ABOUT THE AUTHORS

Adambekova Aynagul Amangeldinovna – PhD in Economics, Professor of the Department of Management, HSEB, Al-Farabi Kazakh National University, email: ainatas0408@gmail.com, ORCID ID: 0000-0003- 2026-4321*

Salimbaeva Rasima Amenovna – PhD in Economics, Associate Professor, Narxoz University, email: salimbaeva.rasima@narxoz.kz, ORCID ID: 0000-0003-0096-5657

Timothy O. Randhir – PhD, Full Professor, Department of Environmental Conservation, University of Massachusetts, Amherst, email: randhir@umass.edu, ORCID ID: 0000-0002-1084-9716

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IMPROVING SUPPLY CHAIN SECURITY THROUGH LOGISTICS RISK MANAGEMENT

O. V. Koshkina[1], A. Z. Nurmagambetova[2] , A. M. Nurgaliyeva[3]*
[1]University of International Business, Almaty, Kazakhstan
[2] al-Farabi Kazakh National University, Almaty, Kazakhstan
[3] Narxoz University, Almaty, Kazakhstan

ABSTRACT

Research objective. To conduct a comparative analysis of logistics risks in Kazakhstan and the USA, identifying key vulnerabilities, assessing their impact on supply chains, and developing specialized risk management strategies.

Methodology. A mixed-method approach was used: quantitative analysis (World Bank LPI, trade statistics) and qualitative expert interviews. Applied SWOT analysis, risk mapping, and comparative assessment. Theoretical framework includes Sheffi (2022), ADB/WTO reports, state programs ("Nurly Zhol").

Originality/value. A comparative risk matrix for differently developed economies was created. Practical significance is evidenced by calculations: $2.1B rail gauge standardization reduces delays by 30%; NIST compliance cuts cyber incidents by 70%.

Results. Structural disparities were identified:

- Kazakhstan: infrastructure gaps (22% roads meet standards), geopolitical risks (68% EU transit via Russia);
- USA: cyber threats ($4.3M damage/incident), climate risks ($18B annual losses).

Priority solutions: for KZ – developing "Middle Corridor", for USA – port cybersecurity.

This study contributes to the existing body of knowledge by providing a comparative analysis of logistical risk factors in different economic contexts (notably Kazakhstan and the USA) and proposing a novel integrated theoretical and methodological framework for risk assessment and management tailored for industrial enterprises.

Keywords: logistics risks, supply chain resilience, transit corridors, sanctions exposure, cybersecurity, infrastructure adaptation, comparative analysis.

INTRODUCTION

The primary objective of supply chain management (SCM) is to ensure its security, i.e., to minimize the occurrence of risks within the system. The goal of effective supply chain security is the timely identification and assessment of logistical risks and the prioritization of measures to manage them through multi-level protection.

This requires careful planning of all supply chain links, as well as the enterprise's assets and infrastructure related to product manufacturing. When ensuring supply chain security, enterprises must also take into account legal and regulatory frameworks, such as national security standards or customs regulations for international supply chains.

The initial step in ensuring supply chain security involves identifying all possible vulnerabilities within the system. This is followed by the adaptation of general enterprise risk management practices to address and prevent these vulnerabilities.

Supply chain security must be a priority for enterprises, as disruption of links within the chain can cause economic damage or completely halt operations. Vulnerabilities in the supply chain can lead to unnecessary expenses, inefficient delivery schedules, and product loss. Moreover, the delivery of damaged goods or late services can harm customers and result in costly lawsuits. Implementing a logistics risk management system can help protect supply chains from various threats.

Although risks cannot be fully eliminated, effective risk management within supply chains can ensure safer and more efficient movement of goods and services and enable quick recovery from disruptions.

Finding solutions to issues related to logistics risk management is currently of high relevance. Risk has become an integral part of the strategic and tactical economic policies of enterprises. Accordingly, it is natural for any enterprise to strive to reduce losses associated with the realization of risks in logistics operations.

The aim of this article is to provide a theoretical and methodological analysis of logistics risk management processes in industrial enterprises.

This research aims to address an identified gap in the literature concerning the lack of a unified framework for classifying and managing logistics risks specific to the operational contexts of industrial enterprises, particularly in emerging economies like Kazakhstan, while also drawing comparative insights from more developed systems such as that of the USA.

The research methods employed include theoretical analysis of scientific literature, systematization, interpretation of conceptual statements, empirical methods, and comparative analysis.

To achieve this goal, the following tasks are defined:

- To study risk classification and assessment methods;
- To identify factors and determine ways to mitigate risks;
- To define a decision-making algorithm for managing logistics risks.

LITERATURE REVIEW

Currently, a large and growing number of academic studies are devoted to the issues of uncertainty and risk within the logistics sector. In an era where the economy is primarily driven by knowledge and information, the ability to anticipate events and adjust company policy accordingly becomes particularly important [1].

Risk refers to the likelihood of an event that can negatively affect the achievement of a company's objectives. The effectiveness of logistics systems is inherently linked to risks, which necessitates the continuous development of risk management methods and tools [2].

Risk management involves the process of decision-making and implementing actions, including risk analysis and the development of mitigation strategies, aimed at achieving planned financial outcomes and creating conditions for the company's further development [3].

Risk is a complex phenomenon with many conflicting and sometimes opposing foundations and premises, which justifies the existence of multiple definitions of the term from different perspectives [4].

In today's economic conditions, it is essential to systematically identify and analyze risks that influence business processes and their performance, in order to ensure the company's survival and competitiveness. Beyond goal achievement, risk assessment can also help improve business processes. The effectiveness of logistics systems is closely linked to risk, highlighting the need for ongoing advancement in risk management methods and tools [6, 7].

Risk management involves making decisions and taking actions, including analyzing risks and developing strategies to minimize them, with the aim of achieving planned financial results and creating a foundation for future company growth.

The drive to ensure an adequate level of competitiveness in logistics systems under the challenging conditions of the modern economy has motivated the development of various resource-saving and loss-minimization concepts. However, implementation of these concepts is often complicated by certain barriers, including the high sensitivity of specific logistics processes [8].

Despite the significance of the issue and the rapid development of risk management, there remains a need to develop the methodological foundations for risk management in logistics systems due to the lack of practical tools for risk analysis and assessment.

Rapid changes in the business environment are giving rise to new risks and risk categories, while also increasing the complexity of logistics processes. This necessitates the improvement of risk classification systems and analysis methodologies [10, 11].

Uncertainty has become a constant characteristic of modern supply chain management, leading to shorter product life cycles, reduced lead times, and increased exposure to risk.

Early 2020 also revealed significant supply chain issues, exacerbated by the uncertainty caused by the COVID-19 pandemic [12]. With growing complexity and the offshoring of production to developing countries, companies have become increasingly vulnerable to supply chain uncertainty (SCU). SCU, explained as turbulence that can occur at any point in the supply chain network – resulting in either positive or negative outcomes – has significant implications for manufacturing planning and control (MPC) activities. It is asserted that when companies face uncertainty in their supply chains, they attempt to manage their internal production activities to mitigate these uncertainties [13].

Risk management is a fairly complex activity. The main goal of a risk management system is to ensure the successful functioning of an organization under conditions of risk and uncertainty [11, p.144].

However, a number of studies (e.g., [14]) justify the need to narrow the research scope on risk issues, due to the global nature of supply chains, both in terms of the number of stakeholders and the complexity of processes, as well as the need to account for numerous heterogeneous factors, whose impact on the entire supply chain is difficult to assess due to the multidimensionality of the task.

Focusing on the similarity of the terms “logistics” and “supply chain management” from an object-oriented perspective, researchers [15, 16] define logistics risk as an unforeseen, undesirable event resulting in the unavailability of required materials at the right time, in the required quality, at the right location, and at the planned cost. Risk management in logistics is complicated by several barriers, including centralized product distribution, changing customer expectations, lack of necessary information, challenges in managing information and outsourcing flows, and inconsistencies in standards used by partners [17].

Additionally, with few exceptions, authors rarely specify or justify the principles used for classifying logistics risks. In [18], logistics risks are defined as “external factors affecting system reliability. These include risks related to management reliability, scheduling reliability of inbound and outbound flows, and risks concerning the evaluation of safety stock (or regulatory) levels.” The author in [19] defines logistics risk (used synonymously with logistics activity risk) as a situation of “potential failures (non-conformities) in business processes triggered by specific events, the criticality of which, from the perspective of the decision-maker, either prevents the achievement of planned results or, conversely, allows for exceeding them through alternative opportunities.”

According to one perspective, “logistics risks encompass various types of risks affecting all components and elements of the logistics system, both in the transformation of material, financial, and information flows and in the process of risk management itself” [20].

Authors [21] define the scope of logistics risks within the broader category of commercial risks, including customs risks, supply disruption risks, and damages during logistics operations across all supply chain links. They also identify specific logistics risks, such as those requiring insurance for high-value shipments under special contract terms.

Transportation risks, often excluded from the logistics risk category, are divided into "hull" risks (originating from the transport vehicle) and "cargo" risks (related to the goods being transported). Some authors, however, classify them under logistics risks (see Appendix).

A classification approach proposed by [22] is based on the logical chain “flow – process – system characteristic – subjective factor,” representing key elements of an economic system.

The attempt to distinguish "logistics risk" as a separate category, define the term, and systematize its types was first made in [22]. For developing a logistics risk model, it is proposed to identify risks by analyzing technologies in functional areas and at different levels of logistics management, distinguishing between logistics and non-logistics risks.

According to [23], "logistics risks involve the risks associated with logistics operations such as transportation, warehousing, cargo handling, inventory management, and logistics management at all levels, including managerial risks arising during the execution of logistics functions and operations."

The author in [24] advocates for the inclusion of a new functional logistics area into academic discourse: "risk logistics," defined as the theory and practice of managing risk flows based on a systems approach.

Here, a risk flow is described as "a set of random situations associated with the movement of material or other flows, influencing the nature of flow processes."

Supply chain risks (or logistics system risks) are classified by "risk centers," which include functional subsystems (e.g., warehousing, customer service), infrastructure objects, resources, and, according to the process approach, by levels: operations, infrastructure, supply chain links/nodes, logistics system, and environment.

The definition of supply chain risks as "an activity factor characterized by specific conditions of occurrence, impact intensity, and resource potential, serving simultaneously as an indicator, integrator, and regulator of the supply system's state," is suggested by [25]. Risk is viewed as a source of additional opportunities and a way to enhance the competitiveness of the supply system and its participants by eliminating bottlenecks and focusing on key success factors [26].

Most scientific and research works use the term "supply chain risk" rather than "logistics risk" or similar variations. The differences between international and domestic research approaches can be attributed to the differing stages of logistics and supply chain management conceptual development in academic centers and companies across countries. For example, in the annual study "Logistics Development in Russia: Current Situation, Forecast, Key Tasks, and Company Priorities," the issue of logistics risk management is not addressed at all. It is only indirectly mentioned in the "Study of Logistics Controlling at Russian Enterprises," conducted in 2021–2022 by the International Center for Logistics Training at the HSE University [27]. This study included construction companies (4%).

Despite the high importance of cost control, service level enhancement, and logistics responsiveness, more than half of the surveyed companies (54%) lacked a controlling system, and 31% were just starting to implement one. At the same time, the evaluation of internal and external logistics effectiveness ranked only 9th and 12th out of 13 key logistics issues.

Authors Karkinbayeva, S. I., Kirdasinova, K. A., Adiyetova, E. M., Kanatova, A. Z., and Korgan, B. B. argue that insurance is one way to reduce risk. There is a viewpoint that insurance increases managerial responsibility by requiring informed decision-making and regular preventive and protective measures as stipulated in insurance contracts. However, insuring logistics risks alone cannot guarantee the reliable operation of the entire supply chain. As supply chains increasingly adopt various innovations in management and product storage, these innovations must also be considered in risk management. In this case, insurance as a means of risk mitigation may have limitations, as it is difficult to assess the reliability of new technologies and lacks analogs [28].

In today's rapidly changing business environment, companies are constantly seeking ways to gain competitive advantage and improve performance. One of the most significant developments in recent years has been the transformation of traditional supply chains into digital ones. This transformation is not just a trend; it is a strategic imperative for companies striving to thrive in the digital age. The growing spread of digitization processes means that all customers today expect availability, personalization, low costs, and high value. Authors Moldabekova, A., Zhidebekkyzy, A., Akhmetkaliyeva, S., and Baimukhanbetova, E. identify possible managerial implications for improving logistics service quality through information and communication technologies [29]. In the modern world, the digital economy plays an increasingly important role in managing logistics processes. Accordingly, the analysis of logistics risk management in supply chains becomes a key aspect of successful organizational performance. However, methodological foundations of risk management remain underexplored.

Scholars emphasize the importance of the following under-researched areas:

- Integrated approach: Many researchers recommend an integrated risk management approach that combines strategic, tactical, and operational management.
- Proactive methodologies: The application of proactive methods enables the anticipation of potential risks and the development of preventive measures...
- Methods of Managing Logistics Risks
- Risk assessment: Conducting a systematic risk assessment allows companies to identify vulnerabilities in supply chains and take appropriate measures;
- Use of technologies: The application of digital technologies such as big data analytics, machine learning, and blockchain contributes to more accurate risk forecasting and improved logistics management;
- Process automation and optimization: The development of digital technologies enables the automation of many logistics operations, which helps reduce risks and increase supply chain efficiency;
- Intelligent data analysis: The use of artificial intelligence and data analytics allows for more accurate risk prediction and better-informed management decisions.

MATERIALS AND METHODS

A systematic review approach was used to thoroughly analyze the scientific literature, applying both quantitative and qualitative methods. The research methodology is based on general scientific methods, including analysis, synthesis, generalization, induction, deduction, and classification. Additionally, the proposed improvement in the risk analysis method is based on the use of a risk register, mathematical methods, expert assessments, and risk evaluation tools.

The risk register is used to collect necessary information about threats that may arise during specific processes, analyze them, and develop measures to prevent or minimize the consequences of risk events. This tool can be used to identify and assess a company's risks as a whole, as well as risks in its subsystems, including procurement management, inventory management, production, and more. The risk register should be reviewed and updated at regular intervals to ensure continuous monitoring.

In total, 100 companies agreed to participate in the survey. In all these companies, respondents mainly worked in operational management positions such as operations managers and supply chain managers. To assess risks using the method proposed in the study, it is necessary to determine the impact of identified risks on the examined processes and business outcomes, using expert evaluation methods. The theoretical foundation of the study consists of scientific articles by international researchers in the field of risk analysis and management, including risks associated with logistics systems. Theoretical analysis of the academic literature revealed that theoretical and practical issues of logistics risk management in supply chains have been addressed by both domestic and international researchers and specialists. These works focus on the properties of supply chains, their response to risks, and the development of methods to improve their resilience and reliability in the face of risks.

Risk management is the process of making and implementing managerial decisions that minimize the adverse effects of damage caused by random events.

The importance of studying the problem of logistics risk (or supply chain risk) cannot be overstated. For example, a study initiated by Oracle Corporation found that a larger percentage of companies in Russia (77%) suffer from unpredictable disruptions (most of which are man-made) in their "value creation chains" compared to Europe (63%). According to our research, 71% of respondent companies in Kazakhstan experience disruptions in the supply chain. The manufacturing and construction sectors showed one of the highest rates (second only to the transport sector, which shares this position with the financial sector). Among Kazakhstani companies surveyed, only 30% reported conducting a comprehensive risk assessment.

Companies that experienced disruptions in their value chains over the past 12 months spent, on average, more than 60 days restoring normal operations after an incident. The average cost per incident was approximately $600,000, including losses from missed sales and customers, product recalls, and recovery measures. According to our survey in Kazakhstan, these costs were around $30,000 per incident, which is lower than the regional average.

Of course, the results of such a study may raise concerns about the qualitative composition of respondents (the same questionnaire was completed by representatives from different industries). Questions also arise regarding the possible variance in terminology interpretation and the interrelation of assessment parameters. However, these findings are confirmed by another study, which showed that 70% of respondents lack complete information about risks and disruptions in their supply chains – a figure that has remained consistent over several years.

DATA ANALYSIS

It is important to emphasize that the aforementioned studies mainly focused on examining external, macro-level risks in supply chains. Alternative surveys distinguish a separate category of risks associated with supply chain operations. According to a global study conducted by the Allianz group of insurance companies at the end of 2021, this category was recognized as the most critical among the ten most significant business risks for 2022 (Figure 1).

These findings are corroborated by the study conducted by Marchese K. and Pundmann S. The survey focused on risk categories within the supply chain. Respondents expressed the greatest concern regarding risks associated with interactions with supply chain partners (63%) and "internal" risks, when combining the importance of risks in core and supporting supply chain processes managed directly by the focal company (46% + 35%) – Figure 2.

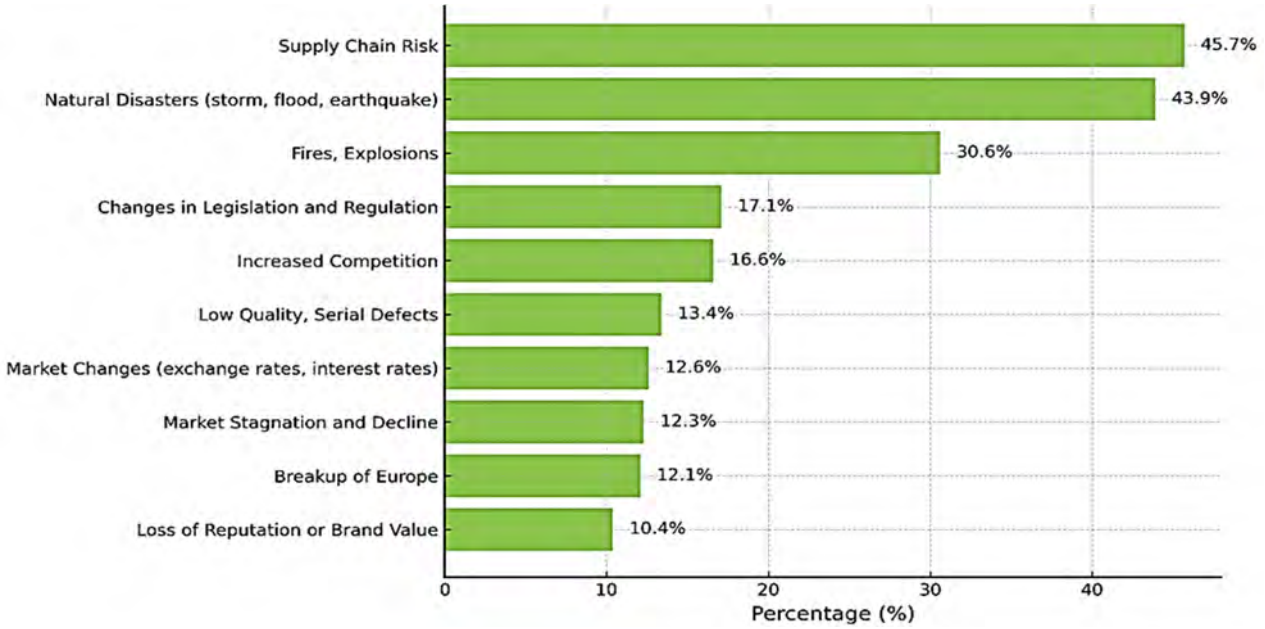

Figure 1 – Top 10 Business Risks of 2022
Note – compiled by the author based on source [30]

The most frequently cited issues include demand uncertainty, competitor behavior, as well as order fulfillment errors and shortages from counterparties (partners and suppliers) in the supply chain.

Most respondents noted an increase in the frequency (48% reported growth, 31% indicated a slight increase/no change) and costs (53% reported growth, 31% indicated a slight increase/no change) associated with risk events. Another critical finding of the study is worth highlighting: although two-thirds of companies have a supply chain risk management program, only half of their representatives consider it effective. This is primarily attributed to:

Lack of adequate cross-functional coordination,

High costs of implementing supply chain risk management strategies,

Deficiencies in the controlling system, which prevent assessing the consequences of risk events compared

to the potential effects of risk mitigation measures,

Absence of or limited information sharing across the supply chain,

Lack of designated "owners" for risk management processes at strategic and tactical levels within the company,

Absence of a holistic/systemic definition of risk in supply chains.

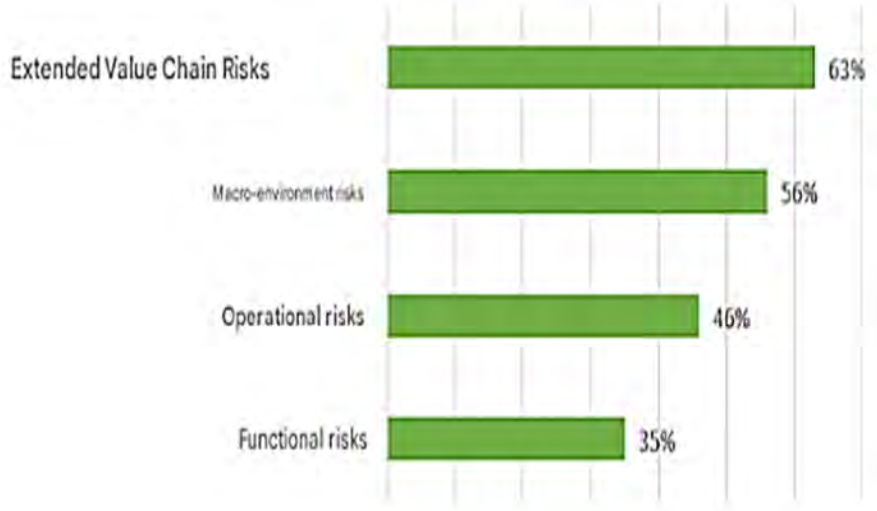

Figure 2 – Ranking of Supply Chain Risks by Severity
Note – compiled by the author based on source [31]

The fact that even global market leaders do not always manage supply chain risks effectively is further corroborated by other studies [32]. According to PWC's 2021 estimates, over 60% of the world's largest companies (out of 209 surveyed) saw their performance metrics deteriorate by more than 3% due to supply chain disruptions (Figure 3).

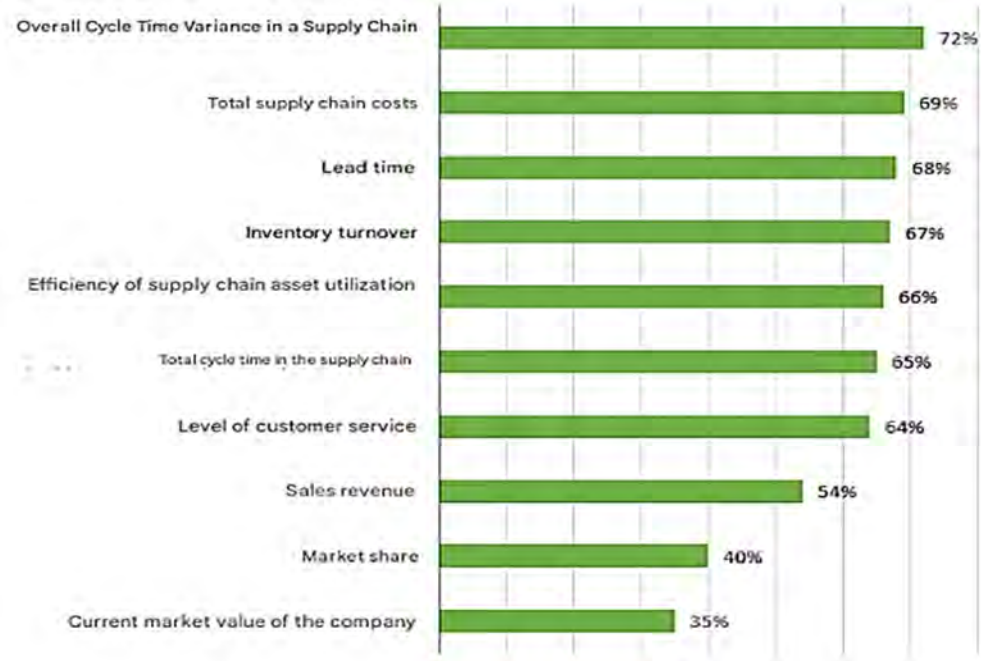

Figure 3 – Percentage of Companies Whose Supply Chain Disruptions Led to a Deterioration of Performance Metrics by Over 3%
Note – compiled by the author based on source [33]

Furthermore, the role of logistics risk management in enhancing key logistics performance metrics within companies remains undervalued. This is evidenced by the low priority placed on critical controlling objectives such as transparency of logistics costs and processes, generating actionable data for decision-making, and minimizing supply risks (Figure 4).

Figure 4 – Importance of Objectives in Logistics Controlling
Note – Compiled by the author based on source [34]

Domestic researchers are actively addressing challenges related to specific types of logistics-associated risks, such as transportation risks (by mode of transport, e.g., risks inherent to logistics enterprises, logistics outsourcing, procurement, staffing, inventory management, warehousing, etc.). For instance, the anti-corruption agency identified corruption risks in the operations of the national company Kazakhstan Temir Zholy (KTZ). These risks stem from administrative barriers and corrupt schemes in wagon allocation, inadequate digitalization, direct contact between railway employees and entrepreneurs, and the submission of requests in paper form. These corruption risks are further corroborated by criminal statistics. Over the past five years, 136 criminal cases have been registered against officials of KTZ and its subordinate organizations, resulting in 52 convictions. The majority of offenses in this sector involve bribery (70%) and embezzlement (13%).

Key steps in risk management for Kazakhstan Temir Zholy may include:

– Risk Identification: The company must identify all potential risks in its operations, including financial risks (currency fluctuations, inflation) and operational risks (technical failures, accidents).

– Risk Assessment: After identifying risks, their likelihood and impact on business operations must be evaluated using methods such as risk matrices or sensitivity analysis.

– Risk Mitigation Strategy Development: Based on assessments, strategies to manage risks should be formulated, ranging from prevention (e.g., adopting new technologies) to minimizing negative consequences (e.g., insurance policies).

– Monitoring and Control: Risk management requires continuous oversight to detect emerging risks and evaluate the effectiveness of mitigation measures.

For example, KTZ could reduce railway accident risks by implementing advanced monitoring and predictive technologies. Insuring assets and personnel against accidents could further mitigate financial losses. Overall, risk management is critical for ensuring KTZ's sustainable growth and market competitiveness.

DISCUSSION

Railway companies like Kazakhstan Temir Zholy (KTZ) face diverse logistics risks. This review examines risk management approaches and methods using KTZ as a case study.

Approaches to Risk Management:

a) Safety Culture Development: A key approach for KTZ is fostering a safety-oriented culture among staff and implementing preventive controls.

b) Technology Integration: Adopting digital tools enhances supply chain transparency, enabling early risk detection.

Proposed Risk Management Methods:

a) Safety Audits: Regular audits and safety evaluations help identify vulnerabilities and improve operational security.

b) Staff Training: Training employees on safety protocols and emergency response enhances preparedness.

Outlined Development Prospects:

a) IoT and Data Analytics: Implementing IoT and analytics systems enables real-time monitoring and proactive risk management across the rail network.

b) Risk Management System Optimization: KTZ aims to refine its risk management framework through continuous evaluation and adoption of best practices.

Logistics risks are inherently tied to disruptions in goods/information flows and external environmental factors. Effective risk management in logistics relies on robust identification and analysis of threats.

For industrial enterprises in Kazakhstan, the findings underscore the critical need to move beyond basic risk identification towards implementing structured, proactive risk management systems. The case of KTZ demonstrates that investing in technological modernization (e.g., IoT, digital twins for supply chain mapping) and human capital (specialized training in risk assessment and mitigation) is not merely beneficial but essential for enhancing resilience. Furthermore, the development of transnational corridors like the "Middle Corridor" presents both new opportunities and complex risks, necessitating the adaptation of the proposed framework to manage cross-border logistical challenges, intermodal operations, and geopolitical factors specific to the region.

CONCLUSION

The term "logistic risk" has become increasingly prevalent in academic and analytical literature over the past decade and is now firmly embedded in professional discourse. However, there remains a lack of consensus on its definition, taxonomy, and alignment with established categories of business risks. Terms such as "logistic risk," "risks in logistics," "risks in logistic systems," "risks in logistic activities," and "supply chain risks" are often used interchangeably. Attempts to classify logistic risks frequently result in overlapping risk scenarios across categories, inconsistent classification criteria, and the conflation of risk factors, sources, causes, events, and consequences under a single risk group.

In analyzing risks within logistics theory, researchers often adapt existing risk management frameworks, aligning general economic risk classifications with specific stakeholders or components of logistic systems: suppliers, customers, logistics service providers, manufacturing and trading enterprises, logistics infrastructure entities, and internal departments.

Some scholars categorize issues such as information distortion, contract renegotiations (e.g., price hikes), contract termination, customer switching, and supply/distribution breaches as part of a broader class of coordination risks in supply chains. These risks arise from misalignment between departments, companies, suppliers, customers, and other stakeholders in ensuring product delivery through the supply chain with maximal mutual

benefit. Additionally, innovation risks are highlighted, encompassing uncertainties in cross-functional collaboration between a focal company, its suppliers, and clients to develop new strategies for growth and sales. This category includes risks related to market selection, emerging technologies (both in core production and supporting logistics), and competitive advantages in management practices, operational technologies, and cost structures.

For Kazakhstani companies, the primary tasks in risk management remain risk identification and assessment. The success of these tasks determines the effectiveness of subsequent actions: risk response planning, monitoring (risk measurement), implementation of mitigation measures, and control. Thus, a robust scientific-methodological foundation for risk management – starting with standardized terminology and taxonomy, followed by methods for identifying risk causes and consequences – is critical to enhancing risk management efficacy in business.

The case of Kazakhstan Temir Zholy (KTZ) demonstrates that risk management in the railway sector requires a holistic approach, integrating safety culture development, technology adoption, safety audits, and staff training. With advancements in digital tools like IoT and data analytics, railway companies can better manage risks while improving operational safety and efficiency.

The key conclusions of this study can be summarized as follows:

- The theoretical and methodological framework for managing logistics risks must be adaptive and integrated, combining strategic, tactical, and operational levels of management.
- A comparative analysis reveals significant differences in the structure and prioritization of logistics risks between industrial enterprises in Kazakhstan (where infrastructure and internal process risks dominate) and the USA (where cybersecurity and demand volatility are more prominent), necessitating context-specific risk mitigation strategies.
- For Kazakhstani enterprises, immediate practical value lies in implementing systematic risk identification tools (like the proposed risk register adaptation) and investing in digitalization and personnel training to build resilience.
- The proposed framework addresses a clear research gap by offering a structured approach to logistics risk classification and management tailored for industrial sectors in emerging economies, contributing to the enhancement of supply chain security and overall competitiveness.

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ЛОГИСТИКАЛЫҚ ТӘУЕКЕЛДЕРДІ БАСҚАРУ АРҚЫЛЫ ЖЕТКІЗУ ТІЗБЕГІНІҢ ҚАУІПСІЗДІГІН АРТТЫРУ

О. В. Кошкина[1], А. З. Нурмагамбетова[2], А. М. Нургалиева[3]*
[1]Халықаралық бизнес университеті, Алматы, Қазақстан.
[2] әл-Фараби атындағы Қазақ ұлттық университеті, Алматы, Қазақстан
[3] Нархоз Университеті, Алматы, Қазақстан

АҢДАТПА

Зерттеудің мақсаты – Қазақстан мен АҚШ-тағы логистикалық тәуекелдерді салыстырмалы талдау арқылы негізгі осалдықтарды анықтау, олардың жеткізу жүйелеріне әсерін бағалау және арнайы тәуекелді басқару стратегияларын әзірлеу.

Зерттеу әдіснамасы. Қосарлы әдіс қолданылды: сандық талдау (Дүниежүзілік банк Логистикалық тиімділік индексі, сауда статистикасы) және сараптамалық сұхбаттар. SWOT-талдау, тәуекелдерді картаға түсіру, салыстырмалы бағалау әдістері қолданылды. Шеффидің (2022) еңбектері, АДБ/ДТҰ есептері, "Нұрлы жол" мемлекеттік бағдарламалары теориялық негіз болды.

Түпнұсқалылығы / құндылығы. Әр түрлі даму деңгейіндегі елдерге арналған тәуекелдерді салыстыру матрицасы жасалды. Практикалық маңыздылық есептеулермен расталды: теміржол бөгетінің стандарттауына $2,1 млрд инвестиция кідірістерді 30%-ға азайтады; NIST стандарттары киберинциденттерді 70%-ға төмендетеді.

Нәтижелері. Структуралық айырмашылықтар анықталды:

- Қазақстан: инфрақұрылымдық жетіспеушіліктер (жолдардың 22%-ы стандартқа сай), геосаяси тәуекелдер (ЕО-ға жүктердің 68%-ы Ресей арқылы);

- АҚШ: киберқауіптер (бір инцидентте $4,3 млн шығын), климаттық тәуекелдер (жылына $18 млрд шығын).

Басымды шешімдер: ҚР үшін – "Middle Corridor" дамуы, АҚШ үшін – порттарды киберқорғау.

Зерттеу білім қорына үлес қосып, әртүрлі экономикалық контекстерде (әсіресе Қазақстан мен АҚШ-та) логистикалық тәуекел факторларын салыстырмалы талдайды және өнеркәсіптік кәсіпорындарға арналған тәуекелдерді бағалау мен басқарудың жаңа интеграцияланған теориялық-әдістемелік негізін ұсынады.

Түйін сөздер: логистикалық тәуекелдер, жеткізу жүйелерінің төзімділігі, транзиттік дәліздер, санкциялық тәуекелдер, киберқауіпсіздік, инфрақұрылымды бейімдеу, салыстырмалы талдау.

ПОВЫШЕНИЕ БЕЗОПАСНОСТИ ЦЕПЕЙ ПОСТАВОК ЧЕРЕЗ УПРАВЛЕНИЕ ЛОГИСТИЧЕСКИМИ РИСКАМИ

О. В. Кошкина[1], А. З. Нурмагамбетова[2], А. М. Нургалиева[3]*
[1]Университет международного бизнеса, Алматы, Казахстан.
[2] Казахский национальный университет им. аль-Фараби, Алматы, Казахстан
[3] Университет Нархоз, Алматы, Казахстан

АННОТАЦИЯ

Цель исследования. Провести сравнительный анализ логистических рисков в Казахстане и США для выявления ключевых уязвимостей, оценки их влияния на цепочки поставок и разработки специализированных стратегий управления рисками.

Методология исследования. Применен смешанный подход: количественный анализ (Индекс логистической эффективности Всемирного банка, статистика торговли) и качественные экспертные интервью. Использованы методы SWOT-анализа, риск-картирования и сравнительной оценки. Теоретической базой послужили труды Шеффи (2022), отчеты АБР/ВТО, государственные программы ("Нұрлы жол").

Оригинальность / ценность исследования. Разработана сопоставительная матрица рисков для стран разного уровня развития. Практическая значимость подтверждена расчетами: инвестиции $2,1 млрд в стандартизацию ж/д колеи сократят задержки на 30%, внедрение стандартов NIST снизит киберинциденты на 70%.

Результаты исследования. Выявлены структурные различия:

-Казахстан: инфраструктурные ограничения (22% дорог соответствуют стандартам), геополитические риски (68% транзита в ЕС через Россию);

- США: киберугрозы ($4,3 млн ущерб/инцидент), климатические риски ($18 млрд годовых потерь).

Приоритетные решения: для РК – развитие коридора "Middle Corridor", для США – киберзащита портов.

Исследование вносит вклад в существующую базу знаний, предоставляя сравнительный анализ факторов логистических рисков в различных экономических контекстах (в частности, Казахстана и США) и предлагая новую интегрированную теоретико-методологическую основу для оценки и управления рисками, ориентированную на промышленные предприятия.

Ключевые слова: логистические риски, устойчивость цепочек поставок, транзитные коридоры, санкционные риски, кибербезопасность, адаптация инфраструктуры, сравнительный анализ.

About the authors

Koshkina Olga – PhD in Finance, Associate Professor, Department of Finance and Accounting, University of International Business, Almaty, Kazakhstan. Email: o.koshkina@mail.ru. ORCID ID: https://orcid.org/0000-0002-0847-3537

Nurmagambetova Azhar - candidate of economic science, PhD, associate professor, al-Farabi Kazakh National University, Almaty, Kazakhstan, email: n_azhar@mail.ru, ORCID ID: https://orcid.org/0000-0001-9142-4420

Nurgaliyeva Aliya - candidate of economic science, PhD, associate professor Narxoz University, Almaty, Kazakhstan, email: aliya_mn@mail.ru, ORCID ID: https://orcid.org/0000-0001-6044-6926*****