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Organization of business processes in the warehouse

What is the role of warehouses in logistics?

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The purpose of the dissertation was to take a deeper look at such an aspect of global logistics as warehouse management. Various aspects of the functioning of warehouses, their role in the supply chain, and the importance of individual elements of warehouse management were considered.

Qualitative and quantitative research methods were used in the work. Quantitative research data were collected using a wide list of online articles, Internet sources, as well as book sources. Qualitative research is presented in the form of an interview with a professional in the field of logistics and business, who has long experience in the field of warehouse management. Both of these approaches were used to answer the questions posed in the thesis.

From the study it becomes clear that there is a wide variety of types of warehouses, depending on the needs of the supply chain and many methods of organizing warehouses, which depend on the purpose of the warehouse. It also became clear that the right steps to organize a warehouse are to determine the type and size of the warehouse depending on the needs, professional development of employees, and installation of automation systems.

Research has proved the importance of automation as one of the key elements of the functioning of modern warehouse management.

The author recommends warehouse managers pay more attention to employees, and their professional skills, as well as embedding a clear hierarchy. Automation systems are also very important, which help the warehouse to be less dependent on the human factor.

Keywords: Professional development, professional skills, approach

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1 Introduction

1.1 Research problem

In today's world, warehouses are one of the most important aspects of the global supply chain. It is impossible to imagine a supply chain, global or local, in which there would not be warehouses as connecting links supporting the production process at all stages. The fact that warehouses are an important link in the logistics chain, is hardly anyone doubts. They are extremely important in many areas - in manufacturing, wholesale and retail trade. Similarly, it is impossible to imagine the sphere of cargo transportation without such a complex, where the storage, processing, and distribution of cargo take place (Gwynne Richards 2014: 6).

Warehouse management is an important part of the warehouse organization, and without it, effective work in such a place would be impossible, and the warehouse itself would do more harm than good (Syed Ammar Arshad 2021).

Warehouses are very tightly integrated into the supply chain, but in which places which types of warehouses are more efficient and in which less, it is not always easy to understand. It is also not always obvious how to make it more efficient and use the full potential for faster and clearer movement of goods along the supply chain, which is a problem.

In this thesis, problems related to the activities of warehouses and individual elements of warehouse management will be considered.

1.2 Research questions

The questions posed in this thesis will be aimed at finding more effective warehouse management methods, and will also answer questions about the value of individual elements of warehouse management, such as automation.

The main questions posed in the thesis are as follows:

- How are warehouses classified and what are the methods of organizing warehouses?
- How to properly organize all business processes in a warehouse?
- Why is automation important?

These questions will help to take a deeper look at warehouse management and understand how to manage it effectively.

1.3 Author's interest

I am personally extremely interested in the topic of warehouse management and its impact on global logistics because many of my relatives work in this field and I have been listening to stories about their work since childhood. Specifically, warehouses were chosen as a research topic because, in my opinion, their role is often downplayed or completely forgotten, and it is not so obvious to most people. Since I plan to link my career with logistics in the future, it was interesting for me to look deeper into this area.

2 Literature review

Warehouse management is a very important link in the supply chain, and without it, there would be no logistics as such. At the same time, no single warehouse management element would be the most important. Warehouses are just a link in the global logistics chain, although very important. Logistics is a formative factor in this chain, and it is thanks to logistics that goods and raw materials are moved from factories to warehouses, and from there to customers. In logistics, every element is important.

Since the topic of the dissertation is tied to warehouses, there are many theories and topics related to logistics in the work.

2.1 Logistics

To begin with, it is important to understand what logistics in general is, so that later we can move on to a narrower part of it, such as warehouse management. Logistics is the science of planning, controlling, and managing transportation, storage, and other tangible and intangible operations performed during the delivery of raw materials and materials to a manufacturing enterprise, in-plant processing of raw materials, materials, and semi-finished products, delivery of finished products to the consumer through the interests and requirements of the latter, as well as the transfer, storage, and processing of relevant information. (David Essex, 2019).

Warehouses are part of the logistics chain, and therefore the dissertation will very often emphasize the role of warehouses in the global chain and their impact on it.

2.2 Transport logistics

Warehouse management is inextricably linked to transport logistics, as these two areas interact closely, as cars delivering goods arrive at warehouses. The definition is highlighted: transport logistics is the science of system integration of transport and logistics activities (actions of economic entities) in the form of transport and logistics services to optimize cargo flows. It is considered both the delivery of goods to customers by private vehicles and cooperation with a large logistics company that carries out transportation around the world (Jaydi Reyes 2022).

2.3 Supply chain

The importance of the supply chain for warehouses is the same as warehouses are important for the supply chain. There are warehouses throughout the supply chain, and without them, such a practice would not be possible.

The supply chain is a set of organizations, people, activities, and information involved in the process of converting primary raw materials into a finished product and moving raw materials (finished products) from the supplier of primary raw materials to the final consumer. Warehouse management is most actively traded at this stage, as raw materials are moved from one point to another, and intermediate stops are warehouses that accept various products at all stages of production (Indian Institute of Materials Management 2019: 21).

2.4 Warehouse

Warehouses are the basis of warehouse management and an important link in logistics. Warehouse — is a building/buildings (also their complex) intended for storage of material values and provision of warehouse services. In logistics, a warehouse performs the function of accumulating stocks of material resources necessary to dampen fluctuations in supply and demand, as well as synchronizing the flow of goods in systems of promotion from producers to consumers or material flows in technological production systems. Warehouses come in various types, and purposes and serve as an important aspect of logistics (Indian Institute of Materials Management 2019: 99).

Warehouses are a very important element, but in the modern world this is not enough and it is also necessary to take into account modernization and automation systems.

2.5 Warehouse management system

Automation is a very important element for a warehouse, providing a modern approach to work. The WMS system is a program designed to automate the management of warehouse processes and the operation of a warehouse complex.

The functionality of the WMS warehouse management system allows the user to perform warehouse operations centrally, under the control of the WMS program, using mobile and voice terminals. Warehouse operation with the implemented WMS system

is carried out simply and efficiently, allowing minimized losses during warehouse operations (Abby Jenkins 2020).

2.6 Automation

Warehouse and logistics automation — the introduction and integration of modern software and electronic trading equipment are one of the best ways to simplify, speed up and make more efficient any business operations related to the warehouse and logistics of a particular enterprise. Automation of production is the use of a set of tools that allow you to carry out production processes without direct human involvement, but under his control (Abby Jenkins 2020). Automation can be either complete or partial, depending on the needs of the company (Abby Jenkins 2020).

Full warehouse automation is an automatic storage and delivery system with the ability to use a variety of functions, including order collection and selection, distribution, storage, and even waste disposal (Abby Jenkins 2020).

All these terms refer to warehouses in one way or another and are very important for understanding the basics of warehouse management.

2.7 The concept and essence of warehouse management at the enterprise

Frequent changes in the modern market lead not only to fierce competition. Such a situation requires every enterprise, firm, or company to ensure an increasingly high level of quality of products or services provided. Otherwise, they risk being forced out of the market. One of the modern means of achieving such results is the logical use of warehouse management in the management of a company or firm (Alec Porco 2022). The subject of logistics management is movable material and information flows and inventory management of products. The movement of any material flows is impossible without the concentration of necessary stocks in certain places, for the storage of which infrastructure facilities called warehouses are intended. In this regard, warehouses are an integral part of any logistics system - an organizationally complete economic system consisting of interrelated elements in a single process of managing material and related flows. The totality of these elements, boundaries, and tasks of functioning are united by the internal goals of the business organization or external goals (Indian Institute of Materials Management 2019: 97).

Warehouse complexes are not only an integrated component but also a system-forming link of the logistics system, which provides for the accumulation, processing, and distribution of material flow. This approach will ensure the achievement of a high level of profitability for the entire system. Warehouse management appears to be the most important cell of any enterprise, as it has no small influence on the course of production processes. Most of the material values of the enterprise go through warehouses, based on this, they occupy a large part of the factory territory (Gwynne Richards 2014: 6).

2.7.1 Warehouse economy structure

Warehouse management is a set of buildings and structures intended for storage, placement, reception, and any products, as well as means and objects of labor. Part of the material and technical base, which ensures the safety of products from the production area to the consumption area, as well as within the production area; is the necessary condition for acceptable circulation of raw materials, fuel, and finished products. The structure of the warehouse economy determines its inherent nature to a particular branch of the economy - agriculture, trade, as well as placement on the territory and place in the process of reproduction (DEAR systems 2021).

The objects of the warehouse economy are various tanks, platforms, premises, and any other structures of a universal or specialized type, equipped with control and measuring devices, equipment that has protection for stored products from fires and any climatic influences, as well as means for laying products and other means.

Warehousing of products is necessary due to the existing fluctuations in production cycles, transportation, and consumption. Warehouses of different types can be created at the start, in the middle, and at the finish of cargo transportation, as well as production processes for the temporary storage of goods and timely delivery of materials to production in the right quantity.

2.7.2 Warehouse processes

The temporary storage of products is determined by the nature of production and transport. With its help, spatial, temporal, qualitative, and quantitative discrepancies between the availability of materials and consumption are overcome.

In addition to cargo warehousing operations, sorting, loading, picking, and intermediate operations are also performed in the warehouse, as well as some

technological operations and others. Based on this, warehouses should be considered not only as means for storing goods but also as transport and warehouse complexes in which the processes of moving goods play an important role. The operation of these complexes is dynamic, and stochastic in nature due to the uneven transportation of goods (Indian Institute of Materials Management 2019: 100).

Warehouses are buildings, structures, and various devices designed for inventory management at various parts of the logistics chain and the material flow as a whole: acceptance, placement, storage, preparation for production and personal consumption, search, picking, delivery of various products to consumers (Nicole Pontius 2022).

The warehouse includes various zones such as storage area, equipment, reception, imported pantry, and others. Warehouses are also one of the most important elements of logistics systems (Abby Jenkins 2020).

3 Methodology

3.1 Types of research

3.1.1 Exploratory

The exploratory method assumes a problem that needs to be solved with the help of hypotheses, the search for possible solutions to the problem, and the study of sources and conclusions based on the data obtained. This method is the basis of almost any theoretical research and will help in data collection and analysis.

3.1.2 Descriptive method

The descriptive method is a method whose essence consists of the presentation of the characteristics of the subject of research and in the primary analysis. This method will help to better understand the theoretical aspects of the topic and structure the facts.

3.2 Causal method

Causal research attempts to identify a causal relationship between two variables. Like descriptive research, this form of research serves to prove an idea and serves to better reveal the topic.

3.2.1 Qualitative method

Qualitative data is a research methodology aimed at investigating the object and explanation, as well as providing detailed information for a deep understanding of all their consequences.

Qualitative data are descriptive in nature and can be presented in the form of a survey or interview.

3.2.2 Interview

An interview is a communicative method based on the respondent's direct answers to the researcher's questions. This interview will help in revealing the issues raised in the thesis since the person with whom the interview will be conducted is a professional and his opinion is extremely valuable due to his vast experience in this field. The interview questions will directly relate to the issues of the thesis and the answers received will be valuable for a broader understanding of the problem, as well as providing an alternative point of view on the problems of the thesis in addition to the author.

3.3 Research strategy

This thesis is based on the study of a wide range of online articles, as well as books on the topic of warehouse management.

A significant part of the data is taken from book sources, but online articles have also been studied and processed. The relevance of the topic made it possible to use a wide range of Internet sources since at the moment many specialists prefer to share their knowledge in the field of business in the format of a blog or articles.

Book sources include works by well-known authors and professors with extensive experience in this matter. Online sources will include the subjective experience of the authors of the articles, theoretical aspects of the topic, as well as analytical research.

3.4 Limitations

There are several limitations when working on this dissertation. Firstly, the research topic is limited to research problems. The thesis is not a broad overview of warehouse management, but only its elements, such as automation and varieties of warehouses. Next are the limitations of research methods. In this thesis, there will be only book and online sources, as well as interviews. There will be no surveys, voting, or personal visits to warehouses to collect data since this is not the subject of research.

Also, a number of restrictions are imposed on the conducted interview with a professional. One of the most important limitations is the absence of the possibility of a

personal meeting. The interview will be conducted in the format of answers to questions, which will prevent you from asking clarifying questions and discussing the topic in more detail. There is also a limit on the number of people interviewed because one person is not enough to form a complete picture.

To avoid problems associated with restrictions, several methods will be applied, such as the maximum number of questions asked for the interviewee to get more accurate and succinct answers corresponding to the topic.

3.5 Data analysis

The data analysis in the thesis will be a description of the types of warehouses and ways of their organization, as well as descriptions of all business processes in the warehouse.

The steps that managers take to make warehouses more efficient and meet modern standards will be analyzed.

4 Analysis of warehouse management

4.1 Classification of warehouses

There is an objective need for the accumulation and maintenance of reserves at all stages of the movement of the material flow, starting from the primary source of raw materials and ending with the final consumer. This explains the presence of a large number of different types of warehouses.

Concerning the basic functional areas of logistics, there are warehouses for supply logistics, production logistics, and distribution logistics (Oleg 2020). According to the type of products, warehouses are distinguished:

- Raw materials, semi-finished products, and components
- Intermediate production, i.e. warehouses of work in progress
- Finished products
- Residues and waste
- Tools

According to the form of ownership, warehouses are distinguished: individual use, owned by one enterprise; cooperative, built by several enterprises sharing their warehouse facilities; leased warehouses, the company's warehouses, warehouses of state or municipal enterprises (Indian Institute of Materials Management 2019: 100).

Let's take a closer look at the classification of warehouses based on the content of the operations performed. On this basis, all warehouses can be divided into the following groups:

- Sub sorting

- Distribution warehouses of wholesale and retail trade
- Seasonal or long-term storage
- Transit-transshipment (negotiable) - for transshipment of goods from one type of vehicle to another
- Procurement - for the storage of agricultural products
- Customs - for the temporary storage of goods subject to customs clearance
- Storage warehouses - for the delivery of stored goods from the warehouse for a certain period and their subsequent return to the warehouse. These can be, for example, machines, and equipment that have a high cost and are intended for rental and reuse.

Based on product specialization, warehouses are divided into universal - for storing various food or non-food products in a wide range and specialized - for storing individual product groups. In addition, there are highly specialized warehouses for storing one type of product, as well as mixed warehouses for storing food and non-food products (Gwynne Richards 2014: 9).

Warehouses also differ in the number of floors of the building, i.e. in the height of cargo stowage. They can be single-floor (up to 6 m), high-rise (more than 10m), multi-floor, and with a height difference (Amika moda 2019).

Depending on the design, the following types of warehouses are distinguished:

- Open, representing a fenced-off paved area adapted for the storage of products. Cargo that is not affected by atmospheric conditions (gasoline, kerosene, lubricants) is usually stored at such sites.
- Closed, used for storing finished products, components, tools, and products in progress. These are the most convenient and most common warehouses since

the goods stored in them are not affected by atmospheric influences and spoilage. In addition, its material safety is ensured.

Warehouses form one of the main subsystems of the logistics system. The logistics system forms organizational and technical and economic requirements for warehouses, sets goals and criteria for the optimal functioning of the warehouse system, determines the conditions for cargo processing (Oleg 2020).

4.2 Methods of organization of warehouse management at enterprises

Along with the introduction of modern cargo processing technology, which is based on complex mechanization and automation of technological operations, an important prerequisite for further improving the efficiency of the warehouse economy is the rational organization of the warehouse process (Abby Jenkins 2020).

The organization of the warehouse process is a system of measures that provide for high-quality performance of warehouse work promptly with minimal labor and money. Rational organization of the warehouse process should contribute to:

- Reducing the time spent on handling vehicles and servicing consumers
- To increase labor productivity and reduce the costs of warehousing and storage of materials
- Elimination of unnecessary overloads and cargo movement
- Implementation of production standards, taking into account compliance with safety regulations during the production of warehouse work
- Rational use of loading and unloading equipment, vehicles, storage areas, and volumes
- Increase in the volume of warehouse supplies and additional services provided to consumers by supply and sales organizations

These principles must be followed to achieve effectiveness (Newcastle Systems 2016).

Proper organization of warehouse management should ensure:

- Safety of materials and equipment
- The best placement of materials and equipment, ensuring the speed and convenience of their acceptance, sorting, and delivery
- Extensive mechanization of loading and unloading operations, which ensures a reduction in labor costs when performing these works and the cost of storage

Compliance with fire safety requirements, and safety requirements when performing loading and unloading operations (Newcastle Systems 2016).

For the rational organization of the placement and storage of products in a warehouse, it is necessary to group them taking into account the volume and weight characteristics and physic-chemical properties. This work is carried out in order to form groups of products that are approximately the same in these parameters. For the storage of each group of products, a separate area is allocated in the storage area, equipped with appropriate equipment for warehousing and storage (Gwynne Richards 2014:).

The placement of materials in the storage area of the warehouse should be carried out in such a way that they are released from the warehouse in the order of receipt. Deviations from this principle lead to a deterioration in product quality. The placement of products in the storage area should ensure the material time spent on packing products, removing them from storage sites, and delivering them to vacation destinations. To do this, most mass-market products should be placed as close as possible to the main passages of the warehouse and vacation points (John Cutsey 2022).

For the warehouse management of supply agencies, an important condition for ensuring the rational organization of the warehouse process is its concentration, i.e. the process of concentrating cargo, loading and unloading mechanisms and

equipment, workers in large parts of the warehouse economy - in supply and sales bases, warehouses, production areas of warehouses - and bringing their sizes to an optimal level (John Cutsey 2022).

4.3 Main processes in the warehouse

Warehouse management includes the management of a complex of warehouses specialized by types of material resources and organized taking into account the requirements for their storage and processing. The warehouse is one of the main elements of the logistics system, therefore it should not be considered in isolation, but only as an integrated component of the entire logistics system, which forms organizational and technical requirements for the warehouse system, sets goals and criteria for its optimal functioning, dictates the conditions for cargo processing (Indian Institute of Materials Management 2019: 144).

Warehouses are found in all functional areas of logistics: supply, production, and distribution. In each of them, the functioning of the warehouse is associated with a certain specialization and purpose and has its characteristics, which largely determine the policy of technical equipment of the warehouse (Gwynne Richards 2014:60).

The effective functioning of the warehouse economy and its warehouses in the logistics system, regardless of their purpose and type of activity, is possible only if several problems are successfully solved. The main such problems that firms face when creating a warehouse economy and rationalizing existing warehouses include:

- Choose between your warehouse and a public warehouse
- Determining the number of warehouses and the location of the warehouse network
- Choosing the location of the warehouse
- Determining the type and size of the warehouse

- Development of a warehousing system

These problems become especially relevant when a company enters new sales markets, when consumption volumes and the territorial distribution of buyers change, increasing competition, and several other factors (Gwynne Richards 2014:16).

The problem of developing a warehousing system is quite acute both during the construction of a new warehouse or reconstruction of existing storage facilities, and when searching for the most rational technological solutions for a constantly functioning warehouse (Gwynne Richards 2014:36).

The totality of warehouse technological operations for:

- Unloading,
- Moving,
- Unpacking,
- Acceptance,
- Placement,
- Packing,
- Storage,
- Release of goods,

Is the content of the warehouse technological process?

The number and nature of warehouse operations depend on the assortment, physical and chemical properties, conditions of acceptance and release of goods, the degree of mechanization and automation of operations, and other factors (Gwynne Richards 2014:60).

The rational organization of the warehouse process is based on compliance with the following basic principles:

- Mechanization and automation of technological operations;
- Optimal use of storage space and capacity;
- Organization of end-to-end "direct-flow" commodity flow;
- Regularity and rhythmicity of warehouse work;
- Complete safety of goods.

All operations for the movement of goods in the warehouse are managed by a manager (warehouse manager), who in some cases is also a financially responsible person. Taking into account the possibly large number of simultaneous operations related to the acceptance and release of goods, it is structurally possible to divide the materially responsible warehouse personnel working directly with goods (cargo) into the following groups: acceptance, picking, vacation (shipment), and inventory control. When applying for a job, contracts on full individual financial responsibility are concluded with this personnel (Polyexcel, 2020).

We will consider the organization of unloading and delivery of goods (cargo) to the place of acceptance. The incoming transport with goods must be unloaded and accepted as soon as possible. The speed of unloading operations depends on the availability and use of the necessary lifting and transport equipment (auto and electric loaders, cargo trucks, etc.) and a clear organization of work on unloading transport (Gwynne Richards 2014:61).

One of the key parameters for the organization of operations related to transportation and subsequent warehouse processing is a cargo unit - a certain number of goods that are loaded, transported, unloaded and stored as a single mass and which, by its parameters, links technological processes at various parts of the logistics chain into a single whole. The essential characteristics of a cargo unit are the correspondence of its dimensions to the vehicle and the ability to preserve the integrity and original

geometric shape during transportation and subsequent operations. The agreed sizes of cargo units, as well as equipment for their processing, make it possible to effectively use the material and technical base of various participants in the process at all stages of the material flow movement (Gwynne Richards 2014:61).

A properly formed cargo unit allows you to provide:

- The high degree of cargo safety
- Relatively low labor costs
- The efficiency of loading and unloading operations due to their complex mechanization and automation
- Possibility of overload without reformulation
- Safety of warehouse work

The unloaded goods are delivered to the receiving area of the warehouse, where they are checked. After the acceptance is completed, the goods are delivered to the storage sites and placed in free cells on racks or reserve places reserved for storage (Gwynne Richards 2014:66).

Organization of acceptance. The order and terms of acceptance of goods depend on the contractual terms, on which container (packaging) the goods are delivered in, on the physic-chemical properties and characteristics of certain goods, the method of delivery, and some other reasons (Gwynne Richards 2014:61).

The following terms of acceptance of goods are normative:

- Received without packaging (packaging), in an open or damaged container (packaging) - at the time of receipt from the supplier, or at the time of opening sealed and unloading non-sealed vehicles

- Received in a serviceable container (package) - by weight and number of places - in the above-mentioned terms, by the number of commodity units in each cargo place - simultaneously with the opening of the container (package), but no later than 10 days from the moment receipt of the goods. If the acceptance is carried out within the specified time, it is considered timely.

When accepting goods from transport companies (from the carrier) following the current rules of cargo transportation, it is necessary to:

- Make sure that there are seals of the sender or the point of departure on vehicles or containers, their serviceability, impressions on them, and the condition of vehicles or containers, removed seals must be kept until the end of acceptance and registration of goods;
- To establish whether the rules of transportation were observed, ensuring the protection of cargo from damage and damage (cargo stowage, ventilation, temperature conditions, etc.).

Together with the goods/cargo, the warehouse receives accompanying documents: waybills, invoices, invoices, etc. These documents are recorded in the log of incoming goods and vehicles and the database of the warehouse computer system (Gwynne Richards 2014:73).

During the acceptance process, the actual parameters of the received cargo are verified with the data of the accompanying documents. This allows you to update information about the quantitative and qualitative composition of the accepted goods by identifying them. The identification of the goods can be made based on text-numeric information contained on the label located on the package or by reading the barcode using portable readers or in another way.

When accepting a container to a warehouse, it is advisable to provide for the acceptance procedure in the contract for the supply of goods, in particular, the permissibility of unilateral acceptance of goods, indicating which warehouse employees can participate in such acceptance. If there are no such instructions in the contract,

then a serviceable container should be opened with the participation of an authorized representative.

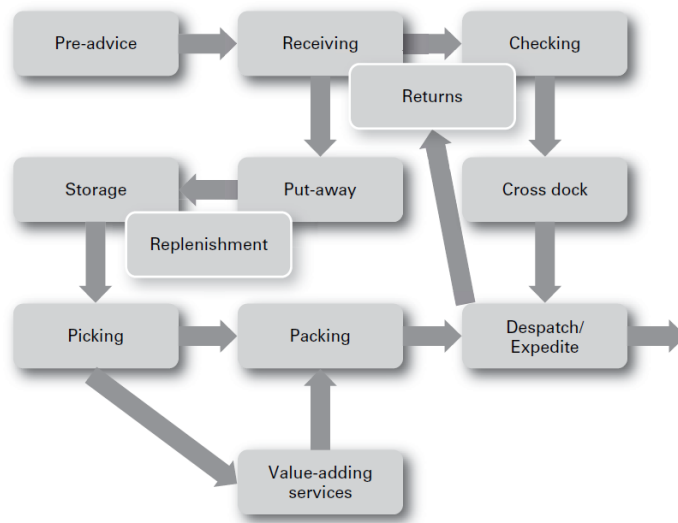


Figure 1: Warehouse process (Gwynne Richards 2014:60)

At acceptance according to the nomenclature, the container (packaging) is opened and the goods are identified, their quantity in each cargo place. If there is a shortage of the number of commodity units in certain places, or a discrepancy in the gross weight (the package is not opened), the recipient is obliged to suspend the acceptance of the remaining places, save and, if necessary, present to the authorized person called to participate in further acceptance, the containers, and packaging of the opened places and the products inside these places. The act should indicate the number of investments, the cost, and the conclusion about the reasons and place of formation of the shortage and other data. All necessary documents confirming certain circumstances of shortage are attached to the act (Gwynne Richards 2014:73).

After checking the actual availability of cargo packages or the nomenclature of goods, information is entered into the database of the warehouse information system, the generation of warehouse labels for cargo packages or packaging of commodity units with the designation of the necessary parameters for warehouse accounting and placement (order No., the owner of the goods, the number of received cargo packages, etc.) and the formation of a receipt order template in which in the case of

accounting for goods by nomenclature, the supplier's product code must be recorded against each name. This code is an important parameter for identifying and controlling the movement of goods (Gwynne Richards 2014:67).

It should be noted that the goods are accounted for in the units of measurement specified in the accompanying documents, but it should be taken into account that when the goods arrive in one unit of measurement and are spent in another, then their entry and release are taken into account and reflected in the documents simultaneously in two units of measurement, when the goods arrive in larger units of measurement (for example, tons), and is spent in smaller ones (kilograms), then it is received and taken into account in those units in which it is spent (Gwynne Richards 2014:65).

Organization of placement and laying. After the end of the inspection of the goods, the stickers of the marking labels, and the template of the receipt order are transferred to the foreman of the movers to place the received goods in the storage area.

Proper placement and stacking of goods in a warehouse is an indispensable condition for the rational organization of the intra-warehouse technological process. With a large assortment of goods stored in warehouses, allows you to create appropriate conditions and storage conditions, reduce losses, increase the efficiency of using warehouse space, allows you to quickly find the right product, keep accurate records of its availability, receipt, and consumption, ensure the safety of the quality of goods, etc. (Management Daily Advisor 2019).

Two types of stacking are used in warehouses: stacking and shelving.

Stacking is appropriate for storing large batches of homogeneous goods (for example, monitors, etc.). To ensure free air circulation, the stack is stacked on a pallet. Free space is left between the stacks and the ceiling. The height of the stack is determined by the nature of the goods, the type of packaging, the height of the warehouse, the maximum load per 1 sq. of floor and pallet area, and the degree of mechanization of labor in warehouses (Pallet racking 2022).

The stack should be quite stable. An unstable stack can collapse, spoil the container, cause scattering, damage the goods and even cause an accident. The stability of the stack is achieved by the correct ways of laying it: straight stacking, in a cross cage, and in a reverse cage.

Direct stacking is used for cargo packed in boxes of the same size. The location of each upper object in the plan coincides with the location of the underlying object. Cross-cage packing is used for boxes of various sizes, in particular for long cargo spaces. Loads of the upper row are stacked across loads of the lower row. As a rule, goods packed in bags are placed in the reverse cage (Pallet racking 2022).

Shelving method of cargo stowage. Provides maximum convenience for warehouse operations, creates good conditions for the daily operational accounting of goods, and is the most rational use of warehouse capacity. The possibility of damage to containers and loss of goods from the pressure of the upper rows on the lower ones is excluded; each container place or pallet with cargo is evenly washed with circulating air. For the rational placement of goods, economically and technologically sound placement schemes are made. It should be remembered that it is better to place fast-moving goods on the lower level of the shelves. This will reduce the time to find and take the goods. At the same time, the time spent on the road during the selection of goods is reduced with the concentration of fast-moving goods at the closest distance from each other (Pallet racking 2022).

In placement schemes, permanent storage locations are usually assigned to goods of certain groups, subgroups, and names. Each storage location is assigned a code (index, serial number, symbol, etc.) using different encoding methods. They are applied with bright paint on the structures of racks, compartments, and the floor. The space without shelving can also be divided into compartments either structurally or conditionally using markup. The coding of compartments as well as cells on racks can be alphanumeric or numeric, each character of which contains information. Codes of places of storage of goods - the necessary elements of an automated system for searching, moving, and stowing goods - are entered into the database. They are entered upon receipt of the goods and indicated when printing out the complete set sheet.

After the placement of goods has been made, the receipt order template with the designation of the cell codes (locations) in which the goods are placed is transmitted to enter information about the placement of goods in the database, filling out warehouse accounting cards and final registration of the receipt document. Warehouse operations begin from the moment of receipt of the order and documents for shipment. After receiving the completed shipping document at the warehouse, the documents are registered, a request is made to the database about the availability and location of goods and a complete set sheet (route map) is printed. It should be borne in mind that the goods for picking should always be indicated in the sequence of location, and not in the sequence of the numbering of goods. The third batch consists of orders containing more than five items in each order (Gwynne Richards 2014: 95).

Warehouse workers, having received a complete set list (route map), make a selection of goods from storage sites. After the completion of the process of completing the batch and settling possible inconsistencies, packaging, and filling out packing lists, the packing list is transferred to complete the stage of preparation for shipment, marking the shipped cargo packages and entering relevant information in the database. After the completion of the paperwork, the actual shipment of the goods from the warehouse is made (Gwynne Richards 2014: 139).

5 What is the role of warehouses in the global supply chain

5.1 Importance of warehouses

Efficient and fast warehouse operation is a necessity caused by the increasingly accelerating pace of global trade turnover.

Every day millions of goods travel around the world from factories to shops, from stores to customers, and so on. Warehouses in the entire transport chain are an intermediate, but extremely important link, without which this whole system simply could not function. The ability to quickly pick up the cargo from the sender, process it, and also quickly transfer it to the recipient is valued quite highly (Michael ten Hompel, Thorsten Schmidt 2007: 2)

Not only regional transport companies are engaged in warehouse business processes. Such organizations also belong to world-class industrial giants, and due to the ever-increasing pace of world trade, efficient and fast storage facilities are a necessity.

All these and many other facts indicate that warehouses are the most important links in the logistics chain. This leads to the conclusion that the correct and accurate organization and debugging of all work processes in the warehouse is extremely important, which directly affects the speed with which goods will pass through the supply chain. A slow or inefficient warehouse means a lot of time and loss of profit (Syed Ammar Arshad 2021).

The economic activity of the enterprise is impossible without the storage function, and, consequently, without warehouses, which take place in any logistics system. Modern commodity turnover is impossible without effective warehouse logistics. A modern warehouse complex with advanced technologies allows us to solve many problems related to the circulation of inventory values, speeding up the processes of turnover by building effective warehouse logistics systems. A properly organized warehouse makes it possible to optimize the costs of the logistics system, and the processes associated with the functioning of warehouses, in the end, result, are a significant component of the total costs. Therefore, the correct use of warehouse logistics capabilities makes it

possible to optimize the operation of the enterprise (Michael ten Hompel, Thorsten Schmidt 2007: 3).

According to the logistics concept, there should always be storage facilities between production and transport, transport and consumers, designed to smooth out uneven cycles of production, consumption, and functioning of various modes of transport. In this regard, in the general process of promoting material flows along logistics chains from the producer and the consumer, it is necessary to take into account the presence of a network of various storage and processing systems of products, transforming forms and parameters of material flows. At the macro-logistic level, the structure of this network includes a warehouse economy consisting of state warehouses of national, regional, and territorial, as well as inter-farm (inter-production) and technological significance.

In warehouse facilities, material flows are transformed from dynamic to static and vice versa. In addition, material flows enter the storage and processing systems with some parameters, and exit with others. The parameters should be understood as intensity, power, rhythm, and structure of material flows, as well as the type and method of packaging products, arrival and departure time of transport shipments, etc.

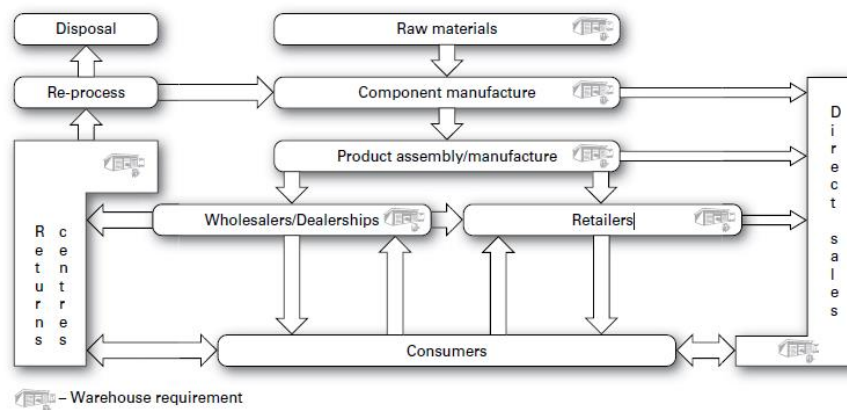


Figure 2: Warehousing in the supply chain (Gwynne Richards 2014:20)

If the parameters of material flow on some sections of transport networks do not need to be changed, then there is no need to create warehouses or transformation centers (including several warehouse complexes). Not only transformation centers but also

individual warehouses form a kind of storage and processing systems of varying degrees of complexity. Misunderstanding their role and importance in the management of flow processes leads to the inefficient organization of transport networks, to shortcomings in the overall system of production, distribution, physical movement, and consumption of products. In macro logistics, product storage and processing systems are no less important than transport. In micro logistics, warehouses play an essential role in the process of normalizing the functioning of the main production. Thus, the efficiency of any logistics system depends not only on the nature of industrial and transport production but also on the warehouse economy (Abby Jenkins 2020).

5.2 Warehouse functions

Warehouses are buildings, structures, and various devices designed for receiving, placing, and storing various material values, preparing them for consumption and release to consumers. The main purpose of warehouses is the concentration of stocks, their storage, and ensuring the uninterrupted and rhythmic supply of consumers. Depending on their place in the logistics system, warehouses perform various functions.

Acquisition of the necessary range of goods following the order of consumers: this function is performed at all stages of the material flow movement, in all functional areas of logistics. In supply and production logistics, this function is aimed at providing the production process with all the necessary materials and technical resources. Of particular importance is this function in distribution logistics. Trade warehouses carry out the transformation of the production assortment into a trade one. The trade assortment differs from the production one in that it includes a wide list of goods that differ in sizes, styles, models, shapes, colors, etc. This means the need to unpack goods coming from various manufacturers, sort them, and complete new batches, packaging, packaging, labeling, etc.

The concentration of stocks, their warehousing, and storage: the implementation of this function makes it possible to equalize the time difference between the output of finished products and their consumption, to ensure a continuous production process

and uninterrupted supply of consumers. In supply and distribution logistics, the concentration of stocks, their warehousing, and storage may be caused by the seasonality of supply and demand for goods, the need to accumulate stocks for goods, shipments to areas where there is no production of these goods, as well as the creation of state reserves. The performance of this function involves carrying out a whole range of works on the placement of goods for storage. and it requires the creation of certain conditions to ensure the safety of the quality of the goods (Pranjal 2022).

Unitization of shipments of goods: This function of warehouses is because many consumers order small non-transit shipments of goods, which significantly increases the costs associated with the delivery of such goods. To use vehicles efficiently and reduce costs, warehouses unify (combine) small batches into larger ones intended for several customers at the same time.

Provision of logistics services: The performance of this function is associated with the provision of various logistics services to customers, which provides the company with a high level of customer service. These include the preparation of goods for sale (packing of products, unpacking, labeling, loading containers), checking the functioning of weighing devices, freight forwarding services, making products marketable, and pre-processing of goods (Pranjal 2022).

Risks: Once the product is in stock, the warehouse operator is responsible for any damage or malfunction.

Transportation: A service provided by some warehouses. Picks up the product from the warehouse and delivers it at the request of the customer (Indian Institute of Materials Management 2019: 112).

6 Automation of business processes in the warehouse

6.1 Relevance of warehouse automation

A modern large warehouse is a complex technical structure that consists of numerous interconnected subsystems with a certain structure and performs the functions of transforming material flows, as well as accumulating, processing, and distributing goods between consumers. Based on the current economic requirements imposed on the warehouse, its operation should be automated (Abby Jenkins 2020).

Automation is one of the directions of scientific and technological progress that uses self-regulating technical means and mathematical methods to free a person from participating in the processes of obtaining, converting, transferring, and using energy, materials, products, or information, or significantly reducing the degree of this participation or the complexity of the operations performed. Management of complex automation in the warehouse is performed by the warehouse management system (Abby Jenkins 2020).

The warehouse management system is a computerized information management system that provides automation and optimization of all warehouse work processes of a specialized enterprise (Diana Chabanovska 2022).

This topic is relevant since only an automated warehouse can provide a competitive advantage in the modern market, automation, speeding up the logistics process, simplifying work with information, reducing the labor intensity of human work, and improving overall control in the warehouse, can significantly reduce costs compared to a non-automated warehouse (Gwynne Richards 2014: 189).

Automation of the finished goods warehouse is carried out by companies to simplify control over the movement of goods. Thanks to automation, it is possible to know the quantity of each article, calculate the balances, and plan the order of products.

Automation is especially needed if the product range increases and the volume of deliveries increases.

With the development of the enterprise, the turnover is growing, so additional requirements are imposed on the warehouse:

It is necessary to accept the process and execute the order in a short time.

Work with clients.

Guarantee the fastest possible movement of products through the warehouse for loading and shipment.

This is only part of the actions that are assigned to the warehouse division. Some companies give warehouses more responsibilities (Instawork 2021).

Problems faced by a warehouse without automation

Without automation, the following difficulties are likely to appear in the warehouse:

Orders are processed slowly.

The activity of the entire warehouse depends on several people, without whom it is difficult to figure out where and what lies.

Employees often make mistakes with the order configuration due to heavy workloads and routine work.

The warehouse loses out to companies with automated turnover (Diana Chabanovska 2022).

This system is designed to comprehensively optimize warehouse processes, and increase transparency and efficiency of warehouse operations, and the productivity of warehouse personnel. As a result, warehouse accounting and warehouse efficiency as a whole is put in order. The result of this is technological, efficient, easy-to-configure solutions that increase the transparency of warehouse operations and reach a new level of warehouse management (Gwynne Richards 2014: 189). The system is an integral element in the activities of enterprises of various industry affiliations: logistics services, wholesale and retail trade, distribution, manufacturing, pharmaceuticals, the public sector, science, and medicine. In addition to the standard task of managing the company's commodity flows, the WMS system allows you to effectively solve the issues of accounting for costs, time and cost of storing goods, increasing the labor efficiency of warehouse personnel, warehouse capacity, and throughput, speed, and quality of selection and shipment of goods (Gwynne Richards 2014: 190).

The goals of implementing a WMS system can be as follows:

- Active warehouse management

- Increasing the speed of product recruitment
- Getting accurate information about the location of the goods in the warehouse
- Effective management of goods with a limited shelf life
- Obtaining a tool to improve the efficiency and development of processes for processing goods in the warehouse
- Optimizing the use of warehouse space (Gwynne Richards 2014:190).

6.2 Advantages and disadvantages of WMS systems

The advantages of WMS systems are:

- It becomes possible to keep records in real-time
- There is an opportunity for better interaction with customers and easier tracking of orders
- It's easier to ship the right items on time
- It also helps to reduce costs
- Flexibility in the execution of business processes. When all data is taken from a single application, processes become more flexible. For example, the picking of an order for a customer may be suspended and the shipment canceled if the credit limit is exceeded after the order is placed.
- Saving investments in equipment. The new module can be operated on existing hardware without purchasing additional ones (iThink Logistics 2019).

However, such systems have their drawbacks:

- The complexity of design and modification. When developing, it is necessary to constantly take into account how compatible the new functionality is with the rest of the system modules. The complexity and complexity of development can increase two to three times.
- Mutual influence. Since all the modules of the system are closely connected, an error in one of them often leads to a malfunction of the others.
- The risk of bottlenecks. Warehouse management procedures are carried out in the same application and the same database as all the others. A resource-intensive process performed by a single module can lead to a noticeable increase in the response time of the entire system. In addition, there may be cases of mutual blocking of processes at the database level.

The total cost of ownership of an integrated system that includes a warehouse management module will be lower than in the case of using a complex heterogeneous information system with heterogeneous programs combined through multiple interfaces. Perhaps an integrated module will be the best solution for automating a medium-sized trading company's warehouse. And for a large organization with a distributed warehouse economy, a separate warehouse system is better suited (iThink Logistics 2019).

The classification of warehouse management systems includes 4 types:

Entry-level systems - warehouses of small companies, stores with a small nomenclature

Boxed warehouse management systems - warehouses of 1000-10,000 m² with a large range, but low turnover

Adaptable systems - large logistics companies, distribution centers, warehouses from 5000 m²

Configurable systems - warehouses from 5000 m² with a large range and high turnover (Diana Chabanovska 2022).

Most companies come to the need to have a WMS when the volume of warehouse activity is large and significant changes are required for reorganization. However, it is possible to increase the efficiency of the warehouse by implementing WMS only over time. To quickly and lossless process the entire flow of information related to the operation of the warehouse, it is necessary to choose a software product that best meets the needs of the company. In other words, the program should provide timely information about sales, profits, and debts for each product (Linda Rosencrance 2021).

7 Interview with a professional

In this chapter, there will be a short interview with a person who has several decades of experience in the field of warehouse management. The questions asked to him will be relevant to the problems posed for the thesis.

Name: Dmitrii Vishniakov

Company/ position: Black Tyres, Storekeeper

Q1 How is your role in the company related to warehouses and warehouse management in general?

Answer: I work as a storekeeper and am responsible for the timely readiness of the goods for shipment, as well as for the compliance of the shipped goods with the shipment request and shipping documents.

Q2 How often do you have to visit the warehouse personally and how much influence do you have on the warehouse management processes?

Answer: I am in the warehouse all the time and manage the movers, who, under my guidance, prepare for the shipment of a batch of goods and carry out the loading

Q3 What do you think is the role of warehouses in global logistics?

Answer: In global logistics, the role of warehouses is to ensure the safety of goods at all stages of the movement of goods from the manufacturer to the consumer, in addition, additional processing of goods takes place in warehouses: packaging, preparation for transportation, labeling, etc.

Q4 What, in your opinion, are the most effective methods of organizing management in the warehouse?

Answer: The efficiency of the warehouse is estimated by the processing time of certain commodity units and by the cost of such processing, for example, the cost and time of loading /unloading of one transport unit (truck).

Q5 How much do you appreciate the importance of warehouses and warehouse management in your company?

Answer: Like any large company engaged in the export of goods, it would be difficult for us to do without warehouses, so for us, their importance is quite high.

Q6 What are the factors affecting the location of warehouses in your company?

Answer: The logic of the location of warehouses in our company is that warehouses are located as close as possible to the consumer of goods

Q7 Does your company have any criteria for the efficiency of your warehouses and how are they measured?

Answer: The efficiency of warehouses in our company is estimated by the cost of processing one commodity unit. In our case, this is one car tire.

Q8 How fundamentally important is the automation of business processes in a warehouse?

Answer: Automation of business processes plays a crucial role in the organization of warehouse accounting. To do this, various programs are being developed and implemented that allow you to instantly determine the location of the goods in the warehouse, ensure the formation of delivery to the customer, and generate shipping documents

Q9 Do you implement any modern technologies in your warehouses or do you prefer more traditional models?

Answer: Our technologies comply with the standards of the European Union. We do not have any unique innovations, but at the same time, we try to keep up with technological progress.

Q10 What is the hierarchy of command in the warehouse, from the director to the loader, and how important is its observance for the effective operation of the enterprise?

Answer: In our company, the warehouse manager reports to the director. His responsibilities include the management and organization of warehouse work. Storekeepers are subordinate to the head of the warehouse, whose duties include the preparation and implementation of shipments of certain batches of goods. Storekeepers manage the movers who carry out the actual loading /unloading of goods. A warehouse is a whole organism that is obliged to work without failures so subordination and even a certain discipline are a necessity for the correct functioning of the warehouse.

Q11 Are there any special requirements that are imposed on the warehouse staff? For example, on safety.

Answer: In warehouse work, strict compliance with safety regulations when working with mechanisms, fire safety, working at height, etc. is very important. The director, the warehouse manager, and the safety engineer are responsible for compliance with safety standards and rules. In addition, we do not put forward additional requirements to our workers.

Q12 Who is the most important person in the warehouse and what are his responsibilities? What kind of education and professional experience should this person have?

Answer: The head of the warehouse, oddly enough, is the head of the warehouse. He manages all operations and reports to higher authorities. We do not necessarily have a higher education for this job, and a warehouse worker with sufficient experience and knowledge can get such a position.

Q13 Are there any differences specifically in your company from the canons of warehouse management accepted in Europe and Russia in terms of the organization of the workflow or certain roles of employees?

Answer: In our company, all processes comply with the standards adopted in the EU. Whether there are any differences, I find it difficult to answer. Perhaps we pay special attention to fire safety since our goods are fire-hazardous.

Q14 Are any global changes expected in the future in the usual process of organizing warehouse management?

Answer: I see the further development of warehouse management in the professional development of warehouse personnel and the introduction and further optimization of warehouse accounting programs. In addition, the future lies with the technologies of automation of processes in the warehouse.

Q15 Does your company have its warehouses, rent them or use the services of other transport companies? Which is more profitable for a large company: renting warehouses or maintaining your own? Why? Can a large company export goods without warehouses at all?

Answer: Our company currently uses its warehouses, at various stages of the entire development, it used leased warehouses, among other things. For a large company that occupies a stable position in the market, it is more profitable to have its warehouses, as this gives the company the necessary competitive advantages in terms of providing customers with the necessary service and convenience. A large company engaged in export cannot do without warehouses, as it is necessary to form batches of goods for shipment, search for vehicles, and interact with suppliers.

Q16 What are the total costs of warehouses and everything related to them, including rent, employee salaries, taxes, etc? Does it pay for itself to a significant extent?

Answer: The company's management says that our warehouse is efficient and pays for itself. Unfortunately, I do not have data on the calculation of taxes and PO.

Q17 What is your opinion about how the Coronavirus epidemic has affected supply chain management and warehouse management in your company in particular?

Answer: The COVID-19 epidemic did not affect the work of our warehouse in any way, except for the use of medical masks during peak periods of the pandemic. I can say with confidence that we were more fortunate than many of our colleagues.

Q18 How do you personally assess the effectiveness of personnel and management in your warehouses? Are you satisfied with them and what ways do you think there are to improve the quality of work?

Answer: We are completely satisfied with the quality of our staff, starting with the movers and ending with the management staff. Improving the quality of our staff's work can only be provided by experience and

Q19 What advice can you give to young entrepreneurs who are just getting to know the basics of warehouse management?

Answer: I can advise young entrepreneurs to study, in particular, to get a higher education. It is also a good idea to communicate more with each other, adopt best practices and enjoy working. In the end, everything is decided by experience and knowledge, and this applies not only to managing a large business but also to working in a warehouse.

8 Conclusion

Based on all of the above, it can be concluded that warehouses are one of the most important aspects of the supply chain. Warehouse management is important, but not an easy area of logistics. It is very important to take into account a huge number of factors and take into account all current development trends in order to be effective. Understanding the theory of warehousing, in particular, the types of warehouses and the best places to use them, as well as the rules for organizing work, serves to increase efficiency and positively affects the entire supply chain.

As part of the study, it was found that there is a wide variety of warehouses and a wide variation of their organization methods. To summarize, warehouses differ depending on the materials stored and the need for logistics of supply, distribution, or production. There is also a wide range of classifications for a variety of warehouse assignments. They can store both raw materials and finished products, but also waste or tools. In addition, there are intermediate production storage warehouses, which are found in special cases.

In addition, emphasis was placed on the organization of the warehouse process as a system of measures regulating the operation of the warehouse. The main goal is to increase labor productivity and meet production standards. Warehouse organization methods vary depending on the goals and preferences of warehouse managers and services to achieve the greatest efficiency.

They also talked about how to properly organize business processes in the warehouse. The fact is that there is no universal method, everyone decides for himself what he should do in relation to his warehouses in this or that situation. However, the generally accepted and very important steps are to determine the type and size of the warehouse depending on the needs, hire the right people, and have a verified plan of all processes, such as organizing the reception of goods, their placement, packaging, and dispatch.

It is also very important to have automation systems in any warehouse. Warehouse automation is the most important aspect of warehouse management in the modern world, as business follows the path of advanced technologies. Automation is important

because it simplifies the execution of most operations in the warehouse while allowing you to organize accounting quickly and without unnecessary problems. In addition, modern technologies are being introduced that make work less dependent on human factors. Automation allows inventory, documentation, and many other things, which makes it useful in any modern warehouse.

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