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METHODOLOGICAL FOUNDATIONS OF FINANCIAL RISK MANAGEMENT IN THE PROCESS OF LOGISTICAL SERVICE OF SUPPLY CHAINS

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МЕТОДИЧНІ ОСНОВИ УПРАВЛІННЯ ФІНАНСОВИМИ РИЗИКАМИ В ПРОЦЕСІ ЛОГІСТИЧНОГО ОБСЛУГОВУВАННЯ ЛАНЦЮГІВ ПОСТАЧАНЬ

In conditions of stochasticity of the external environment, effective financial risk management at all stages of goods and services transportation from the producer to the final consumer is one of the key tasks of logistics service providers. At the same time, financial risks are important factors that determine the stability and profitability of logistics operations and affect the competitiveness of raw material and material suppliers, carriers, and logistics centers that implement logistics services in supply chains. Thus, this study aims to analyze the key financial risks of logistics services in supply chains and develop methodological foundations for their effective management. Within the framework of the study, the authors highlight that logistics service in supply chains is a key component in ensuring the effective functioning of all stages of goods and services movement from the supplier to the final consumer. It's stated that this process includes the organization, control, and optimization of logistics

processes, particularly reducing costs, increasing delivery speed, and ensuring uninterrupted supply. An important aspect of the effectiveness of this process is financial risk management, which should be carried out according to a specific algorithm. It is necessary to identify financial risks by classifying them into appropriate types, which allows for a clear determination of the main threats to logistics services. An important stage is conducting an analysis and assessment of these risks using selected methods, which enables forecasting potential consequences and their impact on the financial situation of the company. An important aspect is the selection strategy for minimizing financial risks, reducing the likelihood of their occurrence and limiting potential losses. It is also crucial to conduct continuous monitoring and control of financial risks, allowing for prompt responses to changes in supply and transportation conditions. An essential aspect is the selection and use of modern information technologies, which ensure a high level of automation, accuracy, and efficiency in monitoring and risk management. The outlined provisions, in turn, allow for defining as further prospects of this research the development and implementation of innovative methods and technologies for optimizing financial risk management in the context of globalization and digitalization of supply chains.

В умовах високої стохастичності зовнішнього середовища ефективне управління фінансовими ризиками на всіх етапах транспортування товарів і послуг від виробника до кінцевого споживача є одним із ключових завдань логістичного обслуговування. При цьому фінансові ризики є важливими чинниками, що визначають стійкість і рентабельність логістичних операцій, а також впливають на конкурентоспроможність постачальників сировини та матеріалів, перевізників, логістичних центрів, які безпосередньо реалізують логістичне обслуговування ланцюгів постачань. Відтак, метою цього дослідження є аналіз ключових фінансових ризиків логістичного обслуговування ланцюгів постачань та розроблення методичних засад їх ефективного управління. У межах дослідження автори звернули увагу на те, що логістичне обслуговування ланцюгів постачань є ключовим компонентом забезпечення ефективного функціонування всіх етапів руху товарів і послуг від постачальника до кінцевого споживача. Констатовано, що цей процес включає організацію, контроль та оптимізацію логістичних процесів, зокрема зниження витрат, підвищення швидкості доставки та забезпечення безперебійності постачань. Доведено, що важливим аспектом ефективності цього процесу є управління фінансовими ризиками, яке має здійснюватися відповідно до певного алгоритму. Необхідно ідентифікувати фінансові ризики, класифікуючи їх за відповідними типами, що дає змогу чітко визначити основні загрози для логістичного обслуговування. Важливим є проведення аналізу та оцінки цих ризиків за допомогою обраних методів, що дає змогу прогнозувати можливі наслідки та їх вплив на фінансову ситуацію підприємства. Також важливим є вибір стратегії мінімізації фінансових ризиків, що дає змогу знизити ймовірність їх прояву та обмежити потенційні втрати. Крім того, необхідно здійснювати постійний моніторинг та контроль фінансових ризиків, що дозволяє оперативно реагувати на зміни в умовах постачання та транспортування. Останнім, але не менш важливим, є добір та використання сучасних інформаційних технологій, що забезпечують високий рівень автоматизації, точності та оперативності в процесах моніторингу й управління ризиками. Окреслені положення, своєю чергою, дозволяють визначити як подальші перспективи цього дослідження розробку та впровадження новітніх методів і технологій для оптимізації управління фінансовими ризиками в умовах цифровізації та глобалізації логістичних ланцюгів постачань.

Key words: raw material and material suppliers, carriers, logistics centers, transportation, exchange rate fluctuations, inflationary processes.

Ключові слова: постачальники сировини та матеріалів, перевізники, логістичні центри, транспортування, валютні коливання, інфляційні процеси.

PROBLEM STATEMENT

In conditions of stochasticity of the external environment, effective financial risk management at all stages of goods and services transportation from the producer to the final consumer is one of the key tasks of logistics service providers. Financial risks are an important factor that determines the stability and profitability of logistics operations and affects the competitiveness of companies that provide logistics services. The increase in transportation costs, exchange rate fluctuations,

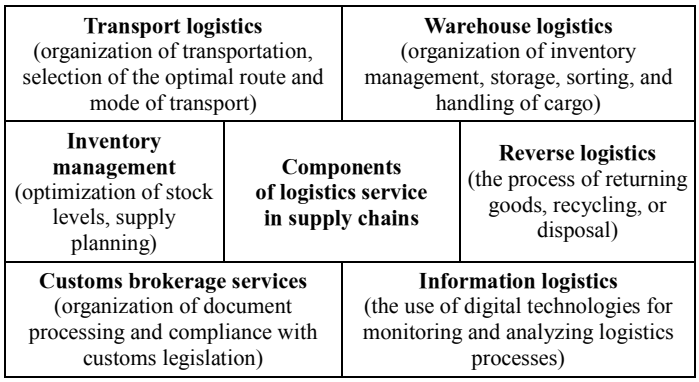

Figure 1. Main components of logistics service in supply chains

Source: compiled based on [4—6].

inflationary processes, and market instability create additional challenges for the logistics business, complicating the decision-making process.

One of the striking examples of the impact of financial risks on the logistics sector was the situation during the COVID-19 pandemic. Global and regional logistics service providers, such as Meest Group, DELIVERY, UPS Supply Chain Solutions, DHL Supply Chain & Global Forwarding, and others, faced significant financial losses due to the rapid increase in transportation costs, exchange rate instability, and disruptions in production processes. This underscores the need for the development of effective methodological approaches to financial risk management, which would contribute to enhancing the stability and efficiency of logistics operations.

ANALYSIS OF RESEARCH AND PUBLICATIONS

Certain aspects of the general problems of forming and assessing financial risks in this context have been studied by researchers such as Haidabrus N.V., Bilovodska O.A. [3], Burkina N.V., Kapitonez M.V. [2], Tsishchik R.V., and Kotys N.V. [6]. At the same time, the issue of selecting an appropriate strategy for minimizing financial risks in the logistics service processes of supply chains at the general level has been outlined by Morgulets O.B. [5], Akelmo V.H., and Kuchmiev O.O. [1].

However, despite these studies, the issue of a comprehensive approach to the formation and application of methodological foundations for financial risk management requires further in-depth analysis and clarification, considering the current challenges and changes in global supply chains.

FORMULATION OF THE ARTICLE'S OBJECTIVES

This study aims to analyze the key financial risks of logistics services in supply chains and develop methodological foundations for their effective management.

THE PAPER MAIN BODY

The authors emphasize that logistics service in supply chains is a set of measures to ensure the effective functioning of all stages of the movement of goods and services from the supplier to the final consumer. It involves the organization, control, and optimization of logistics processes by logistics service providers (including raw material and material suppliers, carriers, and logistics centers) and addresses the following tasks [2]:

— reducing costs;

— increasing delivery speed;

— ensuring uninterrupted supply.

— Thus, the main components of logistics service in supply chains are presented in Figure 1.

Thus, logistics service in supply chains ensures the continuity and efficiency of the movement of goods, which requires special attention to financial risk management, to be carried out according to the following algorithm:

Step 1. Financial risk typology identification. It involves identifying various types of risks that may arise in the logistics supply chain.

Step 2. Analysis and assessment of risks using selected methods. It involves a detailed study of each identified risk to assess its likelihood and potential impact on the company's financial results.

Step 3. Selection of a financial risk minimization strategy. It's the process of determining optimal measures to reduce the likelihood of risks occurring or mitigate their impact on the business.

Step 4. Monitoring and control of financial risks. This involves continuous observation of risks and their changes during the company operation and implementing measures to adjust or adapt to new conditions.

Step 5. Selection and use of modern information technologies. This involves risk monitoring and analysis automation.

The action of the outlined algorithm is combinatorial, as it is based on its customized nature, which, considering the specified specifics, should be examined in more detail [5-6].

Regarding the identification of financial risks, it is important to note that the main financial risks in logistics services for supply chains include [4]:

1. Risks associated with fluctuations in transportation costs (e.g., changes in fuel prices, transportation tariffs).

2. Currency fluctuation risks (for international supplies, where changes in exchange rates can impact the cost of goods and services).

3. Risks of customs and tax changes, which may result in additional expenses for international suppliers.

4. Risks of delivery delays, which may occur due to weather conditions, political instability, or issues at customs.

Regarding the analysis and assessment of risks, note that the manifestations of the identified risks can be diverse. One such manifestation is price changes due to fluctuations in transportation costs. Note during the pandemic, many participants in logistics services faced a container shortage due to port closures and reduced production volumes. The realization of this risk led to delays in cargo delivery and a sharp increase in transportation prices. As a result, for example, sea freight rates from China to the USA increased by 3—4 times, forcing logistics service providers to reassess their logistics strategies and seek alternative routes.

Table 1. Formats of strategies for minimizing financial risks in the logistics service process of supply chains

Formats of strategies	Main focus of action	Advantages of application	Key factors in choosing a strategy.
Diversificati on of suppliers and logistics channels	Allows for reducing dependence on a single supplier or transport company.	Helps to select the most optimal supply/transportation channel or choose an alternative.*	Avoidance of risks associated with monopoly or limited capabilities of the supplier or carrier. Increased flexibility when changing supply or transportation conditions.
Cargo and vehicle insurance	Protection against losses or damage to goods during transportation.	Helps to compensate for losses related to accidents, theft, damage to cargo or transport.	Reduction of financial losses in the event of accidents or unforeseen events. Strengthening trust between partners and suppliers.
Hedging currency risks	Protection against fluctuations in exchange rates during international operations.	Ensures stability of costs and revenues in the event of exchange rate fluctuations, which can be critical in international supplies.	Minimization of financial losses associated with currency fluctuations. Reduction of unforeseen costs in international markets.
Optimization of warehousing and transportation costs	Reduction of storage and transportation costs for goods and cargo.	Reduction of unnecessary costs, improvement of logistics operations efficiency, and ensuring a decrease in logistics expenses.	Improvement of transportation and warehousing cost savings. Enhanced control over inventory and transportation, allowing for increased flexibility and cost reduction.

Note:
*If the supply or transportation channel is blocked or becomes more expensive, there is the possibility to use another, more cost-effective one.
Source: compiled based on [2—3; 5].

Table 2. Format for monitoring and controlling financial risks arising in the hrocess of logistics services for supply chains

Elements of monitoring and control	Main focus of action	Advantages of application
Regular risk and financial indicator analysis	Periodic risk review	Allows for timely identification of changes in the external environment or internal processes of the company that may impact its financial situation.
	Financial indicator analysis	Allows not only to track current financial results but also to forecast future expenses in the context of changing risks.
Monitoring of contract and supply performance	Contract performance control	Allows for detecting potential breaches of contract terms, such as delays in delivery or cost increases, and quickly adjusting plans.
	Supply monitoring	Enables timely identification of possible deviations from the plan and allows for quick adjustments to the strategy to ensure agreements are executed within the planned budget and timelines.
Synergy between risk analysis and contract performance monitoring	Integration of regular risk analysis and contract performance monitoring	Helps maintain a balance between forecasting potential changes and responding promptly to actual situations.

Note:
*This may include changes in transportation costs, currency fluctuations, political or economic changes that could lead to increased expenses or loss of profit.
Source: compiled based on [5—6].

Regarding Ukraine, in 2022, the increase in excise duties on fuel and lubricants, along with other factors, led to a rise in the costs of logistics services within the country's supply chains. It forced many logistics companies to urgently adapt their pricing strategies or search for alternative ways to reduce costs, such as changing routes or using different types of transport.

Assessing the potential impact of these risks on the logistics service provider's financial condition is a key step. Various methods are used for this purpose, namely [2-3]:

1. Sensitivity analysis. This method involves assessing how changes in individual parameters can affect the financial indicators of a logistics service provider. Sensitivity analysis helps identify critical factors that the entity should focus on and provides the opportunity to estimate the magnitude of potential financial losses if these factors change. For example, in the case of a significant increase in fuel prices, as occurred during the pandemic, a company can use sensitivity analysis to forecast how the rise in transportation costs will affect its overall profit or the final product price.

2. Scenario method. This method involves creating different models of potential developments that may occur due to changes in the market or the external environment. It allows built of several future scenarios so that the logistics service provider can prepare for various situations and

Table 3. Formats of modern information technologies in financial risk management within the process of logistics service in supply chains

Modern information technologies	Main focus of action	Advantages of application	Key factors in selecting technology
ERP-systems	Ensure the integration of all business processes within a company into a single platform, allowing for the automation of financial accounting, inventory management, procurement, production, logistics, resource allocation, and many other processes.	Create a unified database where all information is available in real time, allowing for quick responses to changes and risks.	Allows for continuous tracking of the company's financial performance. Enables real-time monitoring of suppliers and available stock levels.
WMS-systems	Ensure the automation of warehouse operations management, such as goods receipt, storage, order processing, packaging, and shipment.	Help optimize the placement of goods, facilitate monitoring of stock levels and processes in the warehouse.	Allows for reducing storage costs and improving inventory management. Helps reduce the likelihood of errors in handling goods and ensures timely order dispatch. Enables the prompt tracking of storage costs for goods.
TMS-systems	Ensure route planning, carrier selection, vehicle monitoring, transportation cost management, and reporting.	Help automate transportation management	Helps reduce transportation costs and, accordingly, financial risks associated with rising delivery costs. Allows for timely detection of delays or unforeseen situations, which reduces the risk of delivery deadline violations.

Source: compiled based on [1; 5—6].

assess their financial consequences. For example, a logistics service provider may create scenarios considering potential changes in transportation tariffs or exchange rates.

3. Statistical analysis. This method involves statistical techniques to assess the probability of various risks occurring and their financial impact. Typically, mathematical models, such as the Monte Carlo method, are used, which allows for the simulation of thousands of event scenarios and the estimation of the probability of each. For example, in the case of currency fluctuations, statistical analysis can be used to determine the likelihood of how changes in exchange rates may impact a logistics service provider's costs for transportation and customs fees.

4. Cost-benefit analysis. This method allows for comparing the costs associated with risks to the benefits of implementing specific strategies to minimize them. The cost-benefit assessment helps determine whether to invest in measures such as cargo insurance or long-term contracts with suppliers. For example, a cost-benefit analysis can be useful when choosing between two logistics strategy options:

1. On one hand, logistics service providers may enter into long-term contracts with clients to lock in transportation rates.

2. On the other, they may agree to variable rates that could decrease during periods of low demand.

Regarding the choice of a strategy to minimize financial risks, the implementation of the outlined task is possible through [2; 5]:

— diversification of suppliers and logistics channels;

— cargo and vehicle insurance;

— hedging currency risks;

— optimization of warehousing and transportation costs.

So, the formats of strategies for minimizing financial risks in the logistics service process for supply chains are outlined in Table 1.

Note that while each outlined strategy has a significant long-term impact on the stability and efficiency of supply chains, their choice depends on the specific conditions of the logistics company's operation, such as business size, geographical scope, types of goods, and markets.

Additionally, it is always important to maintain the continuity of supply processes, reduce the likelihood of disruptions in the supply chain, and improve financial outcomes, which are critical for achieving stability and efficiency in the long-term functioning of supply chains.

Regarding the monitoring and control of financial risks, it should be noted that it must include both regular risk

analysis (or periodic review of risks and financial indicators) and the analysis of contract and supply performance. Thus, the format for monitoring and controlling financial risks arising in logistics services for supply chains is outlined in Table 2.

Monitoring and control of financial risks is a continuous and integrated process that encompasses strategic planning and operational management. Regular analysis of risks and financial indicators allows for adapting strategies to changes in market conditions and ensures flexibility in supply chain management. At the same time, monitoring the execution of contracts and deliveries ensures that agreements are carried out within budget and deadlines, which is critical for maintaining the stability and efficiency of the business in the face of unpredictable changes.

Regarding the processes of selecting and using modern information technologies, their format should be developed in such a way as to ensure the maximum deepening of automation, as well as operational efficiency and accuracy in monitoring and risk management, taking into account the logistics service format [2]. Thus, the main formats of modern information technologies that can be applied in financial risk management within the logistics service in supply chains are WMS, TMS, and ERP (Table 3).

It should be noted that the selection and integration of WMS, TMS, and ERP systems help reduce human errors, improve the efficiency of supply chain management, and ensure timely response to risks that arise during the process.

Thus, the components of the financial risk management algorithm presented above form a systematic approach, which is the key to the stability and efficiency of the system functioning of interconnected processes, covering all stages of the movement of goods and services from initial suppliers to final consumers.

CONCLUSIONS

As part of the study, the authors highlighted that logistics service in supply chains is a key component in ensuring the efficient functioning of all stages of the movement of goods and services from the supplier to the final consumer. It has been established that this process includes the organization, control, and optimization of logistics processes, particularly cost reduction, increased delivery speed, and ensuring uninterrupted supply.

A crucial aspect of the efficiency of this process is financial risk management, which should be carried out according to a specific algorithm. In particular, it has been proven that:

1. It is necessary to identify financial risks by classifying them according to relevant types, allowing for a clear definition of the main threats to logistics services.

2. Conducting analysis and assessment of these risks using selected methods is essential, as it enables forecasting of possible consequences and their impact on the company's financial situation.

3. Selecting a strategy for minimizing financial risks is important, as it helps reduce the likelihood of their occurrence and limit potential losses.

4. Continuous monitoring and control of financial risks are crucial, allowing for prompt response to changes in supply and transportation conditions.

5. The selection and use of modern information technologies, particularly ERP, WMS, and TMS systems, are essential to ensure high automation, accuracy, and efficiency in risk monitoring and management processes.

These provisions, in turn, allow for identifying the development and implementation of innovative methods and technologies for optimizing financial risk management in the context of globalization and the digitalization of supply chain logistics as a promising direction for further research.

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