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JIF	= 1.500	SJIF (Morocco)	= 7.184	OAJI (USA)	= 0.350

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D.M. Mirzakhalilova
Branch of Gubkin Russian State University of Oil and Gas (National Research University)
Candidate of Economic Sciences, Associate Professor of the Department of «Oil and Gas Economics»
Tashkent, Uzbekistan

A.V. Grin
branch of Gubkin Russian State University of Oil and Gas (National Research University)
Student
Tashkent, Uzbekistan

A.R. Prukhnitskaya
branch of Gubkin Russian State University of Oil and Gas (National Research University)
Student
Tashkent, Uzbekistan

THE IMPACT OF LOGISTIC DISRUPTIONS ON PROCESS INTEGRATION IN THE OIL AND GAS INDUSTRY: A SYSTEMIC APPROACH TO ANALYSIS

Abstract: *Oil and gas logistics is a complex and capital-intensive system that includes the management of supply, transportation, storage, and distribution of hydrocarbons. Even minor disruptions in one of the functional areas can trigger cascading effects across all stages of the supply chain. This article explores key logistical errors, their causes, and their impact on the efficiency of oil and gas operations, with examples from international practice and the specific characteristics of the CIS industry.*

Key words: *oil and gas logistics, supply, transportation, storage, system integration, production and distribution chain, logistics digitalization, ERP, SCADA, TMS, logistics risks, functional logistics, CIS oil and gas sector.*

Language: *Russian English*

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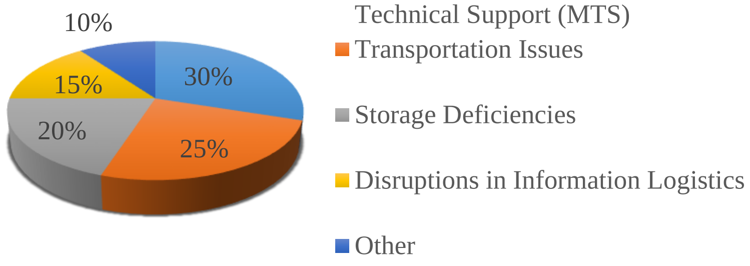
Introduction

Logistics in the oil and gas industry plays a key role in ensuring the stability of production processes and the efficient management of resources. Given the high cost of downtime and vulnerability to external risks, even minor logistical failures can lead to serious consequences at all stages of the supply chain.

The functional areas of logistics in the oil and gas industry cover the entire movement path of resources — from procurement and production to distribution. Key processes include the supply of equipment and materials, the transportation of oil and gas, storage, and export/customs operations. Failures at any stage — such as delivery delays, pumping issues, or lack of storage capacity — can lead to production shutdowns, downtime, and contract disruptions. Even localized disturbances can cause systemic failures in the production and distribution chain. Therefore, a comprehensive approach is necessary to ensure the reliability and flexibility of logistics [1].

Figure 1 — Distribution of types of logistics errors in the oil and gas industry (%)



Source: developed by the authors based on analysis of industry reports [2][3][4][5]

This pie chart illustrates the distribution of typical logistical disruptions occurring at various stages of the production and distribution chain of oil and gas enterprises. The largest share (30%) is attributed to errors in supply and material and technical support (MTS), including delays in the delivery of equipment, pipes, and components for drilling and processing facilities. In second place (25%) are disruptions in the transportation of oil and gas, caused by schedule violations, pipeline accidents, and delays in switching to alternative routes. Approximately 20% of disruptions are related to storage logistics errors: insufficient tank capacity, lack of backup facilities, and forecasting mistakes. Information logistics shortcomings—including non-integrated IT systems and poor coordination between departments—account for 15%. Other failures, including errors in distribution and customs logistics, make up 10% [6].

In the oil and gas sector, logistical errors can occur at different stages and in various functional areas, yet even local disruptions often lead to systemic consequences. One of the most common issues is errors in supply and material and technical support (MTS). Improper planning of equipment and material deliveries for drilling and processing facilities can result in rig downtime, increased production costs, and delays in commissioning facilities. For example, in 2020, a delay in the delivery of pump-compressor equipment to the Shannan field in China caused a forced shutdown of wells for 14 days [6].

Equally significant are problems in oil and gas transportation. Violations in pipeline pumping schedules or logistical disruptions on railways can lead to overflow storage situations, environmental safety risks, and missed export commitments. In 2021, an accident on a section of the pipeline in Kazakhstan (Atyrau–Kenkiyak) resulted in the suspension of pumping and the urgent rerouting of tankers to railway terminals [3].

Storage logistics errors also have a serious impact on the system. During peak production periods, insufficient tank capacity or forecasting errors can lead to forced production halts, increased costs for renting additional storage, and higher losses from prolonged storage. The International Energy Agency (IEA), in its 2020 report, noted that during the pandemic, global oil storage facilities were 95–98% full, which paralyzed logistics [7].

Information logistics deficiencies deserve special attention. The lack of integration between production, transportation, and sales systems (e.g., ERP, SCADA, and TMS) results in delayed responses to disruptions, reporting and planning errors, and multi-million-dollar losses due to uncoordinated actions. A relevant example is the experience of a Rosneft subsidiary, where in 2019 the implementation of a digital transportation tracking system helped reduce unproductive shipments by 12% and prevented disruptions during adverse weather conditions [8].

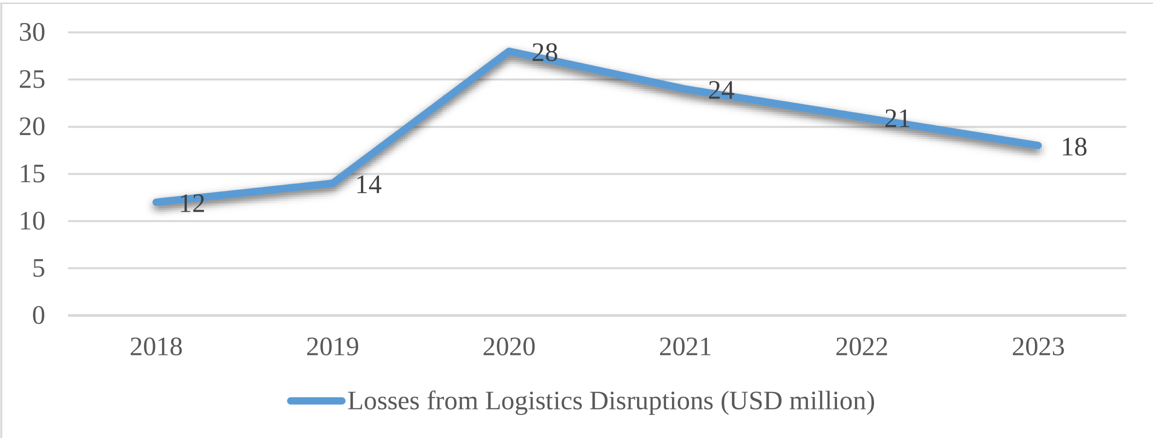
Table 1 — Impact of Local Logistical Disruptions on Overall System Efficiency in the Oil and Gas Industry

Error Area	Systemic Consequence
Equipment Delivery Failure	Drilling halt, delay in project commissioning
Tank Overload	Forced production cutback
Transportation Delay	Disruption of export contracts
Incorrect Forecasting	Inefficient asset utilization

Source: developed by the authors based on analysis of industry reports [7]

The data in the table illustrate how local disruptions in a single functional area—be it supply, transportation, storage, or forecasting—can trigger cascading failures throughout the entire logistics chain of an oil and gas enterprise. This confirms the importance of integrated logistics management and proactive planning to ensure system resilience.

Figure 2 – Dynamics of Financial Losses from Logistics Disruptions in the Oil and Gas Sector (2018–2023)



Source: developed by the authors based on [5][6][7]

The chart presents an indicative trend of financial losses caused by logistics disruptions in oil and gas companies between 2018 and 2023. In 2018–2019, moderate loss levels were recorded (USD 12–14 million annually), typical for a stable macroeconomic environment and orderly operation of logistics chains. A sharp spike in 2020 (up to USD 28 million) was driven by the global COVID-19 pandemic, which disrupted delivery schedules, restricted transport flows, and led to overflowing oil storage facilities. In the following years, thanks to adaptation to new conditions and partial digitalization of logistics processes, losses gradually declined: USD 24 million in 2021, USD 21 million in 2022, and USD 18 million in 2023.

The model reflects average loss estimates for large integrated companies and countries with advanced extraction infrastructure (including Russia, Kazakhstan, and China), where the scale of logistics operations is most vulnerable to disruptions due to the complexity of production and distribution chains.

The graph illustrates a key pattern: the largest financial losses coincide with periods of external crises, while reductions are achieved through the implementation of digital solutions, route diversification, and better integration of logistics into the overall management system.

To enhance the resilience of logistics processes in the oil and gas sector, a set of measures is needed to prevent and promptly eliminate disruptions. First, it is essential to integrate information systems by uniting ERP, TMS, and SCADA into a single management platform, enabling synchronization of data across production, transportation, and sales departments. Second, a shift to digital logistics is critical, with the introduction of artificial intelligence and machine learning technologies to forecast demand, optimize routes, and prevent overloads. Third, duplication of critical routes and storage facilities is recommended as part of a crisis management plan, especially in remote or climate-challenged regions. Fourth, the development of Collaborative Planning, Forecasting, and Replenishment (CPFR) practices across all logistics and operational units is necessary. According to Deloitte (2022), oil and gas companies that adopted digital logistics reduced internal logistics losses by 20–25% [9].

Thus, while logistics errors in the oil and gas sector are inevitable, their consequences can be minimized with a high level of technological integration and proactive management. Timely identification of bottlenecks, digitalization, and cross-functional coordination are key factors for the resilience of logistics systems under high volatility and external risks.

The reviewed examples from international and regional practice confirm that logistics disruptions often result not so much from external circumstances, but from shortcomings in planning, risk management, and digital infrastructure. On the other hand, the experience of successful cases (such as the implementation of digital tracking and forecasting systems in several oil and gas companies) proves that the transition to intelligent and integrated logistics can significantly reduce costs, enhance resilience, and improve manageability of the entire supply chain.

Therefore, reducing the vulnerability of logistics processes requires a systemic approach: integrating IT solutions (ERP, TMS, SCADA), digitalizing logistics, multichannel planning, developing backup capacities, and adapting to external challenges. Only with a flexible, transparent, and technologically advanced logistics infrastructure can the oil and gas industry function effectively amid growing complexity, market volatility, and increasing global risks [10].

References:

1. (n.d.). *Oil and gas supply chain.* Retrieved from https://www.cognizant.com/us/en/glossary/oil-gas-supply-chain
2. (2022). *Deloitte. 2022 Global Oil and Gas Industry Outlook*, Retrieved from https://www2.deloitte.com/global/en/pages/energy-and-resources
3. (2022). *KAZENERGY. National Energy Report - 2022*, Retrieved from https://kazenergy.com
4. (2023). *PwC. Oil and Gas Trends 2023*, Retrieved from https://www.pwc.com/gx/en/industries/energy-utilities-resources/oil-gas.html
5. (n.d.). *McKinsey & Company. Digitizing Oil & Gas Operations*, Retrieved from https://www.mckinsey.com/industries/oil-and-gas/our-insights
6. (n.d.). *PetroChina International Co*. Retrieved from http://www.petrochinaintl.com.cn/intlen/
7. (2020). *Global oil demand to decline in 2020 as coronavirus weighs heavily on markets* Retrieved from https://www.iea.org/news/global-oil-demand-to-decline-in-2020-as-coronavirus-weighs-heavily-on-markets
8. (2020). *ANNUAL REPORT CONTAINING INTEGRIED REPORTING ELEMENTS*. Retrieved from https://www.rosneft.com/upload/site2/document_file/a_report_2020_eng.pdf
9. (n.d.). *ERP vs. TMS: Key Differences for Freight Integration*. Retrieved from https://cargofive.com/erp-vs-tms-freight-integration/
10. (n.d.). *The Role of SCADA in the oil and gas supply chain*. Retrieved from https://prismecs.com/blog/the-role-of-scada-in-the-oil-and-gas-supply-chain