMS on the market today are of comparable quality to the foreign products and offer higher customization levels at more reasonable costs, with prominent ones being WMS by INNOTECH Vietnam, TKELog WMS by TKSolution, SWM by Smartlog, MEK-WMS by Meksmart, etc. WMS businesses help domestic business firms integrate and modernize their independently created WMS to create a more complete system. For others, a new technological ecosystem embracing WMS is also being developed. To illustrate, SWM by Smartlog has been integrated directly into the warehouse system of Sabeco - top firm in the F&B industry, One Mount Group - leading enterprise in Retail industry, and VN POST - large transportation company in Viet Nam, etc.

In general, WMS is presently being built to aid in improving the performance of logistics activities for a wide range of goods and services for practically every firm. WMS and ERP are typically coupled in enterprises to improve workflow, streamline procedures, and more effectively handle data. WMS incorporates technological features to enhance operational performance. WMS tracks product shelf life, keeps track of inventory changes, configures FIFO, LIFO, or FEFO packing methods, and uses 3D visual analysis to simplify and facilitate the collection and transportation of products inside the warehouse. Corresponding process of reverse logistics can also be managed effectively. Another feature is that WMS is embedded with labor management and automatic task distribution, smoothing the efficient distribution of several work at once. Currently, WMS software provides multi-language, multi-platform, multi-account accessibility, and a ton of new features that are tailored to the demands of the firm.

Not only limited to those above-mentioned companies, WMS promises to expand its application scale even more in the future. Specifically, in a survey in 2021 by VLI, up to 16.67%

of surveyed businesses plan to build a WMS in the future, in addition to 63.89% of enterprises already using WMS.

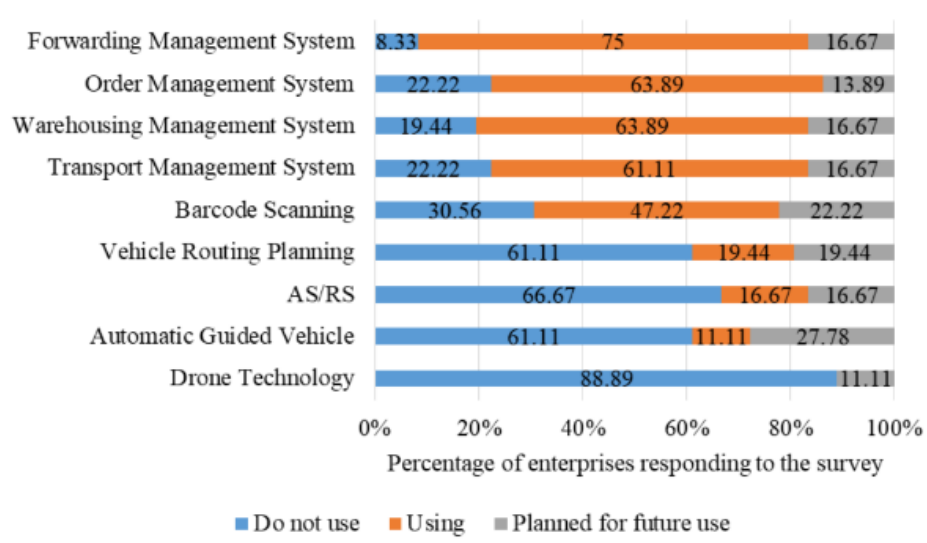

Figure 4: Technology applications and development trends that enterprises are providing or plan to provide to customers using logistics services

Source: *Vietnam Logistics Research and Development Institute – VLI (2021)*

b. At ports and logistics centers

Currently, many logistics companies are investing in developing a modern WMS at ports, border gates and logistics centers. Cities with high import and export volumes like Hai Phong, Ho Chi Minh City, Ba Ria - Vung Tau; or the northern border gates with China such as Lang Son, Quang Ninh, Lao Cai, have seen noticeable development, including incorporating IT and automation into warehouse management, i.e. WMS.

In 2020, many logistics centers in Vietnam already transformed from traditional to new-generation centers applying 4.0 technology. The Vietnam Logistics Report 2022 has recorded several logistics centers and projects with huge potentials in digital transformation and WMS implementation. Examples include:

● ***Vinatrans Da Nang logistics center***: The project covers an area of over 1 hectare, with a WMS built modernly to distribute and store aquatic products, FMCGs, fresh food products, imported fruits,... The logistics center serves seafood import and export companies, production and export companies, trading businesses in the field of frozen food and supermarket chains in Da Nang, the Central region and the Central Highlands.

● ***Da Nang ITL logistics center***: The project is on an 31,244m2 area, having a Grade A standard service quality with 7-storey storage shelves and a WMS capable of integrating in accordance with customer requirements and the port of entry with automatic lifting platform,…

Apart from large-scale logistics centers, many micro-warehouses are potential candidates for WMS deployment, especially for e-commerce, which may be the trend in 2023. These warehouses make many new points in the logistics network, bring goods closer to customers, shorten delivery time, and facilitate last-mile delivery in urban areas.

4. Evaluation of WMS application in Vietnam

Overally, WMS helps solve the backlog problems of logistics activities in traditional warehouse system: including problems that arise throughout the logistics chain as well as specific difficulties of each enterprise, in terms of the main aspects below:

● ***Optimized operational execution:*** WMS offers businesses real-time visibility into inventory levels and warehouse operations, allowing businesses to spot bottlenecks and inefficiencies and take corrective action timely. The manual duties associated with warehouse operations are also automated by WMS.. WMS also fosters collaboration with stakeholders in the logistics chain, including suppliers, customers, and transportation service providers, increasing the flow of data and goods throughout the supply chain.

● ***Risk management:*** WMS helps companies keep accurate inventory records, manage shipments, create invoices, and handle returns and refunds. By such functions, WMS helps manage risk and enhances operational efficiency, profitability, and compliance with regulations, ultimately reducing late payments, financial losses and enhancing customer satisfaction.

● ***Improved logistics services performance:*** WMS monitors performance indicators such product quality, delivery time, and transportation costs. This aids companies in identifying issues and enhancing the efficacy of their logistics services.

● ***Flexibility and adaptability:*** WMS may be scalable to account for adjustments in warehouse operations, allowing firms to develop and react to shifting market conditions. By modifying and interacting with corporate systems like ERP and CRM, WMS may increase efficiency and information flow. Its flexibility and adaptability help firms to act swiftly in response to market changes and seize new possibilities, facilitating digital transformation.

However, WMS adoption in Vietnam still faces limitations, namely:

● ***High investment costs, lack of government guidance, and fragmented IT development***: Businesses still encounter various challenges when requesting funding from international investors due to the high investment cost, also, the government hasn't really provided clear guidance to support and promote firms' use of WMS, the enterprise's IT development is carried out in a fragmented and non-systematic manner, so the investment results are not as expected.

● ***Slow growth rate and investment rate***: The growth rate and investment rate in WMS are still comparatively slow when compared to developed nations. In general, the foundation of Vietnam's warehouse system is not of high standards, and many logistics enterprises have not yet provided a complete supply chain services system, mostly in parts. The supply system of logistics

service chains lacks integration and digitization for total management, and automation in operation is still a new concept.

● ***Uneven development***: There are also problems with connecting infrastructure and goods sources between localities; port congestion; lack of transshipment station system and the controversy related to the port infrastructure fee collection - "bottlenecks" in both infrastructure and management aspects. The discrepancy exists even among businesses of various sizes. Almost only large businesses can invest in a private WMS system while small enterprises frequently overlook or have to outsource due to high cost.

The above limitations have reduced the effectiveness and efficiency of logistics activities. Many localities and businesses are unable to establish linkages in terms of goods sources and logistics with big cities, reducing the ability to optimize resources to improve competitiveness at local and national level. Logistics development in localities far from major economic centers is still slow compared to the expectations of the community; thereby leading to a decrease in investment attraction in this field.

5. Opportunities and challenges of WMS in Vietnam

5.1. Opportunities

Vietnamese distribution centers are increasingly implementing technology to help them become more efficient and productive. Vietnam has become a manufacturing hub in South East Asia and providing efficient warehousing facilities plays a vital role in the overall supply chain process. In Vietnam especially, an increasing number of companies are adopting a WMS that supports effective order and inventory management. Deploying a WMS is part of a macro strategy for logistics management, opening opportunities for the businesses to optimize aspects of warehouse management.

5.1.1. Develop logistics activities through smart warehouse solution:

The application of information technology in the field of logistics is an extremely important factor determining the competitiveness of enterprises (MOIT, 2020). With supportive policies from the government, businesses need to improve synchronously and gradually automate, actively develop information technology systems in logistics to gradually replace logistics platforms and applications exploited by foreign companies.

a. Optimizing the import and export process in the warehouse (Inbound and Outbound logistic)

When goods arrive at the warehouse, WMS helps speed up the receiving process. Users can optimize the location of inventory and equipment, and how it moves around the warehouse. When it comes to picking items, a lot of problems can arise. First, pickers can take a long time to find the right goods in stock to take orders. Second, sometimes pickers choose the wrong product or quantity and ship them for packaging. As a result, customers are not satisfied because they receive goods for which they did not ask. Third, with the lack of prioritization, urgent orders can be dropped while less important ones are being fulfilled first. Finally, warehouse pick-up routes are not optimized, leaving workers with hours of searching for needed goods.

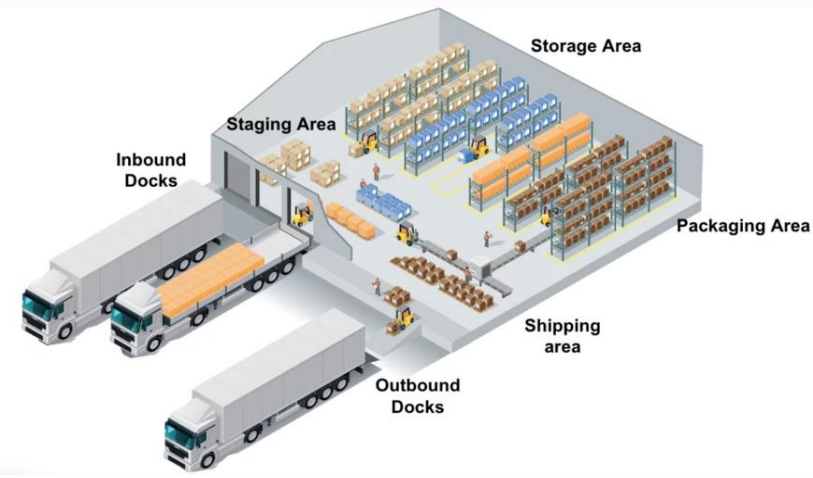

Figure 5: Inbound and Outbound logistic process

Source: *Smartlog*

Using a mobile device to receive items automatically assigns batch numbers, serial numbers, bin locations, and inventory status when items are received. With WMS, receiving goods and putting goods into each position of cells and shelves will be simpler than ever through scanning barcodes on products. From there, it is possible to reduce management costs, calculate and arrange goods more scientifically.

b. Improve Inventory Visibility

Many e-commerce businesses struggle with maintaining the correct amount of inventory in their warehouse or distribution center. The process of inventorying all products can take days or even weeks depending on the size of the warehouse and the volume of products stored. Tracking inventory manually is a time-consuming process, and the results of this process can cost a lot of money. This is especially true for operations that operate in a complex supply chain, where products are frequently transported between multiple warehouses, distribution centers, and stores. If inventory is done traditionally, inaccuracies are inevitable.

WMS provides real-time data on the inventory through barcodes, serial numbers and Radio Frequency Identification (RFID) tagging. These methods allow the user to record each item as it enters the warehouse, all its movements on the warehouse floor as well as its movement during transportation from one location to another.

With advancements in technology such as RFID and barcode scanners, inventory tracking can be much more automated than in the past, allowing for a more efficient use of time and capital. The serial number placed on the final product allows the user to track the item back to the original batch ID to determine if the product was part of a defective batch. Traceability ensures that businesses only have to recall damaged goods, rather than examine all goods that are suspected to have been damaged.

Figure 6: Warehouse Inventory Visibility feature in WMS

Source: *Smartlog*

This type of visibility is needed to generate demand forecasts, providing insight into which products are most popular with customers during specific times of the year. These forecasts assist leadership in deciding which products to invest in and which products may lose ground in the market. The traceability of one company's inventory is one of the many advantages of WMS involved that is also extremely useful in the event of a recall.

c. Labor Management & Productivity

According to Intech Group, the average labor cost accounts for two thirds of warehouse operating costs in Vietnam. However, if human resources are used properly, these warehouse costs can be reduced without affecting overall operational efficiency. Performance monitoring is complicated, especially when a business has multiple departments.

Performance visibility suffers and it becomes difficult to gauge the work of the department as well as that of individual warehouse workers. Without the right tools, businesses cannot understand what the overall workload is and who is responsible for the individual activities. Uneven workload distribution leads to lower performance and inability to achieve key e-commerce business goals.

WMS allows assigning tasks to each employee. So employers proactively forecast the amount of labor required for the operation. Manual processes are cut down to save working time. For example, instead of recording product information, employees can scan product codes. The system automatically records and updates the data.

In addition to creating schedules and daily work assignments, WMS software can be used to gain a broader understanding of the workforce. WMS solutions can identify the best employees for the job. Considering factors such as skill level, proximity and other tasks, WMS helps users to assign work to each team member. Using labor forecasting and KPIs, warehouse managers can see when they may need more or less staff, identify top performers, and look for areas of improvement. With labor costs accounting for 65% of the average warehouse budget, fully understanding those resources are being spent is extremely important.

5.1.2. Create favorable conditions for Vietnam to participate in FTAs

Vietnam has signed and implemented 15 FTAs, becoming an important link in global supply chains; including the EU-Vietnam Free Trade Agreement (EVFTA), the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) and the Regional Comprehensive Economic Partnership (RCEP), etc. The development trend of new generation FTAs is to establish a comprehensive free trade area, remove all barriers, and facilitate member countries to expand market access.

Participating in a new generation FTA helps Vietnamese businesses to seize opportunities to boost exports to markets of countries participating in the agreement. General Department of Vietnam Customs that in the first eight months of 2022, exports to other CPTPP members reached some 41 billion USD, up 38.7% year on year. Shipments to the EU also increased 24.2% to over

32 billion USD. Meanwhile, Vietnam's exports to other members of the RCEP agreement hit 108.48 billion USD in the first nine months of 2022, rising 16.4% from a year earlier. With this upward trend, the implementation of FTAs will continue generating fruitful results for Vietnam in 2023, especially when it comes to potential markets, the official opined.

Vietnam joining FTAs has helped the country secure impressive export growth and partly mitigate the pandemic's adverse impacts on the economy. It is these new trends that have been and will create momentum for domestic logistics activities to develop strongly.

This is also a golden opportunity for businesses to apply technology, innovate and improve their competitiveness in the logistic and supply chain field. Applying better technology in logistics activities will be the key for Vietnamese businesses to reduce operating costs, improve competitiveness and make breakthroughs in the integration period. Digitization and technology automation will be the journey for Vietnam's logistics industry to reach out to the world.

5.1.3. Increase competitiveness in the market

Located in the dynamic development area of the world, where the flow of goods is concentrated and exchanged, Vietnam is considered to have an advantage to develop the logistics service industry. Among many solutions to take advantage, develop logistics into a large economic sector, such as promoting linkages to create a strong logistics network, improving the quality of human resources, investing in infrastructure, etc. Digital transformation and automation is the key factor to leverage the logistic industry.

Applying technology to the logistics industry is a solution to improve efficiency, optimize operational productivity and save operating costs for logistics businesses (Diep, 2022). Thereby, logistics development and operation units closely connect with each other, improving operational efficiency. Similarly, a representative of Kargo 365 Joint Stock Company said that digital transformation will help businesses create many breakthroughs in resource exploitation, market expansion, and competitiveness. Applying better technology in logistics activities will be the key for Vietnamese businesses to reduce operating costs, improve competitiveness and make breakthroughs in the integration period.

The digital transformation revolution in economic and social fields, specifically industries and services in Logistics 4.0 contributes to reducing delivery time, transportation costs, communication costs, thereby optimizing business costs and meeting the increasingly different needs of customers. Digital transformation in WMS helps the logistics supply chain system of companies and enterprises in the country step by step integrate, improve the level of governance, be more transparent and competitive.

In today's world, e-commerce sales are higher than ever, and the trend shows no signs of slowing down. This ever-growing flow of goods all around the world puts a strain on both producers and distributors. To stay competitive, companies need to streamline their processes as much as possible. Warehouse automation technologies can be classified into those that assist in moving goods and those that improve the handling of goods.

5.2. Challenges

In Vietnam, many businesses have applied the WMS model to their production activities. However, the application is not optimal, leading to low efficiency in warehouse management. New generation WMSs also have to connect to the warehouse operating system, which is often automated with embedded programmable control systems with artificial intelligence instead of traditional standard management processes. However, the supply of WMS in Vietnam is currently very limited. Most domestic software enterprises do not fully understand the required features, business models of logistics service enterprises, and inexperienced technical support staff.

For domestic enterprises, only large enterprises specializing in distribution warehouses such as some member units of Tan Cang Corporation are transforming their model into import-export distribution centers, or enterprises such as: Gemadept Logistics, VINAFCO, U&I, TBS, Transimex, Sotrans, etc. are developing WMS applications. These businesses often face difficulties when developing applications, often have to buy foreign products, the installation and commissioning process is difficult, and the connection process internally and with customers is necessary. Most of the small and medium logistics enterprises in Vietnam do not have financial capacity, along with the thought of being afraid to invest, so they do not have a good management system. Even though the rate of WMS is estimated at 41.4% now for Vietnamese enterprises, there are still many challenges in applying WMS effectively and efficiently.

5.2.1. Challenge of smart warehouse investment

Many logistics companies have had strategies and plans to invest in developing modern warehousing systems, forming accredited logistics centers or licensed inland ports. However, in general, the foundation of Vietnam's warehousing system is not of high standard, and many logistics enterprises have not yet provided a chain of services in the entire supply chain. Meanwhile, the demand for a modern logistics system combined with automation to meet the development of retailers and the e-commerce industry in Vietnam is very high. The supply chain logistics system lacks integration, has not yet applied the digitization of total management, and automation in operation is still a new concept.

The relatively weak financial capability of Vietnam’s logistics enterprises is another obstacle to them when realizing a smart warehouse. Whether it is physics-based or process-based, the cost of smart warehouse implementation is subject to its degree of complexity, depth and width. The estimated initial cost of building a smart warehouse ranges from 10 million to 25 million dollars, which is a huge number for Vietnam’s logistics companies.

Therefore, modernization in the logistics management operation system to create a professional management system is a combination not only in modern infrastructure combined with technology application but also integration between modern and professional logistics service providers to create values for the logistics industry, for logistics to adapt and develop stronger.

5.2.2. Challenge of selecting the appropriate WMS

Finding the right WMS is the first challenge that companies face during the implementation process. With thousands of different WMS options available on the market, it can be a daunting task to select one that is perfect for one business. Each warehouse has its own unique set of challenges and requirements, therefore finding a solution that is a perfect fit is not that simple. WMS services vary in areas such as usability, adaptability, decision support, scalability, and lifecycle costs. For example, high throughput, multi-channel operations with multiple options, changing needs, and hundreds of thousands of SKUs (Stock Keeping Unit) require a powerful WMS. Companies should be aware of any unique aspects of their operations, knowing that WMS vendors may not have developed their systems for the specific processes or needs of the organization.

With the complicated requirements of being able to find the right WMS for one business model, finding a suitable deployment partner also plays an extremely important role. A business partner understands specific needs and can implement a WMS in a way that is most beneficial to a business.

5.2.3. Challenge of high installation cost

The cost of such synchronous IT infrastructure investment is up to hundreds of billions of dong, which is a big burden for small and medium logistics enterprises. Vietnam has more than 98.1% of SMEs (GSO, 2021) and almost all of these enterprises are facing difficulties in capital. Small logistics businesses handle orders and sort goods manually, so they only provide simple, slow, sporadic services within the local area.

In addition, WMS systems include a custom code which makes it quite expensive. The upgrade or maintenance can also create an even more expensive and troublesome situation. Businesses could incur many costs from their vendor for testing, coding, and debugging. All these things are done as they need to follow the previous code and all changes made must still fit the old system's functionality and what business needs.

5.2.4. Challenge of human resources and quality

In the context of the developing logistics market in recent years, Vietnam's logistics manpower has strengths: young, dynamic, and willing to take on challenges. However, According to the "Logistics Skills Forecast Report 2021 - 2023" the problem that Vietnam is facing is the lack of human resources logistics in terms of quantity, expertise and professionals.

Regarding "Logistics Skills Forecast Report 2021 - 2023", the logistics sector is currently facing a serious shortage of human resource both in terms of quantity and quantity. Most logistics enterprises in Vietnam are small and micro enterprises, so the need to use high-quality human resources is not high. Enterprises of this type have an average staff size of 10 to 20 employees. Due to limited financial capacity, they often do not invest deeply in technology. And because of

such a small scale, most Vietnam's logistics enterprises only need to hire employees with basic knowledge of foreign trade, forwarding, transportation, and warehouses, there is no need to recruit high-quality human resources due to inability to pay competitive wages. In contrast to big logistics firms in Vietnam that operate 5PL logistics, e-commerce suffers from a severe shortage of highly trained human resources with specialized logistics technology to manage the system.

The 4.0 technology revolution has changed the way of production, business and management, requiring administrators to apply technology flexibly, traditional human resource managers need to improve their capacity to catch up with new trends. Especially for the Logistic industry when the application of technology in processes is gradually becoming essential, it is an inevitable trend in the 4.0 era when technology is crowned because it requires skillful human resources and creates many value added.

Implementing a WMS can be a challenging process, but with the right preparation and team in place, one business can overcome these challenges and reap the benefits of a well-run warehouse. This is indeed a fertile ground for businesses providing software solutions because of the pressure of globalization and the strict demands of customers as well as the rapid growth of e-commerce. Enterprises are put in a situation where they have to apply technology to improve their competitiveness.

6. Recommendations

6.1. For the government, ministries and authorized organizations

a. Building digital government

In the context of Industry 4.0, digitalization being implemented on the state level is expected to deeply encourage logistics businesses to accelerate their own digitization process (Lam, 2021). By bringing the information technology into logistics related tasks such as paperless documentation and transaction system, electronic payment, electronic invoice, e-logistics portal system, etc, the application of WMS in Vietnam would be widespread and thoroughly controlled.

b. Realizing the nationwide logistics center system

According to the approval for nationwide logistics center system development planning by 2020 and orientation towards 2030 signed by the Prime Minister, the government shall take charge and cooperate with other Ministries, agencies, the People's Committees of provinces relevant to construct numerous logistics centers across the country. However, apart from the existing logistics centers, the brand new ones planned in the Decision above will be located in areas where the customers have not had demand for warehousing. Hence, what should be done are emerging the land fund for logistics activities and cost-effectively planning them, and equipping the said centers with technology like WMS.

c. Creating favorable conditions for modernization process in warehousing management of Vietnam's logistics enterprises

While multinational companies and big corporations specializing in distribution warehouses are developing inventory management applications, SMEs are finding it difficult to do so due to significant investment expenses (Lang, 2022). Therefore, it is recommended that the competent authority support Vietnam's logistics enterprises in terms of finance and technique as the warehouse modernization of such companies has not got rid of its infancy stage.

d. Implementing synchronous solutions to improve the investment and business environment

As investment helps boost the resources to advance the modernization and automation of Vietnam's logistics enterprises, the government shall command ministries and related departments to propose feasible policies to attract foreign investors, increase the transparency and convenience for investors. The next crucial step is to create a fair competitive business environment for enterprises to effectively use the capital received and generate higher value added so that the investors earn attractive returns and logistics enterprises obtain financial autonomy to promote their own WMS instead of being dependent on outside financial resources.

6.2. For Vietnamese logistics enterprises

a. Targeting the most suitable software vendors

Logistics enterprises companies are prone to confusion and information crises due to the large number of software vendors of all scales. There is neither perfect nor standardized WMS, which means the companies shall analyze the supply market to pick out the right vendor for their businesses based on their current situation and needs. Some of the criteria enterprises can take into account are: simple dashboard, the layout of menu arrangement, pallet diagram, compatibility with other softwares, customizability, costs, etc.

b. Obtaining and training skilled labor with basic grasp in modernized logistics in general and in WMS in particular

This can be made by tightening the selection criteria for employees in the first place. Companies shall prioritize recruiting applicants with either basic knowledge in using technology or logistics certificates such as CPIM, CSCP, FIATA, etc for further training after being employed. Each enterprise needs to equip appropriate training courses in using WMS for their employees, and there should also be annual quality inspections to ensure their ability to work with technology. Firms can, furthermore, implement Labour Management System (LMS) – as a tool to track the compatibility between WMS and their labor.

c. Allocating warehouses among the locations that are either not densely distributed or belong to the planning of government

Most Vietnamese enterprises are focused on developing warehousing systems in the Southern part of the nation, leaving other areas to have poorer warehousing and inventory storage systems. The firm should develop their warehouses in potential trading and industrial areas to ensure that

the supply chain will not face mere chances of being interrupted and the existing warehouses will not be overexploited.

d. Develop synchronous logistics modernization strategies

The Ministry of Industry and Trade announced an action plan to improve competitiveness and enhance logistics in Vietnam by 2025. In which, the Ministry clearly stated the scientific research and technology transfer as forerunners in the integration trend. Hence, logistics businesses, especially 3PLs, shall consider developing a common digital platform for stakeholders to access simultaneously, share data and information, and oversee the whole process. Besides WMS, other softwares namely ERP, MES, TMS, etc are highly recommended for companies desiring for automation chain of logistics activities. However, it is game changing that all of the modifications and transformations are synchronized to promote the inner connection which, in turn, helps enhance the sustainability and profitability.

7. Conclusion

In the face of competition and the explosion of the digital economy, along with the increasing speed of e-commerce, especially under the pressure of recovery after the COVID-19 pandemic, logistics businesses have implemented applications technology into business activities to improve economic efficiency, as well as optimization in the supply chain of production and logistics. However, only successful implementation of WMS can help meet those requirements and bring the expected competitive advantage to Vietnamese enterprises in the market. Therefore, the research paper provides an overview of warehouse management and WMS, as well as the opportunities and challenges in WMS implementation in Vietnam and possible solutions to overcome the limitations.

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