Економіка

UDC 005.33

Semeniak Mykyta
Bachelor's Degree
Ukrainian State University of Science and Technology;
Owner, Deputy Director of a Logistics Company
Семеняк Микита Олександрович
бакалавр
Український державний університет науки і технологій;
Власник, заступник директора логістичної компанії
ORCID: 0009-0008-0577-8985

DEVELOPMENT AND IMPLEMENTATION OF RISK MANAGEMENT SYSTEMS IN LOGISTICS: PRACTICAL RECOMMENDATIONS
РОЗРОБКА ТА ВПРОВАДЖЕННЯ СИСТЕМ УПРАВЛІННЯ РИЗИКАМИ В ЛОГІСТИЦІ: ПРАКТИЧНІ РЕКОМЕНДАЦІЇ

Summary. *Introduction. In the modern world, successful logistics is impossible without the development and implementation of risk management systems. Operations involving the transportation of goods, warehousing, and fulfillment of orders are subject to a variety of potential threats that can negatively affect the company's business. Therefore, the relevance of implementing risk management systems in logistics is growing every day.*

For effective risk management in logistics, it is necessary to analyze all possible threats and develop measures to minimize them. Each stage of the logistics chain – from the purchase of raw materials to the delivery of finished products-requires attention to possible risks. Control over financial flows, customs procedures, transport companies, and even customer relationships is essential for the successful operation of a logistics system.

Development and implementation of risk management systems in logistics allow companies to minimize losses, increase the reliability of deliveries, improve the quality of customer service and strengthen their position in the market. That is why investing in such systems is considered an important step for the development and successful functioning of modern logistics processes.

Modern technologies allow automating the processes of information processing and material flows in logistics systems. Automation strategies are used to improve the productivity and economic performance of a logistics company, as well as the efficiency of internal transportation, movement and storage processes, improve the quality of service and, consequently, increase competitiveness.

Purpose. To offer practical recommendations for the development and implementation of risk management systems in logistics.

Materials and methods. The research was carried out with the help of theoretical analysis of author's works aimed at studying and analyzing risk management systems in logistics. Practical recommendations for improving risk management systems in logistics were also studied.

Results. The concept of risk is studied in several literature sources. Conclusions are drawn about the ambiguous meaning of the concept of risk and its versatility. It was found that risks occur in all areas of activity of logistics companies. There are also many classifications of risks, and there are no specific standards. Methods of dealing with logistics risks are broad and there are no identical approaches and solutions. Risks in each organization are individual, decisions and actions taken against them are also unique for each object and type of activity.

Discussion. In further scientific research, it is proposed to emphasize the measures of modern economic development to improve the logistics risk management system and assess their economic efficiency for the enterprise.

Key words: *logistics, risk management system, system development and implementation.*

Анотація. *Вступ. У сучасному світі успішна логістика неможлива без розробки та впровадження систем управління ризиками. Операції, пов'язані з транспортуванням вантажів, складуванням і виконанням замовлень, схильні до різноманітних потенційних загроз, які можуть негативно позначитися на бізнесі компанії. Тому актуальність впровадження систем управління ризиками в логістиці зростає з кожним днем. Для ефективного управління ризиками в логістиці необхідно проаналізувати всі можливі загрози і розробити заходи щодо їх мінімізації. Кожен етап логістичного ланцюжка – від закупівлі сировини до доставки готової продукції – вимагає уваги до можливих ризиків. Контроль за фінансовими потоками, митними процедурами, транспортними компаніями і навіть взаємовідносинами з клієнтами має важливе значення для успішного функціонування логістичної системи.*

Розробка і впровадження систем управління ризиками в логістиці дозволяють компаніям мінімізувати збитки, підвищувати надійність поставок, покращувати якість обслуговування клієнтів і зміцнювати свої позиції на ринку. Саме тому інвестиції в такі системи розглядаються як важливий крок для розвитку та успішного функціонування сучасних логістичних процесів. Сучасні технології дозволяють автоматизувати процеси обробки інформації та матеріальних потоків в логістичних системах. Стратегії автоматизації використовуються для підвищення продуктивності та економічних показників логістичної компанії, а також ефективності внутрішніх процесів транспортування, переміщення і зберігання, поліпшення якості обслуговування і, як наслідок, підвищення конкурентоспроможності.

Мета. Надати практичні рекомендації щодо розробки та впровадження систем управління ризиками в логістиці.

Матеріали та методи. Дослідження проведено за допомогою теоретичного аналізу праць авторів, спрямованих на вивчення та аналіз систем управління ризиками в логістиці. Також були вивчені практичні рекомендації щодо вдосконалення систем управління ризиками в логістиці.

Результати. Поняття ризику вивчається в ряді літературних джерел. Зроблено висновки про неоднозначне значення поняття ризику та його універсальність. З'ясовано, що ризики мають місце в усіх сферах діяльності логістичних компаній. Класифікацій ризиків також існує безліч, а конкретних стандартів не існує. Методи роботи з логістичними ризиками широкі і не існує однакових підходів і рішень. Ризики в кожній організації індивідуальні, рішення і дії, що вживаються щодо них, також унікальні для кожного об'єкта і виду діяльності.

Обговорення. У подальших дослідженнях пропонується приділити особливу увагу заходам сучасного економічного розвитку для вдосконалення системи управління логістичними ризиками та оцінки їх економічної ефективності для підприємства.

Ключові слова: *логістика, система управління ризиками, розробка та впровадження системи.*

Problem statement. Logistics companies must constantly assess and manage the risks that may arise when performing their tasks. This is an integral part of running a successful logistics business and requires constant monitoring and monitoring. Risks may arise due to various factors, such as changes in legislation, economic conditions, or technical problems.

In carrying out their business activities, companies face various difficulties related to logistics flows, warehouse storage and delivery of goods. These challenges require competent risk management and the development of strategies to reduce them.

The role of risk management in logistics should not be underestimated, as successful prevention of potential threats can significantly affect the efficiency of the entire logistics process. It is important to be able to adapt to new circumstances and quickly take measures to minimize possible losses.

In the context of dynamic business development, the organization of supply chains and logistics process is of particular importance. This process includes not only the delivery of goods, but also the purchase of necessary materials for production, as well as the sale of finished products. It is important to realize that at each stage there is a risk of losses due to the impact of the market environment and human factor. That is why it is necessary to conduct a thorough analysis and take into account all aspects in order to avoid negative consequences and reduce potential losses for the company.

The topic of research on the organization of supply chains and logistics process is relevant for modern business, especially in a dynamic and competitive market. Today, the successful functioning of these processes plays a key role in ensuring the competitiveness of companies and their sustainable development. In this regard, companies seek to optimize their supply chains and logistics processes, in order to increase efficiency and reduce risks.

The need to adapt to changes in the external environment and quickly respond to possible threats and opportunities related to supply chains and logistics processes is becoming a priority task for modern companies. In a rapidly changing world where competition is becoming more intense, effective supply chain and logistics management is becoming an integral part of a successful business strategy.

In order to successfully manage a business in conditions of unstable Russian and global markets, increased vulnerability of supply chains and volatile competitiveness, it is necessary to actively apply effective risk management methods. The organization of logistics chains has faced a number of challenges, including the diversity of suppliers, carriers, and customers. Managers who

analyze logistics risks should take into account not only the direct losses from possible problems, but also the total costs associated with the occurrence of these risks. Effective risk management will minimize potential threats, reduce financial losses and avoid negative consequences for the company's operations.

Having a professional team for risk management is a key success factor for any enterprise. However, the approach to risk assessment and management requires serious financial investments and careful analysis. Every company should realize that ignoring this issue can lead to serious losses and negative consequences for the business. In today's world, where competition is becoming increasingly fierce, it is important to pay due attention to risk assessment and the development of a strategy to minimize them.

Analysis of recent research and publications. The problematic issue of risk management in the process of organizing logistics activities is devoted to a significant number of scientific papers by leading foreign and domestic scientists, namely:

-to justify the expediency of applying risk management in the management of logistics systems of enterprises, in particular corporate and involved in international supply chains, in order to optimize the process of rational decision-making, scientific works are devoted to X. Fuchs and Y. Vohinza [3, p. 233], T. Andersena and P. Schroeder [1, p. 119], M. Kroukh, D. Galai and R. Mark [2, p. 98], I. Krivovyazyuk, S. Smerichevsky and Y. Kulik [5, p. 36];

- analysis and classification of logistics risks paid attention Y. Sheff [11, p. 55], M. M. Mamchina and O. A. Rusanovskaya [6, p. 45] and others.

Different aspects and diversity of definitions of logistics risks, the lack of systematic approaches to their assessment and management methods in modern scientific publications forms a large range of issues, both on the essence of logistics risk and to the methods of their elimination or reduction.

In today's interdependent business world, organizations face many challenges in their supply chains. To counteract these threats, companies are

implementing an integrated SCRM (Supply Chain Risk Management) approach aimed at ensuring uninterrupted operations. This method allows not only identifying possible problems in the movement of goods from the manufacturer to the consumer, but also developing preventive protection measures. Researchers Nwanko and Okoye [9, p.256] emphasize that the key task of such management is to create an adaptive system that can quickly recover from failures and minimize their consequences. SCRM helps organizations identify weaknesses in logistics processes and eliminate uncertainty factors that threaten supply stability in a timely manner.

In the modern world, technological progress has become an integral tool for analyzing and quickly responding to various threats in real time, as noted by Wang and his colleagues [13, p. 3]. Integration of an integrated approach to supply chain risk management (SCRM) allows you to create an effective system that combines methods for identifying, analyzing and minimizing potential threats. Organizations face a wide range of challenges-from natural disasters and market fluctuations to difficulties with suppliers and changing consumer demand. Technological innovation in this area is of paramount importance, providing companies with advanced solutions for proactive risk management as part of their logistics strategies.

The purpose of the article is to offer practical recommendations for the development and implementation of risk management systems in logistics.

Materials and methods. The research was carried out with the help of theoretical analysis of author's works aimed at studying and analyzing risk management systems in logistics. Practical recommendations for improving risk management systems in logistics were also studied.

Presentation of the main material. Logistics plays an important role in business success, ensuring efficient and timely movement of goods. However, the complex nature of logistics operations makes them vulnerable to various risks that can disrupt supply chains, affect customer satisfaction, and lead to financial

losses. Effective risk management is essential for organizations to proactively identify, assess, and mitigate potential risks in their logistics operations.

Logistics operations face a wide range of risks, which can be broadly classified as follows (Figure 1).

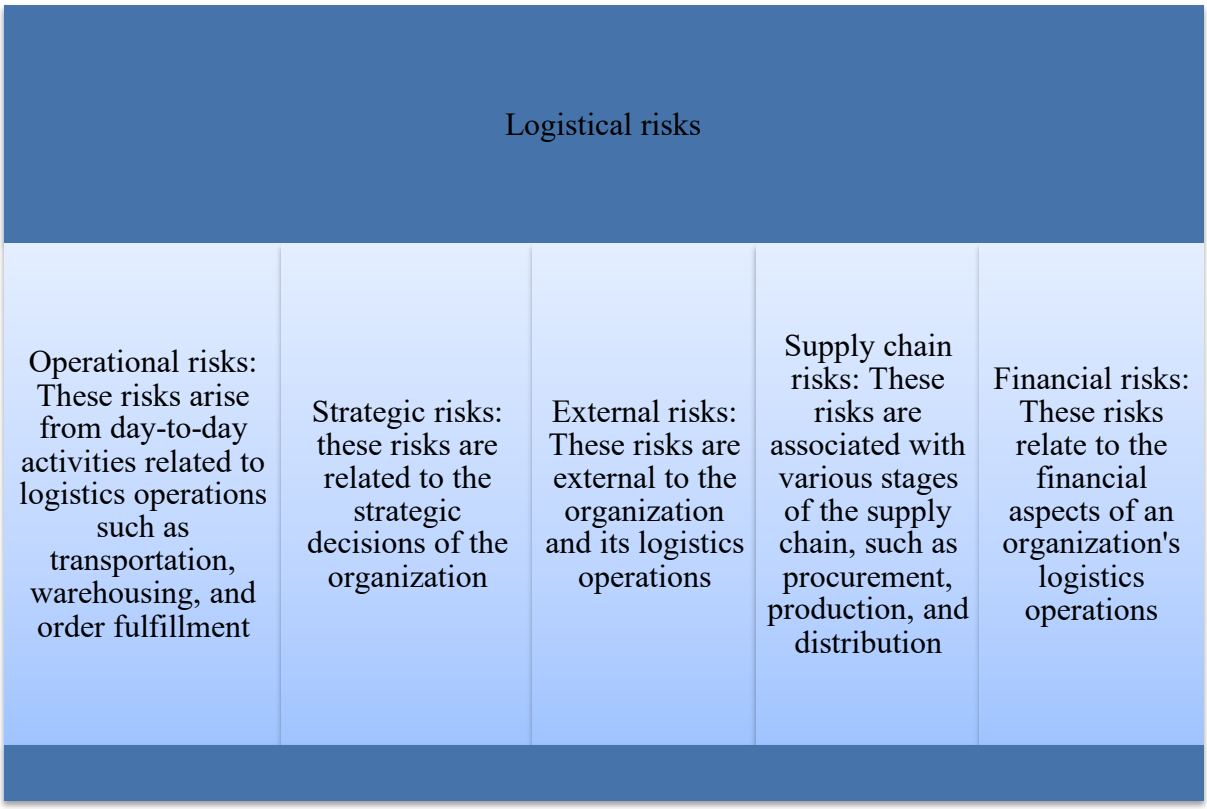

Fig. 1. Types of logistics risks

Source: developed by the author

Examples of operational risks include equipment failures, labor shortages, transportation delays, and inventory inaccuracies.

Examples of supply chain risks include supplier failures, production delays, and transport network failures.

External risks may include factors such as geopolitical events, natural disasters, economic fluctuations, and regulatory changes.

Strategic risks include factors such as market changes, competitors ' actions, and changes in customer preferences.

Financial risks are characterized by such risks as cash flow management, exchange rate fluctuations and changes in interest rates [12, p. 46].

Risk occurs in almost all areas of activity and depends on many factors, such as the industry in which the company operates, the size of the company, or the legal structure.

It is important to properly manage risks, because without this ability of the organization, there are a number of hazards that can have an adverse impact on its functioning and development. To properly manage risks, you need to know the methods that serve this purpose. Their implementation allows you to achieve a number of advantages, including increasing the probability of achieving your goals, upgrading all available control mechanisms, or determining the actual costs of investment projects.

However, keep in mind that the risks are not completely eliminated. They can only be reduced / limited, mainly by introducing preventive measures. Although it is not possible to completely reduce risks, as in the case of a breakdown or adverse consequences, an enterprise that is aware of the likelihood of their occurrence responds more quickly to these unforeseen events and, consequently, spends less labor and financial resources on subsequent repair of damage resulting from risky situations.

It is also worth noting that an organization that uses risk management concepts has much more confidence in the market, which in the long run provides new customers and, consequently, increases turnover. Accordingly, the budget increases funds for risk-related situations.

A conscious enterprise is often more innovative and more willing to accept challenges in the application of new technologies, ahead of the competition. Very often, ignoring the concept of risk leads to loss of financial liquidity and, as a result, to bankruptcy. We should not, therefore, forget about it even in the heyday of our activities.

The problem of risk arises in almost any activity, both social and вeconomic. Their very management is an extremely important element of the

functioning of each organization. Therefore, this aspect should not be forgotten, as it determines the success of the organization [7, p. 147].

Effective risk management is possible only as a result of using modern tools that are used to assess it. Among the most popular ones are the Ishikawa Diagram, the Five Whys method, and interviews and observations, which are described in more detail below.

The Ishikawa diagram - by virtue of its special form, is also called the "fish bone" scheme. It is used for causal analysis by diagnosing the causes of the or potential failures. Currently, it is used in many areas, such as: services, administration, project management and industry.

It is extremely important that a large group of employees with special knowledge in various fields participates in the process of building the diagram. To prepare it correctly, the following rules must be followed:

- in a place intended for the head of the fish, the problem fits;

- at the ends of the ribs of the skeleton, possible categories of reasons are fed, usually this is: a person, machine, material, method, guidance, environment. However, this list can be changed, there are no obstacles to the use of other categories, such as procedures, equipment, materials, information, people - depending on the area in which the schedule is located;

- aspects regarding the category of reasons revealed at the previous stage are fed at the ends of the "braids";

- a prepared scheme is the basis for subsequent analysis, which can relate to specific reasons for problems or relationships between them.

" Five why " - this method allows you to identify the causes of problems. It was created by Sakichi Toyoda. It highlights two extremely important aspects. The first is the question "why there was a problem", and the second is "why we didn't notice it". The most common question – "why" is repeated five times, but there is a possibility that in the analyzed case it will be necessary to ask the question "why" for the sixth or seventh time.

In this method, it is important to collect as much information as possible, as a result of which the chances of identifying the correct cause of the problem will increase. At this stage, the following aspects should be considered:

– what exactly happened?

– when did the problem occur?

– what is the size and number of problems?

– what threat does the problem pose to the client or company?

After collecting sufficient information about a specific problem, a working group is selected, which can help determine the cause of the problem. It is recommended that in the working group there are people who have the greatest contact with the processes in which it was discovered. This increases the likelihood that the root cause of the problem for which the necessary to look for a solution will be diagnosed faster [4, p. 749].

An interview is a research method that involves asking subjects questions in a formal or more or less formal way. The interview involves at least two people, the interviewer and the respondent. The goal is to get an answer to the topic being researched.

Observation is a research activity that involves collecting data through perception. In this method, observational activity plays a major role. It is essential that it does not make any changes to the phenomenon under study, but only serves to record all the necessary data necessary for the start of scientific research.

The observation method is divided into several types:

– objective: it is intended to describe the observed behavior in the studied environment, without interfering with it;

– participation: the researcher intervenes in situations in which he or she is involved;

– open (explicit): the environment under study is aware of the observation being made;

– hidden: the environment under study is not aware of the observation being made;

– structured: the researcher consciously identifies specific events to observe the behavior of the environment under study.

The skillful application of risk assessment methods allows you to make proper risk monitoring and their correct elimination. To manage risk, first, identification, analysis and assessment of risks is carried out. Then, on the basis of identified information about risks, influence on their level and manifestation is carried out.

The main goal of risk management is to reduce losses that may occur because of them. At the same time, it is important to have knowledge about various schemes of behavior in case of its appearance. These solutions are collected in table 1.

Table 1

Possible actions against risk

Possible solution	Level of risk	Action against risk
Acceptance of risk	Very high	Take on risk
Own risk coverage	High	Creation of reserves from equity
Risk diversification	Medium	Various ways of allocating risks to products, customers and markets
Risk compensation (hedging)	Average	Use of derivative financial instruments (derivatives) in parallel hedging operations
Transfer of risk	Low	to a partner to an insurer to other subjects
Prevention of risk	No	inaction

Source: developed by the author

Risk acceptance – if it is not possible to eliminate or limit the occurrence of certain risks, they should be calculated and then included in the price of the final product.

Own risk coverage is the creation of reserves from the company's own capital. When preparing an enterprise's balance sheet, it is necessary to take into account the creation of reserves, for example, for foreign exchange losses. To do this, you must have a large amount of capital at your disposal.

Risk diversification – by expanding the scope of your business, audience, or suppliers, as well as expanding the range of products or services, you can diffuse the risks associated with your business.

Risk compensation is combining transactions so that the risk associated with one transaction is also collateral for another. There are two types of risk compensation: direct and indirect. Direct transactions include situations when these transactions are combined into one, if the purpose of these actions is to create an opportunity for a second transaction. In the case of indirect risk compensation, we can talk about a situation where when combining a transaction into one, the second one does not represent an opportunity for the first, while based on the experience of the transaction, we can assume that compensation will occur in the future.

Risk transfer is an action that involves transferring the impact of a risk to another entity. This action is very effective in the field of finance. This is due to the need to pay a premium to the entity that accepts risks (for example, insurance in case of cargo disappearance, fire, etc.) [8, p. 39].

Risk prevention is a method that is not included in the list of positive ways to deal with risk. It involves changing the process that completely eliminates these risks. However, it is important that the use of this method is not always possible.

The risk management concept should correspond to the specifics of the enterprise. Depending on the type of activity of the enterprise or industry of production, a certain risk management concept is selected. It is also important that management personnel make a conscious decision about how to proceed.

The modern logistics industry faces many challenges that require a comprehensive approach to risk management. The effective functioning of

logistics companies directly depends on their ability to anticipate and minimize potential threats. Figure 2 shows the directions for minimizing logistics risks.

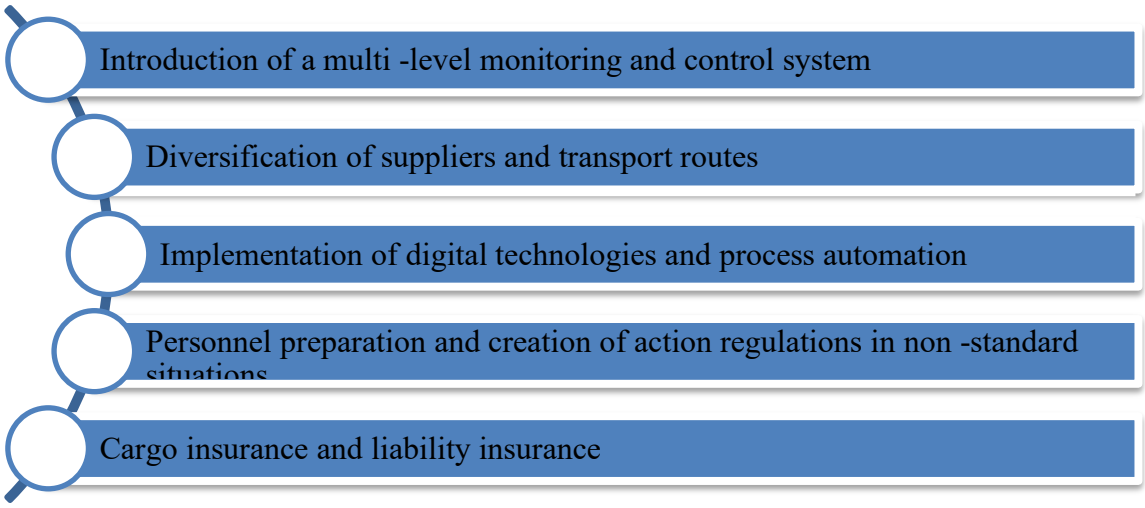

Fig. 2. Directions for minimizing logistics risks

Source: developed by the author

Implementation of a multi-level monitoring and control system is of paramount importance. This includes the use of state-of-the-art technology solutions such as GPS cargo tracking, predictive analytics systems, and automated inventory management.

Diversification of suppliers and transport routes can significantly reduce dependence on individual counterparties. At the same time, it is important to regularly audit the reliability of partners and evaluate alternative logistics chains.

Cargo and carrier liability insurance is a mandatory element of risk management. Companies are encouraged to work with reliable insurance partners and carefully choose their insurance products.

Special attention should be paid to the training of personnel and the creation of regulations for actions in non-standard situations. Regular training sessions and training programs help employees respond effectively to problems that arise.

The introduction of digital technologies and automation of processes significantly reduce the impact of the human factor. The use of blockchain and

artificial intelligence helps to increase the transparency of operations and prevent potential risks [10, p. 557].

Based on the above-mentioned ways of minimizing risks, we can determine practical recommendations for managers of logistics companies (Figure 3).

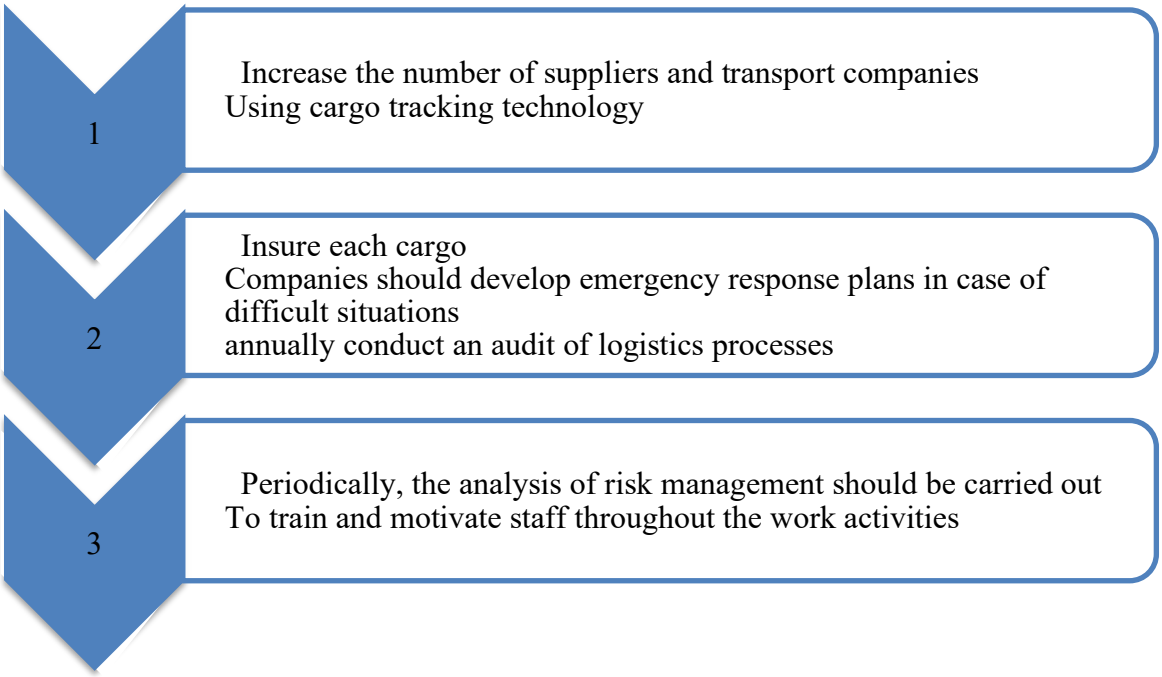

Fig. 3. Practical recommendations for managers of logistics companies

Source: developed by the author

1. To increase the number of suppliers and transport companies, that is, work with several suppliers and carriers, and not just use your fleet. This will reduce the risk of problems with deliveries due to difficulties with one supplier. If there are several suppliers, the company can quickly respond to any problems and ensure the continuity of supply. Thanks to this, the risk of delays, damage to the cargo will decrease, and it will also be possible to choose optimal routes and services for various types of cargo.

2. The use of cargo tracking technology will improve cargo control, increase the transparency and accuracy of tracking the transported cargo in real time, reduce delivery time, thereby the risk of loss and damage to the cargo will decrease. Several modern systems and technologies used in logistics: GPS-tracking-a system that allows you to track the location of the cargo in real time,

wireless sensors that help to track the conditions of storage of cargo (temperature, humidity), which is very important for some groups of goods, barcode and RFID systems that identify goods at all stages of the logistics process, thereby simplify the inventory process And tracking the movement of goods, digital platforms that allow collecting, analyzing and exchanging data on goods to all participants in the logistics chain, which contributes to more efficient planning and performing cargo transportation.

3. It is important to insure each cargo. This will protect the goods from loss, damage or theft during transportation. Insurance provides protection of the interests of both senders and recipients of goods, as well as all participants in the logistics chain. To date, there are several types of insurance: cargo, providing protection against damage to the cargo, insurance of the carrier liability, which will cover the carrier's responsibility to the sender in the case of force majeure situations, insurance of the forwarder liability, thanks to which forwarders and transport companies from possible financial losses in In case of problems of transportation of cargo.

4. Companies must develop emergency response plans in case of difficult situations. Preliminary planning of such actions will help to quickly respond to unforeseen circumstances. In such situations, it is important to be able to evaluate the risks on the roads, in ports and other stages of the logistics chain, to identify vulnerabilities, to develop an action plan for accidents on roads, fires, floods and other emergency circumstances, to establish a monitoring and communication system.

5. Periodically, an analysis of risk management should be carried out. This process includes identification, evaluation, development, risk control. According to the author, the key goal of the analysis is to prepare the complete and reliable information necessary for making managerial decisions that allow minimizing the influence of negative factors on the final results of logistics activity. Conducting a regular analysis of logistics processes will make it possible to identify potential

vulnerabilities, develop measures to eliminate them and create a reliable and stable business environment.

6. No less important, the author believes, is the training and motivation of personnel throughout the work. This will help create a motivating working environment and helps to improve the quality of work, as well as a decrease in the likelihood of errors.

7. It is necessary to conduct an audit of logistics processes annually, that is, to systematically evaluate and analyze all operations and procedures related to logistics. The purpose of such an audit is to identify narrow places, problem areas, ineffective operations, potential risks and the study of opportunities to increase labor productivity, reduce costs. To do this, it is necessary to collect information on the supply, storage, transportation, stockpile management, ordering and customer service. Each company can develop its own strategies taking into account the specifics of its activities and the characteristics of the market in which it works.

The combination of several ways will help to achieve the best results and provide business entities with a real decrease in both the probability of the onset of transport and logistics risks, and the volume of their consequences.

Conclusions and prospects for further research. Transport logistics plays a very important role in the modern world, without it would not be possible to carry out global trade and ensure the supply of goods. It is important to prevent, prevent supplies, damage to goods during transportation, loss of goods and exclude other negative consequences for the business. Therefore, it is necessary to use stock management strategies, choose reliable suppliers and optimize delivery processes.

Logistic processes are of great importance in the economy and not only. They allow you to effectively manage the flows of goods, information and finances from suppliers to consumers, minimize costs and optimize delivery speed. In logistics, risks play an important role, as they can have a significant impact on the effectiveness and results of logistics operations.

Risks can be diverse: from unforeseen events to insufficient information or ineffective processes. Risk management in logistics is the definition, classification and analysis of risks, as well as the development and application of appropriate strategies and methods for managing them. Understanding the risks and their consequences helps to make more conscious decisions and minimize potential negative impacts on logistics processes and supplies [14, p. 52].

In further scientific research, it is proposed to pay special importance to the measures of modern economic development to improve the system of management of logistics risk and evaluate their economic efficiency for the enterprise.

References

1. Andersen T., Schreder P. Strategic risk management practice; How to deal effectively with major corporate exposures. Cambridge: Cambridge University Press, 2020. 268 p.

2. Crouhy M., Galai D., Mark R. Risk management. New York: McGraw-Hill, 2021. 390 p.

3. Fuchs H., Wohinz J. W. Risk management in logistics systems. *Advances in Production Engineering & Management*. 2019. Vol. 4. № 4. P. 233-242.

4. Giaglis G.M., Minis I., Tatarakis A., Zeimpekis V. Minimizing Logistics Risks with Real-Time Vehicle Routing and Mobile Technologies: Current Research and Future Trends. *International Journal of Physical Distribution & Logistics Management.* 2024. Vol. 34, No. 9. P. 749-764.

5. Krivovyazyuk I., Smerichevsky S., Kulik Yu. Risk management of the logistics system of machine-building enterprises: monograph. Kyiv: Condor, 2018. 200 p.

6. Mamchin M. M., Rusanovskaya O. A. Impact of logistics risks on improving the efficiency of enterprises. *Bulletin of the National University "Lviv Polytechnic".* 2021. № 720. P. 45–51.

7. Mitchell E. M., Kovach J. V. (2016). Improving supply chain information sharing using Design for Six Sigma. *European Research on Management and Business Economics.* 2020. № 22 (3). P. 147–154. https://doi.org/10.1020/j.iedee.2015.02.002.

8. Oklander M., Oklander T., Pedko I., Yashkina O. Development of the subsystem of forecasting for the system of marketing information management at an industrial enterprise. *Eastern-European Journal of Enterprise Technologies.* 2021. № 5 (3 (89)). P.39-51. https://doi.org/10.15587/1729-4061.2021.111547.

9. Okoye C.C., Ofodile O.C., Tula S.T., Nifise A.O.A., Falaiye T., Ejairu E., Addy W.A. Risk management in international supply chains: A review with USA and African Cases. *Magna Scientia Advanced Research and Reviews.* 2024. № 10(1). P. 256-264.

10. Rodrigue J.-P., Dablanc L., Giuliano G. The freight landscape: Convergence and divergence in urban freight distribution. *Journal of Transport and Land Use.* 2021. № 10 (1). P. 557–572. https://doi.org/10.5198/jtlu.2017.869.

11. Sheff Y. Modeling Risks в Supply Chains. Finance and risk management for international logistics and the supply chain. B: Stephen X. H. Gong, K. Cullinane. Elsevier Science, 2018. P. 55-84.

12. Slavinska O., Stozhka V., Kharchenko A., Bubela A., Kvatadze A. Development of a model of the weight of motor roads parameters as part of the information and management system of monetary evaluation. *Eastern-European Journal of Enterprise Technologies.* 2019. № 1 (3 (97)). P. 46–59. https://doi.org/10.15587/1729-4061.2019.156519

13. Wang Y., Kung L., Byrd T. A. Big data analytics: Understanding its capabilities and potential benefits for healthcare organizations. *Technological forecasting and social change.* 2023. № 126. P. 3-13.

14. Yashkin D. S. Optimization methods in management of industrial enterprises logistics risks. *ECONOMICS: time realities*. 2022. № 5 (27). P. 52–58.