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Improving the Quality of Warehousing Processes in the Context of the Logistics Sector

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Abstract: Logistics processes play a crucial role in ensuring the smooth operation of the supply chain, and warehouse management is one of the key logistics activities of invaluable significance. To evaluate the management principles of companies, it is necessary to thoroughly analyze their functions, operational standards, and quality requirements. One of the most common strategies in modern businesses is quality improvement. Insufficient quality can lead to competitive disadvantages and have negative consequences for companies that do not prioritize quality and neglect their services and products, resulting in a loss of customer loyalty and revenue. Effective warehouse management is critically important for companies to meet consumer needs, reduce costs, and gain a competitive advantage. Conducting qualitative research is necessary in order to learn how to properly organize warehouse management within companies, which will also help to identify key issues and determine areas for change. This article consists of a theoretical section that analyzes the scientific literature on the quality of warehouse process management in the logistics sector. It examines theoretical aspects of logistics processes and quality assurance in company management, including the implementation of systems that ensure quality in warehouse processes and logistics process management. The subsequent sections describe the research methods applied, evaluate the results of warehouse management quality, and provide insights and recommendations.

Keywords: logistics; logistics companies; warehousing processes; warehouses; process quality

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1. Introduction

As an element of the supply chain process, warehousing is important for an optimally functioning supply chain. Nowadays, most companies face storage problems. These problems have a negative impact on supply chain operations, which affects the performance of companies. Logistics companies need to solve warehousing problems to increase productivity.

Logistics processes play a crucial role in ensuring the smooth functioning of the supply chain, and warehouse management is one of the key logistics activities of invaluable importance [1]. An assessment of the principles of company management requires a detailed analysis of the functions, performance standards, and quality requirements of companies. One of the most common strategies in modern companies is quality improvement. Inadequate quality can lead to the loss of a competitive advantage and result in negative consequences for companies that do not adopt quality as a priority and neglect their services and products, thus losing customer loyalty and revenue.

Logistics can be understood as the functional activities of companies or the performance of functional logistics activities [2].

Innovations in logistics contribute to greater flexibility in solving various problems in companies, with a particular emphasis on quality issues [3]. One of the more important aspects is ensuring the supervision of continuous logistics processes and risks in a company's supply chain [4].

Inadequate quality issues have a key common feature, which is meeting product specifications and the customer satisfaction indicator [1]. In the case of services, quality is linked to customer preferences, and in the case of production, it relates to customer expectations [5]. Innovations in logistics processes have a positive impact on two-way work results [3].

The process approach is defined as a structured and controlled identification, management, and monitoring of processes. Each step requires the right resources or inputs [6].

Efficient warehouse management is crucial for companies to meet consumer needs, to reduce costs, and to gain a competitive advantage. In order to find out how to properly organize warehouse management in companies, research must be conducted on the application of a qualitative research method, which will help to identify the main problems and areas that require change.

This article consists of a theoretical part, which analyses the scientific literature on the quality of warehousing process management in the logistics sector, examines the theoretical aspects of logistics processes, and looks at quality assurance in managing the company, implementing systems that ensure quality in warehousing and logistics processes. The subsequent part describes the research methods used, provides an assessment of the results of the quality of warehouse management, and offers insights and recommendations.

2. Analysis of Theoretical Aspects, Which Includes Improvement of the Quality of Warehousing Processes in Logistics Companies

2.1. Logistics Business Processes

In different latitudes, various work, social, economic, and demographic contexts coexist, and these differences can indeed pose challenges that relativize the possibilities of implementing measures to improve the quality of logistics processes. Here is how these contextual factors vary across latitudes and their implications. Work contexts: different regions may have distinct labor practices influenced by cultural norms, legal frameworks, and historical factors. This can affect the availability of skilled workers, wage levels, work hours, and labor regulations. Workforce education and training: disparities in educational attainment and access to vocational training programs can affect the skill levels of the workforce, impacting their ability to effectively execute logistics processes. Work ethic and cultural norms: societal attitudes towards work, punctuality, and professionalism can vary across latitudes, influencing employee behavior and performance in logistics operations. Social contexts: regions with diverse cultural backgrounds may face challenges in communication, teamwork, and cooperation, which are crucial for efficient logistics processes. Social infrastructure: variances in social infrastructure, such as healthcare systems, social welfare programs, and community support networks, can impact employee well-being and productivity, indirectly affecting logistics operations. Economic contexts: disparities in economic development levels across latitudes can result in differences in infrastructure quality, technology adoption rates, and access to financial resources, affecting the efficiency of logistics operations. Market dynamics: variations in market demand, consumer references, and economic stability can influence supply chain dynamics, inventory management practices, and transportation logistics in different latitudes. Demographic contexts: variations in population size, density, age distribution, and workforce demographics can impact labor availability, market demand patterns, and distribution network design. Migration patterns: differences in migration patterns and urbanization rates can affect labor mobility, workforce composition, and the availability of skilled workers in logistics hubs located in different latitudes [7].

Implications for implementing measures to improve logistics processes: limited resources and competing priorities in regions with diverse contextual factors may hinder investment in logistics process improvements. Adaptation challenges: implementing standardized logistics best practices across diverse contexts may require adaptation to local conditions, increasing implementation complexity and costs. Regulatory compliance: variations in labor laws, environmental regulations, and trade policies across latitudes can necessitate tailored compliance

strategies, adding complexity to logistics operations. Cultural sensitivity: effective implementation of quality improvement measures requires cultural sensitivity and stakeholder engagement to navigate diverse work and social contexts [8].

The coexistence of different work, social, economic, and demographic contexts across geographical latitudes presents challenges that can relativize the possibilities of implementing measures to improve the quality of logistics processes. Addressing these challenges requires a nuanced understanding of regional nuances and tailored strategies that consider local contextual factors.

Companies that comprehensively manage the production process and control the suppliers and carriers directly involved in the supply of raw materials and the distribution of the manufactured products can meet the needs of their customers, thus increasing their profits. In addition, they can reduce their costs and increase operational efficiency through logistics processes [9].

2.2. Warehousing Activities

Some authors [10] acknowledge that warehousing is an important element of the supply chain process, essential for an optimally functioning supply chain. To remain competitive in the market, it is important to focus on productivity levels, and logistics companies need to address warehousing issues in order to increase their operational efficiency [11].

Tran [12] believes that warehousing is important for an organization in various respects, especially for improving the quality of customer service. Rajeswari [13] claims that warehousing promotes agricultural marketing, provides financing opportunities, and contributes to ensuring food supply in the country.

Warehousing is defined as an intermediate procedure for keeping and storing goods between the next two stages in the supply chain. The authors argue that a warehouse management system (WMS) helps to control company functions in warehouses. This system offers many benefits to companies (Figure 1).

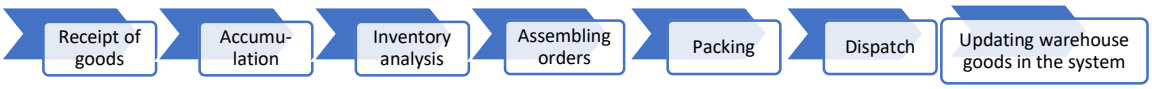

Figure 1. Warehouse management system (WMS) processes [14].

A warehouse management system connected to the Internet of Things (IoT) brings even more benefits to companies. An IoT system linked to a warehouse management system helps to control delivery and dispatch.

Logistics processes play an important role in keeping the supply chain running smoothly, and warehouse management is one of the most important logistics activities. The movement of freight flows in the supply chain poses many challenges to the arrangement of sustainable processes at the international level [15].

The process of accepting goods involves checking the incoming stock list. If the list matches the ordered list, the goods are unloaded. The goods are accepted on arrival by scanning. The scanned goods are marked as received in the warehouse, their storage location is finalized, and they are delivered to the storage location by the staff. Accumulation is the process by which goods are delivered to specified locations and recorded in the warehouse management system. Inventory analysis is the process by which staff must check and compare each stock against a list, and sometimes human error occurs when analyzing inventory. Assembling orders is the stage where, after receiving a request, a worker uses a scanner or a headset to pick all the specified items on a pallet to be transported. During the packing process, the assembled order is wrapped in film or otherwise secured to keep the order stable during transport. Dispatch is the process by which the assembled order is loaded onto the transport for delivery. Updating warehouse goods in the system is the process by which stock that has left the warehouse is updated in the system. The WMS helps the warehouse to work in a much more efficient and high-quality way.

2.3. Models That Ensure the Quality of Logistics Companies

Detailed and carefully performed works of storage of goods, efficient system of stock accounting and stock levels, error analysis and correction systems, packing activities that are continuously being improved, and cargo dispatch operations help to perform warehousing activities correctly.

The quality perceived according to the Gronroos model is defined as the relationship between the expected and perceived service, also taking into account the image of the company [16]. According to this model, the perceived quality comprises two main dimensions—technical and functional quality. Technical quality is the result of operational processes and what the consumer receives as a service. This dimension depends on the technology used, the equipment, and the know-how, professionalism, and qualifications of the staff [17].

The "Gap" model is based on the customers' evaluations and the difference between their expectations and experiences. Quality defects in this model occur at later service provision stages [17].

In the potential, process, and result model, quality has three elements, namely, the potential, process, and result. Potential includes the quality of equipment and the knowledge and experience of the staff. The quality of the result is customers' subjective assessment of the service. The model highlights all the individual areas where deficiencies in the quality of the potential, process, or result may occur and affect the final result. It helps to identify problematic areas [18].

Warehouse maintenance refers to the optimal management of warehouse resources, including inventory, material handling equipment, loading, and unloading [19]. The analysis of wastage rates is the first step in implementing the system in the warehouse. The LEAN methodology used in warehouse operations offers the advantage of a better inventory control system, increasing the accuracy of assembly and reducing storage costs [20,21].

In pursuit of efficiency in business, sales should be more powerful than production. LEAN contributes to cost reduction, employee productivity, and improved quality [22].

Lean methodology, also known as Lean manufacturing, is a systematic approach to optimising processes and eliminating waste while delivering value to customers. It originated in manufacturing but has since been applied to a wide range of industries, including logistics and supply chain management. Lean methodology helps to address the challenges posed by different labor, social, economic, and demographic circumstances at different geographical latitudes by improving the quality of logistics processes. The Lean methodology emphasizes the standardization of processes to ensure consistency and efficiency. Standardization can help to mitigate the impact of different working practices at different latitudes by establishing clear procedures that apply regardless of location. This methodology uses a value stream map to identify value-creating and non-value-creating process activities. By mapping logistics processes across different latitudes, organizations can learn about contextual differences and tailor improvement efforts to address specific problems in each location. Lean emphasizes respect for people, recognizing the importance of engaging and empowering employees at all levels of the organization. In contexts with diverse social and demographic characteristics, this approach fosters inclusivity and enables organizations to leverage the unique strengths of their workforce in improving logistics processes. Kaizen, or rapid improvement events, are a key component of Lean methodology. These events bring together cross-functional teams to address specific process improvement opportunities. By conducting Kaizen events tailored to the local context, organizations can overcome challenges related to varying economic conditions and demographic factors. Lean principles can also be applied to optimize the entire supply chain, from sourcing raw materials to delivering finished products to customers. Lean methodology encourages the use of technology to streamline processes and improve visibility. Leveraging technology solutions such as inventory management systems, transportation management software, and predictive analytics can help organizations adapt to varying economic conditions and technological infrastructure across different geographical latitudes.

Also, Lean methodology provides a systematic approach to address the challenges posed by different work, social, economic, and demographic contexts across geographical latitudes in improving the quality of logistics processes. By emphasizing standardized processes, continuous improvement, and respect for people, organizations can adapt Lean principles to diverse contexts and drive sustainable improvements in logistics efficiency and effectiveness.

The Lean philosophy aims to reduce waste anywhere in the company, optimize key resources and create a company culture dedicated to identifying and continuously promoting customer satisfaction. This philosophy is based on lean principles: value capture, waste elimination, and smooth flow generation. Also, these principles have been expanded into five principles: defining value as defined by the customer, optimizing the flow of value, generating a smooth flow of value by controlling and eliminating waste, activating the pull of demand by synchronizing customer demand and the flow of information, improving all products, processes, and services [23].

All the listed quality systems have both positive and negative characteristics. However, by applying at least one of the methods, companies try to achieve a positive result.

There are many contradictions and differences in the academic literature when explaining the issues of process automation, the implementation of information systems in warehouses, and the risk of leaving employees. Moreover, there is a lack of analysis of potential models for improving the quality of warehouse processes, and little attention to wastage analysis and the introduction of automated processes. Also, there is a shortage of analysis and research on the use and benefits of in-house information systems in logistics and warehousing companies [24]. Various models are presented to help companies to improve the quality of their warehouse processes, as they usually do not know where to start improving the quality of warehouse processes.

3. Empirical Research Methodology and Justification of Methods

The aim of this empirical study is to assess the quality of warehouse processes of logistics companies and to make recommendations for operational improvements after conducting interviews with experts and analyzing the quality parameters of companies' warehousing processes.

The following are the objectives of this empirical study:

(1) To assess the quality of warehouse processes of logistics companies in a quantitative study;
(2) To conduct qualitative research to assess the experts' opinions on the quality of warehousing processes in logistics companies and to make recommendations for improvement solutions;
(3) To assess indicators of warehousing processes in logistics companies and to offer solutions for improvement based on the research results.

This empirical study consists of two parts: a standardized interview with experts and an analysis of the quality of companies' warehousing processes.

Standardized interview: Questions are planned in advance but can be amended in the process. The essence of the interview is to use the expert's opinion to assess the object being analyzed. Experts are people who have extensive experience and can provide the most reliable information about the field or situation being analyzed.

Analysis of the quality of companies' warehousing processes: This analysis consists of several processes in a company's warehouse, the data of which can help to assess the quality of the company's warehouses. The data were obtained from internal company documents and annual reports. The indicators for 2022 were assessed, adapting solutions in certain processes to improve their quality. The comparison period should not be too short, allowing us to determine the overall trend. There is always a possibility that the environment in which companies operate will change over a longer period of time, so the comparative period should not be too long either.

The following is the course of the empirical study:

- Selection of experts.
- Creation of a questionnaire.
- Interview with experts.
- Analysis of the interview with experts.
- Obtaining documents from companies on the quality of their warehousing processes.
- Analysis of the quality indicators of companies' warehousing processes.
- Summarizing interviews with experts and the quality indicators of companies' warehousing processes.

A standardized interview with experts was conducted first of all to assess the quality of the warehousing processes of logistics companies from the expert perspective. Experts who meet the following descriptions were selected for the study:

1. The expert has a university degree.
2. The expert is at least 30 years old.
3. The expert has worked in a reputable company and its warehousing processes for a minimum of 3 years.
4. The expert holds a managerial position.

All experts participating in the study must have sufficient expertise, experience in logistics and warehousing, and be directly related to the logistics companies being studied to be able to answer the interview questions accurately. A group of experts was selected based on the above descriptions. The questions were submitted to experts via e-mail. The interviews were conducted in September–November. Having conducted all the interviews and collected all the necessary data, the answers of the respondents were presented in the form of tables and charts. Having received all the answers, several conclusions were drawn and discussed with all the experts.

The second part of the empirical study is the analysis of the quality indicators of warehousing processes. The analysis required data for 2022, which were obtained directly from the company database. All charts were analyzed, drawing conclusions. Indicators, such as mixed orders, losses incurred in warehouse processes, the speed of assembly, etc., were analyzed.

Having analyzed all the results received, conclusions were provided on the quality of the companies' warehousing processes, and we made recommendations that can help companies to grow.

3.1. Quantitative Study of Warehouse Processes in Logistics Companies

Quantitative research focuses on objectivity and is therefore particularly suitable when it is possible to collect quantitative measures of variables and draw conclusions from population samples. Quantitative research uses structured procedures and formal data collection instruments. Data are collected objectively and systematically. Finally, the analysis of numerical data is carried out using a statistical procedure [25].

The questionnaire for the quantitative study was prepared based on various scientific sources, articles, and studies. The reliability of this method depends on the honesty of the respondent and the sampling rate. In order to draw statistically valuable conclusions, a minimum number of respondents must be determined. To determine the minimum number of respondents (the sample size), the small population formula by Kardelis [26] was used:

$$\mathrm{n} = \frac{p(1-p)}{\left(\frac{e}{z}\right)^2 + \frac{p(1-p)}{N}}, \quad (1)$$

where n—number of respondents (sample size); p—proportions of the population corresponding to the characteristics of interest, p = 0.5; e—sampling error (in social science research, an error is acceptable, otherwise a precision of 5–10% is desirable), e = 0.05;

z—standardized 95% confidence level, z = 1.96; and N—the number of logistics and warehousing companies registered in Lithuania, N = 2027.

$$n = \frac{0.5(1-0.5)}{\left(\frac{0.05}{1.96}\right)^2 + \frac{0.5(1-0.5)}{2027}} = 322.95 = 323 \quad (2)$$

The instruments of quantitative research are the companies' warehouse processes, their certain indicators. Damages, delays, and other indicators related to warehouse processes were analyzed.

A total of 323 companies were analyzed, which is a sufficient number for the formula. Lost loads, returned customer orders, year-end stock shortages, and the number of orders picked were selected as quality indicators for the analysis.

Figure 2 shows the lost loads in the warehouses of the companies analyzed. Up to 50 loads per year were lost by 16% of the companies, 50–100 loads were lost by 30% of the companies, the majority of the companies lost 100–150 loads, 8% lost 150–200 loads, and 6% of the companies lost more than 200 loads each year.

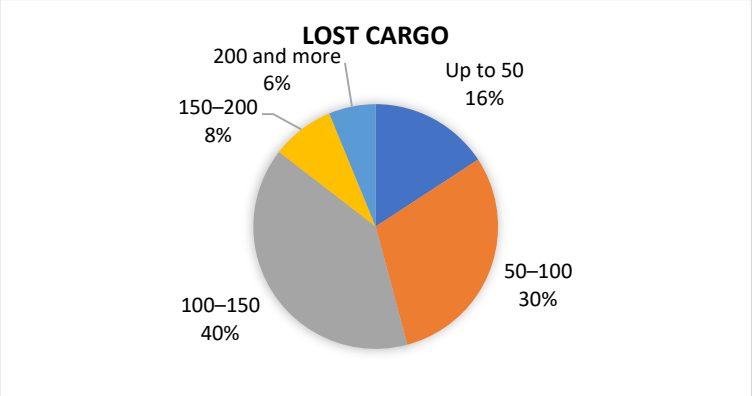

Figure 2. Lost cargo in companies in 2022.

Figure 3 shows the returned orders in companies, which was due to incorrect order picking, damaged packaging, and incorrect freight documentation. The vast majority of companies (55%) had 0–150 returned orders during the period analyzed. A total of 40% of companies had 150–300 returned orders, and 5% of companies had 300–450 returned orders.

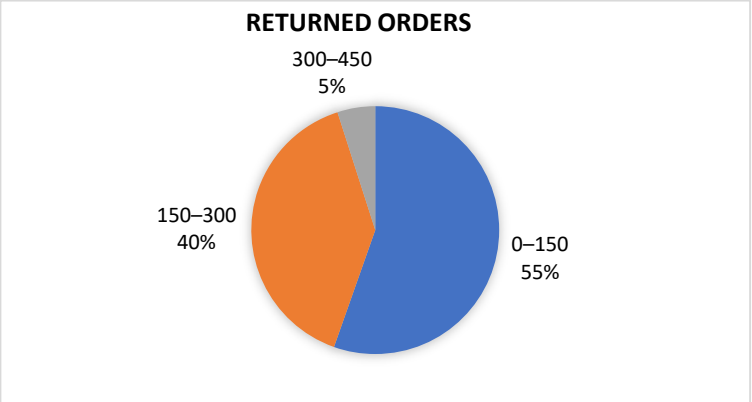

Figure 3. Returned orders in companies in 2022.

Figure 4 shows the stock-outs of companies in 2022. A total of 22% of companies had up to 10 tonnes in short supply, 44% of companies had 10–25 tonnes, 24% of companies had 25–40 tonnes, and the remaining 10% of companies had 40 tonnes or more in short supply.

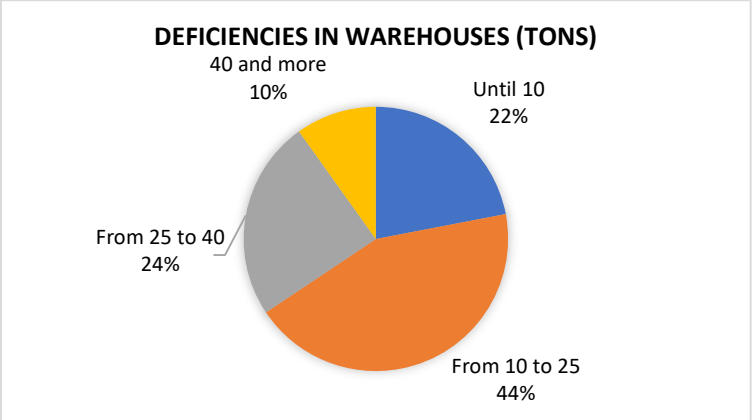

Figure 4. Shortage in companies' warehouses in 2022.

Figure 5 shows the number of picked orders in warehouses in 2022. Up to 0.5 million orders were picked by 25% of companies, 0.5–1 million by 31% of companies, 1–1.5 million by 21%, and 2 million and more by 23% of companies.

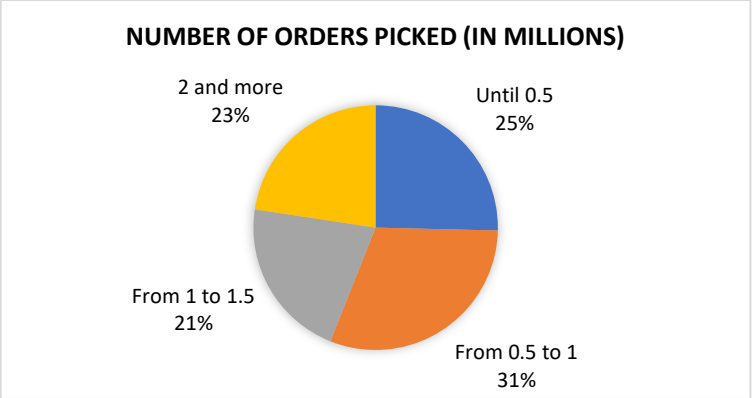

Figure 5. Number of picked orders in companies' warehouses in 2022.

Companies with high order volumes are larger than their competitors, have new information systems, improved picking sequences, improved implementation of systems, and alternatives to out-of-date products are shown in the systems, which makes work faster and more efficient, and makes better use of the machinery in the warehouse.

3.2. Qualitative Research and Results

Qualitative research is a form of social research that focuses on how people interpret and make sense of their experiences in order to understand the social reality of individuals [27]. Qualitative research is a dynamic process allowing us to identify topics as they emerge, to spot the key ideas or units of significance [28]. Researchers usually focus on presenting results in research papers. Research can be most useful for the companies where the experts interviewed work, providing appropriate feedback [29]. The results of the expert survey differed. Both closed- and open-ended questions were asked, so each respondent was asked to answer as concisely as possible, attempting to obtain as open a selection of answers as possible because the companies were not named, and an ordinary employee working in the company's warehouses could not be sure which companies the questions referred to. Table 1 shows the main responses of the experts.

Table 1. Expert observations to improve the quality of warehousing processes.

Observations to Improve the Quality of Warehousing Processes
The assignment of work to employees needs to be improved and the workload of employees should be reduced using automated equipment.
Communication between warehouse employees and the warehouseman should be improved and the system for ordering loading/unloading times should be updated.
Shortening the period of periodic inventory to help trace losses more accurately.
Delays in reporting stock balances, increasing the frequency of training periods.
More frequent training of staff in the use of information systems is needed.

Table 2 illustrates the responses received from the experts on the factors which, in their opinion, influence the quality of warehousing processes.

Table 2. Expert opinion on the factors that determine the quality of warehousing processes.

In Your Opinion, What Determines the Quality of Warehousing Processes?
Motivation of employees, periodic training, quality of equipment used.
Communication between employees, periodic system training.
Usefulness of the information systems used in warehousing processes, the training of employees in the use of information systems.
Frequency of process inspections, prioritization of investment in warehousing processes.

Table 3 illustrates experts' answers on the problems the fixing of which, in their opinion, would improve the quality of the warehousing processes. The main problems identified were the frequency of the periodic training of warehouse employees, upgrade of systems, and improving communication.

Table 3. Problems the solving of which would improve the quality of warehousing processes.

Which Problems Need to Be Solved to Improve the Quality of Warehousing Processes?
More investments in machinery to facilitate physical work; a change in the work environment towards a more western approach, following the example of large successful companies.
Rare trainings on working with new systems and equipment.
Reduction of programs for communication between employees; introduction of a single system.
Application of different methods for assembling orders if the shipment is urgent and large, requiring regrouping of works of employees.

4. Proposals for Improving the Quality of Warehousing Processes in Logistics Companies

The conducted analysis of the sources in the literature allows for the conclusion that logistics companies that have their own warehouses or warehouse rental services find it difficult to improve the quality of their warehousing processes because these processes are continuous, and often, warehouse employees are just doing their job without thinking about how it could be improved. Companies rarely review their warehousing processes and think about how to improve the quality of the processes. The increasing competition in today's logistics market is forcing companies to improve their warehousing processes by automating them, trying to make them faster and of higher quality. After reviewing the results obtained, it was observed that in order to have better quality, fast, and stable warehousing processes, a structured model for improving the quality of warehousing processes is needed; therefore, based on the results of the study and the most important warehousing process quality criteria identified by the experts, a model for the improvement of the quality of logistics companies' warehousing processes will be developed.

The authors distinguished the following methodological methods used to develop the model.

The model is built using the following methodological approaches: (A) single route identification; (B) scheduling problem; (C) wavelet bunching; (D) order grouping.

The single-picker routing problem (A) refers to the shortest route method in a warehouse employed to pick up goods ordered by consumers and stored in specific locations in the warehouse. When collecting all the SKUs from the warehouse storage locations, the single-picker routing problem aims to identify the path with the lowest cost that starts and finishes at the same location. In solving this problem, it is important to locate the goods in the right places in the warehouse, with the most frequently used goods at the most convenient location and the least frequently used goods at the furthest location. The picking time for a single order can be calculated by dividing the number of items in the order by the time required to pick the entire order, unless the order is a single item.

Wave picking (C) is a picking method typically used when a large number of warehouse goods stored in different warehouse locations are dispatched at the same time to the same destination (e.g., departure at a specific time with a specific truck). The proximity of picking points and the time limit are two parameters for order selection. The proximity setting reduces the travel time, and the time limit composition improves the throughput to final picking. All order pickers start at the same time when the warehouseman starts picking an order for a single batch. When a larger set of orders is handled by many order pickers at the same time and the reaction time of the whole set is critical, wave picking is used.

Order grouping (D) is a method of dividing orders into smaller groups that can be picked in one picking trip. In order grouping, the picker collects the items required for the order at a single warehouse location. The models used are the integrated order picking and single picker routing problem models. The aim of grouping is to minimize fatal picking delays in the supply chain.

Modeling framework: Figure 6 shows the warehouse operations in the warehouses of logistics companies based on this modeling framework, starting from the inbound activity to the outbound. The reception area is where the process of receiving the products, checking them, labeling them, and starting the other entry operations takes place. The warehousing activity consists of the transfer of stock to the storage location and the picking activity in the warehouse. In contrast, the outward activity consists of the transfer of goods from the storage area to the outward area, the inspection of the outward goods, and the packaging and dispatch of the outward goods. Parameters to be used to build the model are warehouse layout, distance between storage areas, order picking rate, picking capacity, and staff shift hours.

The functional and the supply sub-systems are important in the presented model. The participants involved in the transport and search process form the functional subsystem. The partners of logistics companies are warehousing companies, international partners, and shareholders, who can help in the event of a problem at any stage of the supply chain, thus ensuring high quality of the processes. Staff recruitment companies allow warehouses to always have the right number of employees in the face of seasonality to ensure quality and continuity in the processes. Suppliers of warehousing equipment provide warehouses with the necessary machinery to ensure uninterrupted work.

The biggest loss of time and quality in warehouses in the warehouse process quality improvement model was observed in order assembly activities, starting from the inbound activities to the goods leaving the warehouse. The process of delivery, inspection, and marking of goods and other inbound tasks takes place in the goods reception area. The activities of assembling and placing goods are categorized as warehousing activities, while outward activities include the transport of goods and the checking of outgoing flows from the warehousing place to the goods warehousing area, as well as the dispatching of goods and the docking of outbound goods.

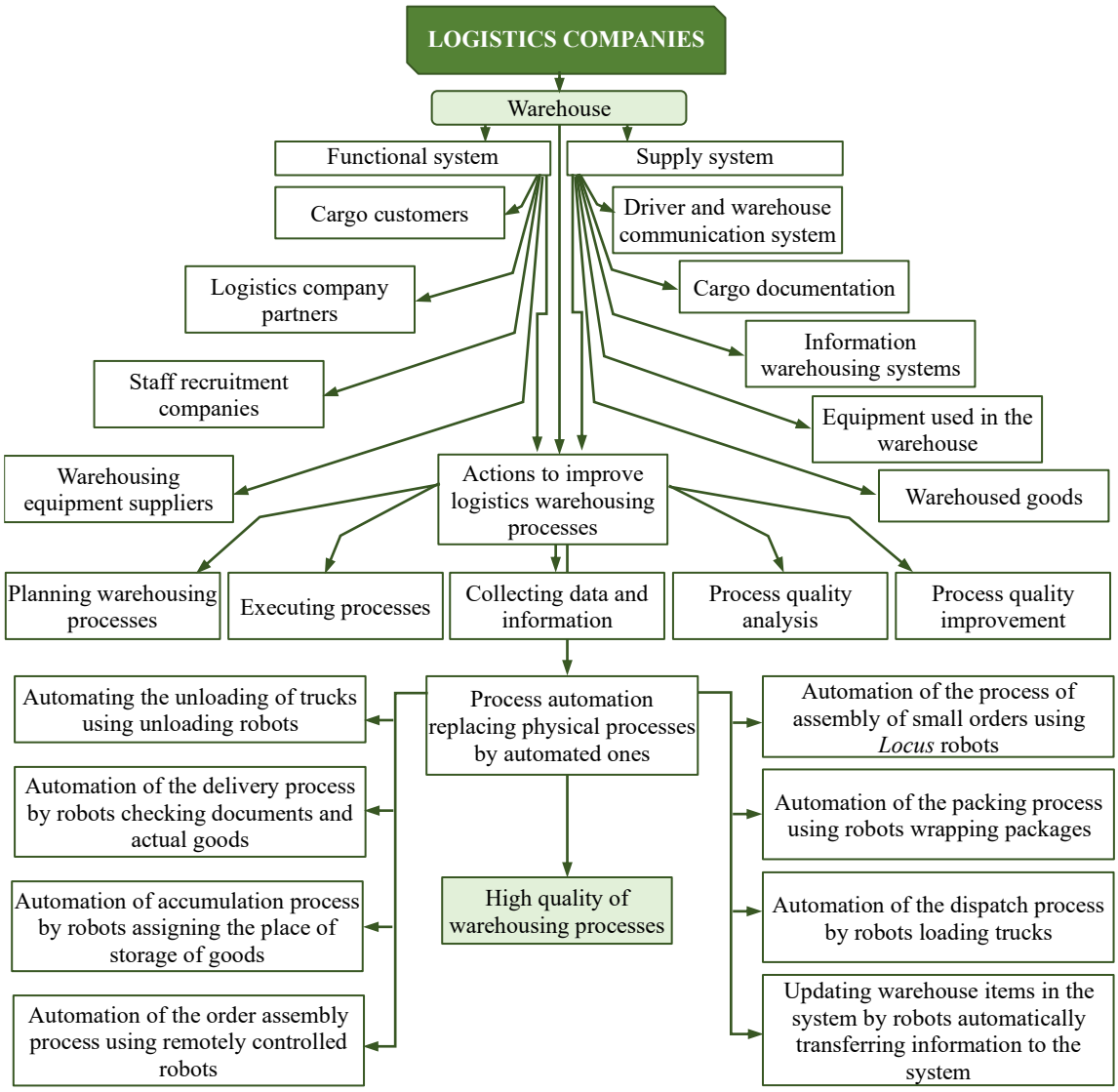

Figure 6. Structured model for improving the quality of warehousing processes in logistics companies. Available online: https://www.dcvelocity.com/ (accessed on 12 January 2024).

Each order assembly batch has an execution schedule. One batch order may consist of different SKUs and quantities. The optimization of warehouses and the application of the wave assembly concept, where the product is released slowly in waves and a process schedule is drawn up, results in a 42.28% reduction in the average order assembly time.

The delivery subsystem includes a communication system between drivers and the warehouse to ensure that trucks are unloaded and loaded on time, a cargo documentation database, and warehouse information systems that allow warehouse staff to communicate with each other and see the orders which they need to assemble. The equipment and goods used in the warehouse are also a part of the supply subsystem.

These subsystems are strongly interconnected. The availability of the warehouse information systems must be ensured for all participants in the model individually. Each order assembly must have a new project created in the system, indicating the customer, the time of arrival of the required goods, drawing up an order assembly schedule, assigning the necessary staff and equipment, delivering the assembled orders to the designated departure gates, and loading them onto trucks.

The model could measure not only the efficiency of the warehousing processes and assembly times but also the activities of other business partners, such as the on-time arrival

of goods and adherence to assembly schedules. To determine the effectiveness of the model, an analysis of past process quality and current process quality can be conducted.

The application of the model allows for the optimizing of warehousing processes; drivers do not have to stick around in the warehouse, and cargo documentation is quickly arranged, providing more opportunities to search for expansion options. Processes are analyzed in the model, searching for ways to improve them and their quality. The aim of all logistics companies is to maximize profits, but this model helps companies to optimize and improve the quality of their warehousing processes by applying information technology and automated processes in order to improve the quality of existing orders and to remain competitive. The model supports the hypothesis that the increase in the quality of warehousing processes depends on the replacement of physical processes by automated processes.

Smaller companies would have to search for new investors to finance the model, to automate a part of warehousing processes only, or to buy second-hand equipment from their competitors. Large companies would have to invest in all automation processes at once, as they have a much larger budget. International companies could receive equipment from warehouses abroad that are installing newer equipment. The payback period would be long, but the quality of companies' warehousing processes would improve.

Companies applying automated processes in warehouses are leaders in logistics and warehousing. Amazon, Alibaba, and also DHL, FedEx, UPS, and DSV are a few examples to be followed by other companies in automating their warehousing processes. These companies invested in the automation of their warehousing processes and have become leaders in warehousing and logistics. The investment payback period is long, but the improved quality of warehousing processes and the growing number of new customers allow companies to generate higher revenues, thus shortening the payback period.

This model takes a different perspective on the problem of improving the quality of logistics warehousing processes. The model proposes to look at warehousing processes, to improve them, and, in case of a failure to improve them, to look for the possibility to automate the processes according to the specified steps, thus achieving a high quality of warehouse processes.

To assess the effectiveness of the application of the model, an expert evaluation methodology was used. As it is difficult to apply an empirical approach to the presented model, expert assessment was chosen as it is appropriate when dealing with a process or phenomenon that requires special skills or experience. A group of experts was brought together for the study of the quality improvement of warehousing processes, whose members have specialist expertise. The interviewed experts favorably evaluated the warehouse process quality improvement model. They easily understood and had a clear perception of all the elements of the model. Every company needs to pay close attention to improving the quality of its warehousing processes in order to remain competitive, to attract more customers and investors, to reduce errors, and to ensure a better quality of processes than competitors. All experts emphasized that information systems and automated processes can help to improve the quality of warehousing processes. However, they acknowledged that information systems and automated processes can require significant investments and have a significant competitive impact on warehouses of logistics companies.

Figure 7 shows the problems that experts believe companies would face if they were to implement the proposed model in their warehouses. According to the experts, the biggest problem would be large investments required and the long payback period, which is why not all companies are financially able to implement the model. Another major problem is that having implemented the systems and equipment, the staff need to be trained to work with the innovations, and periodic training sessions are required. Linking existing systems to new equipment is another problem identified by experts, which requires a long period of time because when upgrading a system, processes have to continue, so they have to be updated in stages. A specialist who understands the new systems and equipment should come to train the existing staff of the companies, and the companies

should look for a permanent staff member in case the equipment breaks down or the system needs to be upgraded. Most logistics companies understand the importance of increasing the quality of warehousing processes, but there are other processes that also require the company's finances.

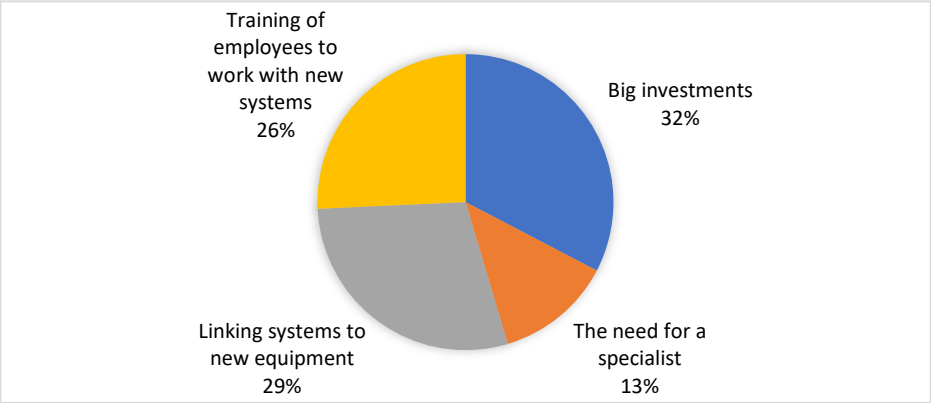

Figure 7. Problems which companies implementing the proposed model may face.

Every respondent understands the benefits of installing information systems. Various logistics and warehousing companies have already made use of information systems to solve many warehousing-process-related problems that, before the changes, prevented them from expanding the scope and quality of their processes. It was acknowledged that one of the procedures that is a very important part of a company's strategy is the improvement of the quality of warehousing processes. Competition between companies requires them to look for new opportunities to raise the quality of their warehousing processes as quickly as possible. The use of warehouse information systems makes it possible to identify every element that has a certain impact on the final product.

The experts emphasized that managers need to be able to involve company employees in the quality assurance procedures of warehousing processes in order to improve the quality of their processes. Every employee must clearly understand the quality requirements for logistics warehousing processes and be able to assess whether all warehouse employees follow them. However, those who offer a lower price have a competitive advantage in the market. Companies that have not introduced new information technologies or have a large number of automated processes can offer lower service prices. For example: systems or processes used by partner companies could be applied in the implementation of the information systems of a company's warehousing processes, thus providing a visible benefit to the companies and making the required processes more visible.

The pandemic has highlighted another shortcoming of companies with few automated processes. Automated processes can run regardless of the number of sick staff members, with only a few employees needed to maintain the equipment. During the pandemic, companies that did not have many automated processes had to coordinate staff schedules and split shifts into smaller ones, resulting in slower and lower-quality work. To prevent this from happening again, companies with warehouses have invested heavily in automated processes.

By modifying the model for it to suit the needs of logistics companies' warehouses, the experts recognized that the model could improve the quality of logistics companies' warehousing processes. The model demonstrates the need for close cooperation and the use of information technology between all warehousing processes in order to improve the final quality of the product which the customer receives.

Large companies have the financial resources to implement the latest technology in warehouses. Company managers should be willing to invest in improving the quality of warehouse processes to become market leaders and attract new investors and partners.

Continuous analysis of process quality is essential to address foreseeable problems at an early stage.

Based on relevant warehouse process quality standards for logistics companies' warehouses and logistics companies' business partners, which directly contribute to the overall improvement of warehouse process quality, a model for warehouse process quality improvement is proposed. The high quality of service is ensured by the model's functional and supply sub-systems, which operate continuously and uninterruptedly due to the warehouse's critical process quality procedures. Old warehouse systems should be linked to the new one, which would be time-consuming, but would ensure faster and higher-quality processes in companies' warehouses, a reduction in the physical workload for employees, and a competitive advantage.

5. Conclusions

Analyzing the existing warehousing processes and identifying problem areas is recommended to improve the quality of warehousing processes. Based on the expert survey method used, it is important to focus on how to improve the allocation of staff in the case of large orders, the use of automated equipment, the need for periodic training of staff to work with new systems and equipment, and the need for a continuous survey of warehouse staff in order to identify problem areas and to review the proposed solutions.

The conducted study shows that logistics companies that replace physical processes with automated ones in their warehouses improve the quality of their warehousing processes. Automated facilities perform physical processes faster, and a few employees are sufficient to serve many facilities.

A model for improving the quality of warehousing processes has been proposed based on the relevant warehouse process quality standards applicable for logistics companies' warehouses and logistics companies' business partners, which directly contribute to the overall improvement of the quality of warehousing processes. The model's functional and supply sub-systems, which operate continuously and uninterruptedly due to the warehouse's important process quality procedures, ensure a high quality of services.

The contribution of this study to the academic and practical community is obvious: the quest to understand the evolution of the implementation of quality improvement measures in the logistics sector, their effectiveness for the organization, and the level of return that these improvements can bring to organizations. Another aspect of the study's analysis is related to indirect effects resulting from the implementation of logistical changes. For example, it would be appropriate to understand how the human resources of these organizations respond to the implementation of various automations aimed at increasing the efficiency and effectiveness of the logistics sector.

In order to understand the evolution of the implementation of quality measures in the logistics sector and their impact on the performance and returns of organizations, it is recommended to carry out research on how quality measures are implemented, i.e., to identify the different approaches and methodologies of quality management in the logistics sector and to investigate their effectiveness in different organizations. In addition, studies on return measurement would be relevant to assess the impact of the implementation of quality measures on the return of organizations.

The main limitations of this study are as follows: In this work, the opinions of representatives of logistics companies about the operation of these companies' warehouses were examined, and a theoretical model of the quality assessment of warehouse processes was prepared based on the opinions. However, the study did not examine the size of the warehouses or the type of warehouse processes; i.e., company warehouses were not categorized. Incomplete feature input and some substantial differences may lead to heterogeneity and bias [30].

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